KIMISTARI
Fasalka Labaad

DUGSIGA SARE
KIMISTARI

Fasalka Labaad

2

DUGSIGA SARE
H O R D H A C


Sidaasi darteed, waxa uu Xafiiska Manaahijtu u mahad naqayaa dhammaan dadkii ku hawshoodey soo saarista buuggan.

Maamulaha Xafiiska Manaahijta
Xasan Daahir Obsiye
TUSMO

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XUS

Buuggan waxa aanu si gaar ahaan eed ugu xuseynaa Jaalle Maxamed Xasan Aadan (Gahayr) oo ahaa Xoghayiibi Wasaaradda Waxbarashada iyo Barbaarinta (6diintii Diisambar 1974 ilaa 23diintii Febraayo 1975).


Sidaasi darteed ayaanu buuggan oo ah kimistari kii labaad ee Dugsiyada Sare u soo baxa ku xuseynaa Gahayr si loo xusuusnaado kaalintii uu kimistariyahannada Soomaaliyeed kaga jiray.
Baabka Kowaad

XEERARKA KIMIKAAD EE ISUTAGGA CURIYEYAALKA

Haddii laba walaxood isla falgalaan, waxa dhaca falgal kimika ah; isutag kimika ah ayaana dhaca marka laba curiye isu tagaan si ay u dhaliyaan iskudhis cusub. Sidaas oo kale kalabax kimika ah ayya dhaca marka uu iskudhis u kala dhambalmo walxo yaryar. Markii isutagga curiyeyaalka iyo kalabaxaa iskudhisyada loo fiirsaday, waa la arkay in ay xeerar gaar ah raacaan. Xeerarkaasi ayaynu ku falanqaynaynaa baabkan.

Xeerka Waaridda Cufka:

Laafisoor markii uu darsayey isutaggaa ka dhex dhaca meerkuriga iyo qaybta hawada ka mid ah ee firfircoo ee la yidhaa ogsijiin, waxa uu arkay in mugga ogsijiinta ah ee soo baxaa, marka ogsaydhka meerkuriga la kululeeyo, uu la mid yahay muggii ogsijiinta ahaa ee meerkuriga la falgalay markii ogsaydhku samaysmayey. Taasi waxa ay inna dareensiinaysaa in aan muggii ama cufki ogsijiinta waxba ka luminum. Arrintaasi sidaas ah ayya loo bixiyeexeerka waaridda cufka. Xeerkaasina waxa uu odhanayaa cufka maatarka lama baabi'in karo lamana abuuri karo marka falgal kimika ahi uu dhaco. Tijaabada soo socota ayaana inoo caddaynaysa xeerkan.

Tusaale 1:

Soo qaado dhalo, kuna shub woxoogay milan arjantam naytareyt ah. Dhuun-hubsashoo ay asiidh haydarokolorik ihi ku jirtana miyir ugu dhaadhici dhalada sida aad jaantsuska 1.1 ku aragtid.

Miiisaan dhalada iyo waxa ku jiraba; qorna culayskaas, (x g). Qalabka yara janjeedhi, si ay isugu darsamaan labada milan. Waxa ka dhex dhici doona falgal kimika ah, waxaana soo bixi doona ruushi cad oo arjantam koloraydh ah iyo asiidh naytariik ah.

\[
\text{AgNO}_3 + \text{HCl} \rightarrow \text{AgCl} + \text{HNO}_3
\]

ruushi cad

Mar labaad miisaan dhalada iyo waxa ku jiraba (y g). Maxaad aragtay? Wax isbeddel ihi ma ku dhacay culayskii hore? Waxa aad arki doontaa, haddii aad si sugan u samaysid tijaabada, in culayska dhalada iyo waxa ku jira, falgalka hortii isyo dabadiisabta ay isku mid yihii. Taas macnaheedu waxa uu yahay, culayska falgaleyasha iyo ka maxsuulku waa isku mid, mar haddii culayska dhalada uu madoorsoome yahay.
Culayska dhalada iyo waxa ku jira = x g falgalka hortiiis.
Culayska dhalada iyo waxa ku jira = y g falgalka dabadiis.
\[ x \text{ g} = y \text{ g} \]
(Culayska falgalyaasha) (culayska maxsuulka)

Halkaa waxa aynuu ka arkaaynaa in sida uu xeerka waaridda cuufku odhanayo aan maatarka la baabi'in karin lana abuuri karin.

1905ti, Albert Aynishitaan ayaa, waxa uu soo jeediyeey in cuufka maatarka iyo tamartu ay isku xidhan yiihin. Xidhiidhkaasina waxa ku tusaya isle'egta E = mc². E waxa ay u taagan tahay xaddiga tamarta, m na cuufka maatarka, c na waa madoorsoome la mid ah kaynaanka ilayska.

Tijaabooyin badan oo la sameeyey afartankii sannadood ee ugu dambeeyey, ayaana caddeevey in uud xidhiidhkaasii run yahay. Xidhiidhkaasi waxa aynuu ka aragnaa in cuufka loo rogi karoo tamar. Sidoox waxa aawgeed cuufka iyo tamartu ma aha laba xaddi oo kala duwan. Xeerkiis hore ee waaridda cuufkana waxa loo balaadhin karaa, xeerka waaridda cuufka iyo tamarta. Hase yeshee, falgallada caadiga ah, cuufka tamar isu rogaa aad iyo aad ayuu u yar yahay, wax la arki karana ma aha. Sidoox waxa aawgeed qaexiddii hore ee xeerka wuxubka ba beddelimeynno, laakiin waa in aynuu xusuusnaanaa in cuufka loo rogi karoo tamar, inkasta oo ay taasi aad iyo aad u adag tahay.

Xeerka samayska go'an ama saamiga go'an:


Tijaabo 1.2:

Diyaarri saddex namuunadood oo kubram ogsayd ah. Namuunadda hore (b) waxa laga diyaarinarayaa iskudhiska la yiraahdo kubrik naytareyt, oo marka la kululeeyo u kale baxa sida ay isle'egta hoos ku taallaa tusayo:

\[ 2\text{Cu(NO}_3\text{)}_2 \xrightarrow{\text{kul}} \text{CuO} + \text{H}_2\text{O} + \text{NO}_2 \]

Namuunadda labaad (i) waxa laga diyaarinarayaa iskudhiska la yiraahdo kubrik haydarogtayd:

\[ \text{Cu(OH)}_2 \xrightarrow{\text{kul}} \text{CuO} + \text{H}_2\text{O} \]

Namuunadda saddexaad (j) waxa laga diyaariyayaa iskudhiska la yiraahdo kubrik karboneyt, oo marka la kululeeyo u kale baxa sida isle'egta soo socota ay tusayo:

\[ \text{CuCO}_3 \xrightarrow{\text{kul}} \text{CuO} + \text{CO}_2 \]
JT. 1.2:

Bal hadda aynu saafnno saddexdaa namuunadood. Waxa aad miisaantaa saddex dhaal, oo yaryar oo magubtayaal ah. Saddexda dhaal mid ahaantood, in yar oo namuunadda (b) ah ku rid, ka labaadna in yar oo namuunadda (t) ah, ka saddexaad in yar oo namuunadda (j) ah. Markaa dabaddeed miisaan dhaal walba iyo xaddiga ku jira. Dhex dhig dhaalasha dhuun qarsho adag ah, dabaddeedna u meerar saabaanka sida jaantuuska 1.2 ku aragtid. Dhuuntu waa in ay waxooga qaxgaa u yar foortaa xagga (j) si wixii hoor ah ee dhashaa aanu dib ugu noqon dhuunta. (Maxaa dhacaya haddi uu dib u noqdo?) Neef haydarojin ah dhex mari dhuuntu, kana ololi xagga u dambaysa. Dhaal kasta goonidisa aad ugu kulayli. Namuunadaha kubram ogsaydhka ihi way ifi doonaan; waxayna isu rogi doonaan maar cas. Biyaha samaysmaa waxa ay ku ururayaan xagga ay dhuuntu u yar foorto (j). Haddii ay biyuuhu dib ugu noqdaan dhuuntu kulul way jabinayaan. Marka falgalku uu joogsado; dabka ka riiq dhuunta si ay u qabowdo, laakiin neeftu ha ku socoto si aanay maartu dib isugu rogin kubram ogsaydh. Marka ay qabooloobna dhaalashu, miisaan iyaga iyo waxa ku jiraba.

Soo saar boqolkiiba inta maar ah iyo inta ogisijin ah ee ku jirta kubram ogsaydh. Tusaha soo socda ayaa tusaya natiijooyinkii laga helay tijaabada lagu sameeyey qolka-shay-baarka.

<table>
<thead>
<tr>
<th>Cul. Dhaalka</th>
<th>B</th>
<th>T</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>» Dhaalka iyo CuO</td>
<td>4.26 g</td>
<td>3.65 g</td>
<td>4.14 g</td>
</tr>
<tr>
<td>» Dhaalka iyo Maarta</td>
<td>4.02 g</td>
<td>3.46 g</td>
<td>3.85 g</td>
</tr>
<tr>
<td>» Maarta</td>
<td>1.01 g</td>
<td>0.92 g</td>
<td>1.15 g</td>
</tr>
<tr>
<td>Cul. Kubram Ogsaydh</td>
<td>1.25 g</td>
<td>1.15 g</td>
<td>1.44 g</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% Inta maar ah ee ku jirta kubram ogsaydh</th>
<th>1.01 × 100</th>
<th>0.92 × 100</th>
<th>1.15 × 100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.25</td>
<td>1.15</td>
<td>1.44</td>
</tr>
<tr>
<td></td>
<td>= 80.8%</td>
<td>= 80%</td>
<td>= 79.8%</td>
</tr>
</tbody>
</table>

Boqolkiiba (%) inta maar ah ee ku jirta saddexda namuunadood waa isku mid (80/%), si kastaba ha loo diyaariyo markooda hore ee % inta ogisijin ihina waa isku mid (20%). Halkaasna waxa inooga cadataay in iskudhis kasta uu ka samaysan yahay curiyeelay ga’an oo culays go’an isugu tegay.

Xeerka samayska go’an awgii, waxa u suurtagashay dadka soo saara iskudhisyada kimikada ah, in ay si dhib yar u doortaan xaddiyaada curiyeelayka ee loo baahan yahay marka ay samaynayaan iskudhis gaar ah.
Samayska Iskudhisyada ee Boqoleed:

Waxa in badan loo baahnaa in la ogaado boqolkiiba (％) culayska curiyeh kasta ee ku jira iskudhis, si iskudiska loo samayn karo markii la doono ama looga faa‘ideysan lahaa curiyeaasha ku jira iskudhiskaa. Sidii aynu u aragnay, culayskaasi waa mid go‘an oo aan doorsoomin: waxaana lagu helaa tijaabo. Hase yeeshee, tijaabadasii wax dhib badan tahay, saabaan iyo waqti badanna way u baahan tahay. Sida ugu dhib yar ee loo helo boqolkiiba (％) culayska curiyaha ee ku jira iskudhis waa iyadoon laga xisaabiyo naanaysta iskudhiska. Inta aan la xisaabin culayska curiyeh kasta ee ku jira iskudhis boqolkiiba (％), waa in marka hore la xisaabiyya culays-molikiyuulka iskudhiska. Culays-molikiyuulkuna (cul-mol) waxa weeye inta jeer ee uu hal molikiyuul oo walaxdaasi ihi uu ka culus yahay hal atam oo haydaroojiin ah. Waxana lagu helaa cul-mool. Isugeynta culays-atamyada (cul-At) curiyeaasha uu ka samaysan yahay hal molikiyuul oo walaxdaasi ihi. Tusaale ahaan, culays-molikiyuulka salfiyuuric asiidh (H₂SO₄) waxa weeye.

<table>
<thead>
<tr>
<th>Tirada Atamyada</th>
<th>Cul-Atam</th>
<th>Wadaro culays</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 atam oo H</td>
<td>1</td>
<td>2 × 1 = 2</td>
</tr>
<tr>
<td>1 » »S</td>
<td>32</td>
<td>1 × 32 = 32</td>
</tr>
<tr>
<td>4 » »O</td>
<td>16</td>
<td>4 × 16 = 64</td>
</tr>
</tbody>
</table>

\[
\text{Culays-molikiyuul = 98}
\]

Markaa hal-molikiyuul oo H₂SO₄ ihi 98 jeer ayuu ka culus yahay hal atam oo haydaroojiin ah.

Haddii aynnu wadarta culays-atamyada curiyaha u qaybinno culays-molikiyuulka iskudhiska, waxa aynnu helaynaa jabka uu culayska curiyehu ka yahay culayska iskudhiska. Haddii culayska iskudhiska aynnu u qaadanno boqol (％), oo dabadeeto aynnu ku dhufanno jabka uu culayska curiyaha ka yahay culayska iskudhiska, waxa aynnu heleynaa boqolkiiba (％) inta uu culayska curiyehu ku yahay culayska iskudhiska.

**Tusaale ahaan:**

\[
\frac{\text{Wadarta cul. atamyada curiyaha}}{\text{Culays-molikiyuulka iskudhiska}} \times 100 = \% \text{ cul. curiyaha}
\]

**Tusaalooyin:**

1) Soo saar samayska boqolleed ee Fe₂O₃. Marka hore soo saar culays molikiyuul Fe₂O₃,

b) \[
\text{Wadarta cul-At. xadiidka= } 2 \times 55.8 = 111.6
\]

\[
\text{Wadarta cul-At. ogsijin = } 3 \times 16 = 48.0
\]

\[
\text{Culays-molikiyuul Fe₂O₃ = } 159.6
\]

t) Culays iskudhiska (％) boqolkiiba inta xadiid ah,

\[
\frac{\text{Wadarta cul-At. xadiidka}}{\text{cul-mol. Fe₂O₃}} \times 100 \text{ Fe₂O₃}
\]

\[
= \frac{111.6 \times 100}{159.6} = 70.0\%
\]
j) Culayska iskudhiska boqolkiiba inta ogsijiin ah,

\[
\text{Wadarta cul-At ogsijiin} \times 100\% \text{ Fe}_2\text{O}_3 \nonumber \\
\frac{\text{Cul-mol. Fe}_2\text{O}_3}{159.6 \text{ Fe}_2\text{O}_3} = \frac{48.0 \text{ O}_2}{159.6 \text{ Fe}_2\text{O}_3} \times 100\% \text{ Fe}_2\text{O}_3 = 30\%
\]

2) Soo saar samayska iskudhiska Na\textsubscript{2}CO\textsubscript{3} . 1OH\textsubscript{2}O ee boqollee.

Waxa aynnu aragnaa in toban molikiyuul oo biyo ihi ay ku lifaaqan yiihiin naatriyam kaarboonetyka, si ay u sameeyaan naatriyam kaarboonety cokan. (dhibicdu waxa ay tusaysa in dabar kimika ihi uu u dhexeeyo biyaha iyo naatriyam kaarboonetyka).

**Culays-molikiyuulka iskudhiska:**

I.  
\[
\begin{align*}
\text{2Na} & \quad 2 \times 23 = 46.00 \\
\text{1C} & \quad 1 \times 12 = 12.00 \\
\text{3O} & \quad 3 \times 16 = 48.00 \\
\text{1OH}_2\text{O} & \quad 10 \times 18 = 180.00
\end{align*}
\]

\[
\text{Cul-Mol. 286.00}
\]

II.  
\[
\frac{46.0 \text{ Na}}{286 \text{ Na}_2\text{CO}_3 \cdot 1\text{OH}_2\text{O}} \times 100\% \text{ Na}_2\text{CO}_3 \cdot 1\text{OH}_2\text{O} = 16.1\% \text{ Na}
\]

III.  
\[
\frac{12.0 \text{ C}}{286 \text{ Na}_2\text{CO}_3 - 1\text{OH}_2\text{O}} \times 100\% \text{ Na}_2\text{CO}_3 - 1\text{OH}_2\text{O} = 4.2\% \text{ C}
\]

IV.  
\[
\frac{48.0 \text{ O}}{286 \text{ Na}_2\text{CO}_3 \cdot 1\text{OH}_2\text{O}} \times 100\% \text{ Na}_2\text{CO}_3 \cdot 1\text{OH}_2\text{O} = 16.8\% \text{ O}
\]

V.  
\[
\frac{180 \text{ H}_2\text{O}}{286 \text{ Na}_2\text{CO}_3 - 1\text{OH}_2\text{O}} \times 100\% \text{ Na}_2\text{CO}_3 - 1\text{OH}_2\text{O} = 62.9\% \text{ H}_2\text{O}
\]

**Layli:**

1. Soo saar culays-molikiyuullada iskudhisyada soo socda:

   i) N\textsubscript{2}H\textsubscript{4}  
   ii) C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}  
   iii) Ca\textsubscript{3}(PO\textsubscript{4})\textsubscript{2}  
   iv) CuSO\textsubscript{4} . 5H\textsubscript{2}O  
   v) Al\textsubscript{2}S\textsubscript{3}  
   vi) NaOH  
   vii) HNO\textsubscript{3}  
   viii) Ca(NO\textsubscript{3})\textsubscript{2}  
   ix) Fe\textsubscript{2}(CrO\textsubscript{4})\textsubscript{3}.

2) Soo saar samayska iskudhisyada ee boqollee:

   b) SO\textsubscript{3}  
   t) Ca(OH)\textsubscript{2}  
   j) MgSO\textsubscript{4} . 7H\textsubscript{2}O  
   x) H\textsubscript{2}SO\textsubscript{4}  
   kh) NaHCO\textsubscript{3}
3) Iskudhisyada soo socda midke ayay culayska naytarojiintu ugu badan tahay boqolkiiba?
   i) $N_2O$  ii) $NO$  iii) $(NH_4)_2$

4) b) Soo saar boqolkiiba culayska Maartha ee ku jira:
   i) $Cu_2O$  ii) $CuO$  iii) $CuFe_2S_4$

   1) Boqolkiiba intee biyo ah wiriqda kubrik salfeyt ($CuSO_4 \cdot 5H_2O$)?

5) Waxaad raadisaa boqolkiiba inta curiye kasta ah ee ku jira salfiyuurik asiidh?

6) Markii la gubay 6.35 g oo maar ah, waxa ay isu rogtay 7.956 g oo kubrik ogsaydh ah, kubrik ogsaydhkaa boqolkiiba intee ayaa maar ah, intese ogsajin ah?

7) Culays-molikjiyuulka naatriyam salfeytka oomani waa 142. Waxa aad soo saartaa boqolkiiba inta curiye kasta ah ee ku jirta iskudhiska.

Xeerka Saamigalka Dhufsan:

Xeerkan waxa uu odhanayaa: marka laba curiye ay sameeyaan iskudhisyo mid ka badan, culaysyada curiyeeyaasha midkood ee ku darsama culays go'an oo curiyaha kala ihi, waxa ay isu yihiin saami fudud. Xeerka waxa markii ugu horreesay soo jeediyey kimistariya-qaankii Ingiriiska ahaa ee la odhan jiray Daalal.

<table>
<thead>
<tr>
<th>Iskudhis</th>
<th>Culayska Naytarojiin</th>
<th>Culayska Ogsijiin</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_2O$</td>
<td>14</td>
<td>8 g</td>
</tr>
<tr>
<td>$NO$</td>
<td>14</td>
<td>16 g</td>
</tr>
<tr>
<td>$NO_2$</td>
<td>14</td>
<td>32 g</td>
</tr>
<tr>
<td>$N_2O_3$</td>
<td>14</td>
<td>24 g</td>
</tr>
<tr>
<td>$N_2O_5$</td>
<td>14</td>
<td>40 g</td>
</tr>
</tbody>
</table>

Tijaabo 1.4:

Haddii aynnu tusaale u soo qaaddanno ogsijin iyo naytarojiin, waxa aynnu ognahay in ay sameeyaan shan iskudhis oo kala duwan. Sida aad tusaha ku aragtid, haddii aynnu qaaddanno culays go'an oo naytarojiin ah oo dabadeeto aynnu ku darro ogsijin, waxa aad arkaysaa in culaysyo kala duwan oo ogsijin ihi ay ku darsamaayaan culayskaa go'an (14 g) ee naytarojiinta ah, si ay u samaysmaan shantaa iskudhisi. Culaysyadaa ogsijinta ihiin a(8 g, 16 g, 24 g, 32 g, 40 g) waxa ay isu yihiin saami fudud (1: 2: 3: 4: 5). Sidaasi oo kale haddii aynnu qaaddanno culays go'an oo ogsijin ahna, culaysyada kala duwan ee naytarojiinta ah ee ku darsami lahaa culayskaa go'an ee ogsijinta ah, waxa ay iyana isu noqonayaan saami fudud. Tusaalooyin kale oo fara badan oo ta la mid ah ayaad arkaysaa mar allaale marka laba curiye ay sameeyaan hal iskudhisi in ka badan. Tijaabada soo socota ayaana innoo caddaynaysa arrintaas.

Tijaabo 1.5:

Waxa aad miisaantaa laba dhaal oo nadiif ah oo qallalan. Labada dhaal midkood ku rid in yar oo kubras ogsaydh ah, $Cu_2O$, (midabkeedu waa casaan); ka kalena in yar oo kubrik ogsaydh ah, $CuO$, (midabkeedu waa madow). Labada dhaal iyo waxa ku jiraba miisaan. Ogsaydhyaada u rog maar adigoo isticmaalaya haydarojiin sidii tijaabadii 1.2.
Tijaabadan waxa aynnu ka heli karraa, saamiga ay isugu darsamaa maarta iyo ogsijiiintu si ay u sameeyaan kubras ogsaydh (Cu₂O) iyo kubrik ogsaydh (CuO). Markaa dabadeed waxa aynnu si dhib yar u xisaabinkaarra culaysyada curiyeaasha midkood, ee ku darsama culays go'an oo curiyaha kale ah, si ay u sameeyaan Cu₂O iyo CuO.

Tusaha hoos ku yaal ayaa tusaya natiijooyinkii laga helay tijaabo lagu sameeyey qolka-shay-baarka.

<table>
<thead>
<tr>
<th>Cul. dhaalka</th>
<th>6.9 g</th>
<th>7.30 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cul. dhaalka iyo ogsaydhka</td>
<td>9.75 g</td>
<td>9.20 g</td>
</tr>
<tr>
<td>Cul. dhaalka iyo maarta</td>
<td>9.43 g</td>
<td>8.82 g</td>
</tr>
<tr>
<td>Cul. maarta</td>
<td>2.53 g</td>
<td>1.52 g</td>
</tr>
<tr>
<td>Cul. ogsijiiinta</td>
<td>0.32 g</td>
<td>0.38 g</td>
</tr>
</tbody>
</table>

\[ \text{\( \frac{0.32 \text{ g}}{0.38 \text{ g}} \) oo ogsijiiin waxa ku darsamaya 2.53 g oo maar ah, 100 g oo ogsijiiin ihina waxa ay ku darsamayaan} \]

\[ 2.53 \times 100 \text{ g} \]

\[ 0.32 \]

\[ = 790 \text{ g oo maar ah.} \]

\[ \text{\( \frac{0.38 \text{ g}}{0.32 \text{ g}} \) oo ogsijiiin waxa ku darsamaya 0.52 g oo maar ah, 100 g oo ogsijiiin ihina waxa ku darsamayaan} \]

\[ 1.5 \times 100 \]

\[ 0.38 \]

\[ = 400 \text{ g oo maar ah.} \]

Saamiga ay culaysyada maarta ihi isu yihin waa:

\[ 790 : 400 = 2 : 1. \]

Halkaa waxa ka cad in culaysyada maarta ah ee ku darsama culays go'an oo ogsijiiin ah (100 g), si ay u sameeyaan labada iskudhis Cu₂O iyo CuO, ay isu yihin saami fudud oo ah 2 : 1 Haddii aynnu qaadamno culays go'an oo maar ahna, culaysyada ogsijiiinta ah ee ku darsami lahaa culayskaa go'an ee maarta ah, waxa ay iyana isu noqonayaan saami fudud. Culayskaa go'an inkastoo loo qaadan karo intii la doono,, haddaba waxa had iyo jeer loo qaataa 100 g, si ay xisaabintu innoogu dhib yaraato.

Tusaaale :

1.90 g oo ogsaydh kubram ihi wuxu bixiyaa 1.52 g oo kubram ah marka la yareeyo (yaraayntu waa falgal kimika ah). 2.85 g oo ogsaydh kale oo kubram ahina wuxu bixiyaa 2.53 g oo kubram ah. Tus in ay natiijooyinki waaafaqsan yihin xeerka saamigalka dhufsan.

1) Marka u horraysia, iskudhiska (ogsaydhka) hore qaado oo soo saar culayska curiye kasta:

\[ \text{iskudhis B.} \]

Culayska maarta = 1.52 g
Culayska ogsijiiinta = 1.90 g — 1.52 g = 0.38 g

2) Tallaabada labaad: culays go'an oo curiyeyaasha midkood ah qaado (100 g ayaa u fiican), dabadeedna raadi saamiga ay isu yihin: 1.52 g oo kubram ihi waxay ku darsan tay 0.38 g oo ogsijiiin ah. 100 g oo kubram ihina waxa ay ku darsameysaa,

\[ \frac{100 \text{ g Cu} \times 0.38 \text{ g O}}{1.52 \text{ g Cu}} = 25 \text{ g oo ogsijiiin ah.} \]
Iskudhis T.
culayska maarta = 2.53 g
culayska ogsijinta = 2.85 g — 2.53 g = 0.32 g
2.53 g oo kubram ihi waxay ku darsamaysaa 0.32 g oo ogsijiin ah. 100 g oo kubram ihina waxa ay ku darsamayaan
\[ \frac{100 \text{ g Cu} \times 0.32 \text{ g O}}{2.53 \text{ g Cu}} = 12.6 \text{ g oo ogsijiin ah.} \]

Halkaa waxa ka muuqda in culaysyada ogsijiin (25 g iyo 12.6 g) ee ku darsamay culays go' an oo kubram ah (maar), si ay u sameeyaan laba iskudhis oo kala duwan, ay isu yiihiin saami fudud 25 : 12.6 = 2 : 1. Sidii awgeedna, natiijoyinku way waafaqsan yiihin xeerka saamigalka dhufsan.

Layli:
1) Saddex ogsaydh oo natarojin ayay ku kala jiraan 53.3%. 69.6% iyo 26.4% oo ogsijiin ihi. Tus in taasi waafaqsan tahay xeerka saamigalka dhufsan.
2) Tus in natiijoyinka hoos ku qoran, oo laga helay yaraynta laba ogsaydh oo bireed, ay waafaqsan yiihin xeerka saamigalka dhufsan.

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<thead>
<tr>
<th>Iskudhiska (b)</th>
<th>Iskudhiska (T)</th>
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</thead>
<tbody>
<tr>
<td>culayska dhaalaka</td>
<td>5.30 g</td>
</tr>
<tr>
<td>cul. dhaalaka iyo ogsaydhka</td>
<td>11.85 g</td>
</tr>
<tr>
<td>culayska dhaalaka iyo birta</td>
<td>12.12 g</td>
</tr>
</tbody>
</table>

3) Laba ogsaydh oo bir ah, waxa ku kala jira 7.41% iyo 3.85% oo ogsijiin ah. Tus in ay taasi waafaqsan tahay xeerka saamigalka dhufsan.
4) Curiye ayaa salfaydhadiisa waxa ku jira 33.7% iyo 20.4% oo ogsijiin. Tirooyinkaasi ma waafaqsan yiihin xeerka saamigalka dhufsan.
5) Curiye ayaa sameeyaa laba ogsaydh. 1.00 g oo ogsaydhadahaa midkood ah waxa ku jira 0.239 g oo ogsijiin ah, 1.00 g oo ku kale ahna waxa ku jira 0.385 g oo ogsijiin ah. Tus in taasi caddaynayso xeerka saamigalka dhufsan.
6) b. Sheeg xeerka saamigalka dhufsan.
   t) Sidee ayaad tjaabo ugu caddayn lahayd xeerkaas?
   j) Curiye ayaa sameeyaa saddex ogsaydh, oo ay ku kala jiraan 76.47%, 68.42% iyo 52% oo birta ihi.

Tus in ay natiijoyinkaasi waafaqsan yiihin xeerka saamigalka dhufsan.

Aragtida Atamka ee Daalton:
Marka la doonayoo in si cilmii ahaan ah walax loo derso, waxa loo baahan yahay in la ogaado waxa ay walaxdaasi ka samaysan tahay. Sidaa darteed in badan ayay culimada saynisku raadsheen waxa uu maatarku ka kooban yahay. Culimo sidaas wax ugu fiirsatana waxa ugu horreyay culimadii Girrigga iyo Roomanka. waxa tusaalee ay u qaateen dahabka waxayna yidhaahdeed haddii in dahab ah aad in yar in yar u jajabisid; innaaaha xaribanka aad sii qaybqaybisiaan waxa la gaadhi karraa heer uu dahabku noqdo saxarro aan sii kala qaybsami karin. Saxarka aad si kala qaybqaybisiaan waxa ay u bixiyiyeen ATAM; waxaana noqdo ogaadeen in maatarku ka samaysan yahay atamyo. Hase yeeshee, wax si habsami ah oo cilmii ku dhisan u dersa maatarka waxa u horreeyay Daalton.
Daalton markii uu u fiirsaday samayska iskudhisyo badan ayuu soo jeediyey fikrad uu ku sharxi karo xeerarkii markaa la yiqiin ee ay ka mid ahaayeen xeerka waaridda cufka, xeerka samayska go'an iyo xeerka saamigalka dhuusian. Fikradihiisina waxa loo yiqiinnay "Aragtiida Atamka ee Daalton". Waxa ay aragtiidaasi odhanaysaa:

1) Maatarku waxa uu ka samaysan yahay saxarro aan qaybsami karin oo la yidhaahdo atamyo.
2) Atamyada lama abuuri karo, lamana baabi’in karo.
3) Atamyada curiyuhi si kastaba waa isugu mid; gaar ahaanna culayskoodu waa isku mid.
4) Isutag kimiko, waxa uu dhexmaraa tiro yar oo idil oo atamyo ah. Tusaale ahaan 1 : 1, 1 : 2, 2 : 1, 2 : 3 iwm.


Hase yeesshe aragtiyi waxa ay dhab tahay, ahaana doontaa ilaa iyo inta ay sharxayso dhacaddaas loogu talagalay in ay sharaxdo, waxana suurtagal ah in la shirrabo aragtidu. Sida loo shirrabayaanaa waa iyada oo lagu isticmaalaya saadaalinta waxyaalo aan weli la tijaabin. Haddii ay saadaasho dhabowdana, waxa loo qaadanayaa in ay aragtidu hagaagsan tahay. Aragtidu Daalton waa ay sharxadda natijyooyinka tijaabooyin dhaarw ah, waxana lagu isticmaalay saadaalinta waxyaalo dhaarw ah oo markaa dambe la arkaay in ay dhab yiihin, iyadoo la adeegsanayey qalab ku shaqaynaya danab, waxa suurtagashay in la miisaamoo atamayada; waxna la arkaay in ay atamayadu aad iyo aad u fudud yiihin. Taasina waxa ay waafaqsan tahay aragtidii Daalton. Tusaale ahaan atamka haydarojiintu waa ka ugu fudud atamayaa; 600,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000 atam oo haydarojiina culayskoodo waa 1 mg. Sidaa awgeed culayska atamkuu aad iyo aad ayuu u yar yahay.

Bal hadda aynnuu u fiirsanno sida ay aragtiida Daalton ee atamku u sharxayso xeerarka kimikaad ee isutagga curiyayaelkka.

1) **Xeerka Waaridda Cufka:** Sida ay aragtiida atamka ee Daalton odhanayso, atamayada lama abuuri karo lamana baabi’in karo. Sidaa awgeed, haddii falgalalaalka tijaabo kimika ah, ay tusaale ahaan ku jiraan konton bilyon oo atamyo ihi maxsuulladana waxa ku jiridoona tiradaa mid le’eg oo atamyo ah. Sidaa awgeed culayska maxsuulku waxa uu la mid noqonayaa culayska falgalalaalka oo ah culayska kontonka bilyon ee atamayada ah. Taasina wax ay waafaqsan tahay xeerka waaridda cufka.

2) **Xeerka Samayska Go’an:** Sida ay aragtiida atamka ee Daalton odhanayso, iskudhisa waxa uu samaysmaa marka tiro yar oo idil oo atamyo ihi ay isu tagaan ee ay sameeyaan molikiyuul iskudhiskaah ah. Waxa kale oo ay aragtiidaasi odhanaysaa culayska atamayada isku curiyaha ihi wa a waa isku md. Sidaa awgeed saamiga ay culaysada curiyayaelku isugu tegayaan waa saamiga culaysiyada atamayooda. Tusaale ahaan molikiyuulkii iskudhiska kubrik ogsaydii waxa uu ka samaysan yahay hal atam oo kubram ah iyo hal atam oo ogsijiin ah. Halkii atam ee kubramta ahaana afar jeer ayuu ka culus yahay halkii atam ee ogsijinta ahaa. Sidaa awgeed molikiyuuladda kubrik ogsaydii waa isku wada mid; xaddi kasta oo kubrik ogsaydii ah oo molikiyuuladda ka samaysanna, saamiga uu culaysa ku jiridamay ugu darsamay culayska ogsijiinta waa mid go'an.
3) Xeerka Saamigalka Dhufsan:

Sida ay aragtida atamka ee Daalton odhanayso, molikiyuul kastaa waxa uu ka samaysan yahay tiro yar oo idil oo atamyo ah. Tusale ahaan 1,2,3,4, iwm. Haddii aynnu u qaaddanno culayska go’an ee curiyeaalka isu tegaya midkood in uu yahay culayska hal atam molikiyuulkiiba, atamyada curiyaha kale ee u tegaya atam curiyihii hore ah si ay u sameeyaan molikiyuullo kala duwan, waxa ay noqonayaan 1,2,3,4, ama in ka badan, hadba inta iskudhis ee kala duwan ee ay labadaa curiye samayn karaan. Sidaa awgeed, mar haddii culayska atamyada curiyuhu ay isku mid yihii, saamiga culaysyada kala duwan ee curiye, ee ku darsama culays go’an oo curiye kale ihi, waxa uu la mid yahay saamiga ay isu yihii atamyada curiyaha ee ku darsamaya hal atam oo curiyaha kale ihi. Tusale ahaan iskudhiska kubrik ogsaydh (CuO), waxa uu ka samaysan yahay hal atam oo kubram ah iyo hal atam oo ogsiijin ah, iskudhiska kubras ogsaydhna (Cu₂O), laba atam oo kubram ah iyo hal atam oo ogsiijin ah. Saamiga ay isu yihii atamyada kubramta ah ee ku darsamaya hal atam oo ogsiijin ihi waa 1 : 2. Sidaa awgeed, mar haddii atamyada kubramtu ay isku wada culays yihii, saamiga ay isu yihii culaysyada kubramta ah ee ku darsamaya culays go’an oo ogsiijin ah si ay u sameeyaan laba iskudhis oo kala duwan, waxa uu noqonaya 1 : 2.

Layli 1.3:

1) Maxay oranaysaa aragtida atamka ee Daalton?
2) b. Sheeg xeerka wasridda ee cuufka.
   t. Sidee ayuu xeerkaas u sharxayaa aragtida atamka ee Daalton.
3) Adiga oo adeegsanaya samayska go’an, tus in xeerkaasi daliil u yahay aragtida atamka ee Daaltoon.
4) Marka ay isu tagaan curiyeyaasha kala ah feeram iyo koloriin, waxa ay sameeyaan laba iskudhis, (FeCl₂ iyo FeCl₃). Waxa kale oo aad ku soo baratay buuggii kowaad kaaf-toonka curiyeyaasha. Haddaba wax xiriir ah oo ka dheexeyaa saamiga ay isku yihii kaaftoonyada feeramka ee labada iskudhis iyo culaysyada kala duwan ee koloriinta ah ee ku darsamaya culays go’an ee feeram ihi, ma kuu muuqdaa, muxuuna yahay.
Baabka Labaad

TUSAHA KALGALKA CURIYEYAASHA

Heerarkii taariikhiga ahaa ee uu soo maray:


Qaybintaasi waxa ay yeelaytay doldaloolo badan. Curiyeeyaasha labadaa kooxoood la kala raacsheyna ma ay laha astaamo gaar u ah biraha ama bir-ma-ahayaasha. Tusaale ahaan curiyeeyaasha sink iyo aluminam, in kasta oo lagu daray qaybta biraha, haddana ogsaydhiyadoodu waxa ay leeyihiin astaamaha asiidhada. Ta kalena faraqa u dhexeyey biraha iyo bir-ma-aheyaasha tartiib ayuu u kordhaa. Sidaa awgednawa waxa dhib noqoto sidii soo hadda cad looga kala dhigi lahaa labaad u qaybta. Isla markaana kimistiriyaqaannadii wax caawinweeday in kasta oo ay dareensisay baahida loo qabo in curiyeeyaasha si habsami ah la isugu urursho.


<table>
<thead>
<tr>
<th>Curiyaha</th>
<th>Cul. At.</th>
<th>Celceliska Cul. Atamka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liitiyam</td>
<td>7</td>
<td>(\frac{7 + 39}{2})</td>
</tr>
<tr>
<td>Naatriyam</td>
<td>23</td>
<td>(\frac{7 + 39}{2})</td>
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<tr>
<td>Kaaliyam</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Koloriin</td>
<td>35.5</td>
<td></td>
</tr>
<tr>
<td>Boromiin</td>
<td>80.0</td>
<td>(\frac{35.5 + 127.6}{2})</td>
</tr>
<tr>
<td>Aayodhiin</td>
<td>127.6</td>
<td></td>
</tr>
</tbody>
</table>
In kasta oo curiyeaasha uu sidaas isu raaciay ay leeyihiin astaamo kimikaad oo aad isugu dhow, haddana curiyeaasha markaa la yaqaannay oo dhan, afar saddexo oo qudha ayuu ku guulaysay.


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<td>F</td>
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<td>Ca</td>
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<td>T</td>
<td>Mn</td>
<td>Fe</td>
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</table>

Sida aad ku aragtid tusaha sare, ratibaaddii uu u sameeyey curiyeaasha khilaafyo iyo doldalooloobadan ayaa lahayd. Saddex tax wax ka badanna wuup samayn kari waayey; gaar ahaan waxa ka dambeeya kaalsiyam, way waafiqii waayeen xeerkiid siddeed-siddeedha. Ratiibaadda uu u sameeyey Niyuulaandis curiyeaasha, in kasta oo ay doldaloolooyinkaasi lahayd, haddana waxa ay ku xidhnayd oo sal u ahaa u qaadaasha saxa ah ee ahayd in astaamaha curiyeaashuu kalgal ahaan iskula beddelaan culays-atamaddooda.

Haddaba Doberiniyar, Niyuulaandis iyo Saynisyahannadii kale ee ka horreeyey Mendeleef, markay samaynayeen habsamida ratibaadda ee curiyeaasha, waxa ay ku dedaaleneen kale qaybintooda oo keli ah. Wax ay halkaasi sii dhaafiyeenaa ma aay jirin, oo aan ahayn ratibaaddii ay curiyey kastaba raaciyeen koox sida ay isugu dhow yiihiin astaamahoodu. Waxayna u haysteen in curiye kastaaba uu gooni yahay oo aanay waxba ka dhexayn curiyeaasha kale.

**Xeerka kalgalka ee Mendeleef:**

Mendeleef wuu ka duwanaa saynisyahannadii ka horreeyey; wuxuuna rumaysnaa in ay si habsami ah astaamaha curiyeaasha oo dhammi isugu xidhan yiihiin. Intii aannu ratibaadda guda gelin, waxa uu raadshay astaanta isku xidhi karta curiyeaasha oo dhan. Wuxuuna gaadhay go'aanka ah in culays-atamku uu yahay ka isku xidhi kara curiyeaasha oo dhan. Markii uu isu dabadhigay curiyeaasha siday u kala culays-atam badan yiihiin, waxa uu arkay in ay curiyeaasha isugu astaamo dhowi u soo noqnoqdaan, noqnoqod go'aan. Mendeleef xidhiidhkaasna wuxuu u bixiyeexeerka kalgalka, wuxuuna odhanayaa: «Astaamaha curiyeaasha iyo iskudhisyaduba waxa ay kalgal ahaan isula beddelaan culays-atamyada curiyeaasha.»

Si aynnu u aragno habsamidii uu helay Mendeleef, 20ka curiye ee ugu horreeya ayaa hoos ku dhigan, iyaga oo u yaal siday ay u kala culays-atam badan yiihiin, curiye kasta summaddisana waxa ku hoos qoran naanaaysta ogsaydhiisaa ugu sarreeya.
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<td>1</td>
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<td>—</td>
<td>Li₂O</td>
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<td>—</td>
<td>—</td>
<td>Na₂O</td>
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<td>39.9</td>
<td>39.1</td>
<td>40.1</td>
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<td>P₂O₅</td>
<td>SO₃</td>
<td>Cl₂O₇</td>
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<td>K₂O</td>
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Curiyaha keli ah ee aan waafaqsanayn kala horreynta curiyayaasha sida ay u kala culeys-atam badan yiihin waa curiyaha kaaliyam. Taasina waxa aynnu garan doonnaa marka aynnu soo gaadhno tasxiixdii lagu sameeyay xeerka kalgalka e Mendeleef.

Haddii aynnu ka tagno haydaroojiin iyo heliyam, waxaynu si fiican u arki karraa horsiimada ay astaamaaha curiyeyaasha kale oo dhammi isu beddelayaan.


Haddii isbeddelkaas ku dhacaaya astaamaha curiyeyaashu uu sidaas u soo soco lahaa, foloriin waxa ku xigi lahaa curiye bir-ma-ahi ah oo aad uga si xooggan. Hase yeeshee, curiyaha ka dambeeya foloriin waa niyoon, oo ka mid ah neefaha wahsada. Wax falgal ah oo ay la gasho curiyeyaasha kalena ma ay jirto. Niyoon ka baadi waxa imanayaaya curiyaha naatriyam oo astaamaheedu la mid yiihin kuwii litiyam. Halkaas, haddii aynnu si raacno taxa, waxa innooga muuqanaysa in astamihii curiyeyaashii hore dib u soo noqonayaan. Taasina waxay inna tusaysaa in xeerki kalgalka ee Mendeleef run yahay.
Taxa curiyeaasha ah, sida curiyeaashaa liitiyam ilaa niyoone, ee astaamahoodu tartiib isu beddelayaan ayuu Mendeleef u bixiyey kal. Haddii aynnu labada kale ugu horreeya isku hoos qoranno, waxa aynnu helaynaa ratibaaddan soo socota:

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<td>Ar</td>
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</tbody>
</table>

Sida aad kor ku aragtid, joog-taxyadu waxay ka kooban yiihiin curiyeeyaal astaamahoodu isku eg yiihiin, kaaftookooduna isku mid yahay. Curiyeaashaa isku joog taxa ah ee astaamahoodu isku mid yihay, sida liitiyam iyo naatriyam, ama bereliyam iyo magneesiyam, ayaa la yidhaahdaa urur. Haddaba Mendeleef isaga oo curiyeaasha isugu hagaajinaya ururro iyo kalal ayuu soo saaray tusaha kalgalka curiyeaasha oo ka koobnaa 10 kal iyo 9 urur.

**Beddel lagu sameeyey kalgalkii tusaha curiyeaasha ee Mendeleef:**

Tusaha kalgalka curiyeaasha ee maanta la isticmaalaa wuxuu ka kooban yahay 7 kal iyo 8 urur. In kasta oo la beddelay qaabkii tusihii uu sameeyey Mendeleef, haddana fikradii salka u ahayd dhismihii tusaha Mendeleef ayuu tusaha cusbina ku dhisan yahay. Hase yeeshee, halkii uu Mendeleef uga qaataay culays-atamka, astaanta isku xidhaysa curiyeaasha oo dhan ayaa maanta waxa loo qaataa inay astaantasi tahay tiro-atamka. Tiro-atamka curiyuhi waa tiro sheegta inta elektaroon ama borotoon ee curiyuhi leeyahay. Sidaa awgeedna maanta xeerkii kalgalka waxa loo qoraa:

«Astaamaha curiyeaashu waxay kalgal ahaan isula beddelaan oo ay xidhiidh la leeyihiin tiro-ataamyadooda.» Marka curiyeaasha loo qoro sida ay u kala tiro-atam badan yihinna, waxa aad arkaasaa in kaaliyam ka dambaynayso argon in kasta oo kaaliyam ka culays-atam yar tahay.

**Layli 2.1:**

1) Saynisyahannada magacyadoodu hoos ku qoran yiihiin, sheeg waxa uu mid walba ku soo kordhiyey kala qaybinta curiyeaasha: Doberiniyar, Niyuulaands iyo Mendeleef.

2) b. Maxaa sal u ahaa ratibaaddii kalgalka curiyeaasha ee Mendeleef?
   t. Maxay ahaayeen doldalooloooyinkii ay ratibaaddaasi yeelatay?
   j. Maxaa maanta sal u ah ratibaadda curiyeaasha?
   x. Muxuu ahaa ururka ma ka maqnaa kalgalkii curiyeaasha ee Mendeleef?

3) b. Maxay yiihiin urur curiyeeyaal ihi?
   t. Halkee ayuu ka geli karaa ururku tusaha kalgalka curiyeaasha.

4) b. Muxuu yahay kalku?
   t. Halkee ayuu ka geli karaa kalku tusaha kalgalka curiyeaasha.

5) Sheeg xeerkii kalgalka ee curiyeaasha.
Baabka Saddexaad

HAYDAROJIIN

Birisalas ayaa qarnigii 16aad ogaaday in ay jirto haydarojiin, hase yeshee 1776kii Kafendesh ayaa hubsaday in astaamaha neeftu ka geddisan yihiin kuwa neefaha kale; wuxuu u bixiyeey "hawada holacda". Laafisoor, oo kimistariyahan Faransii ahaa, ayaa ugu horreeyey qof haydarojiinta ka soo saara biyaha, ogaadayna in biyuhu ka samaysan yihiin haydrojiin iyo ogsijiin. Laafisoor wuxuu neeftaa u bixiyeey haydarojiin oo la macna ah biyo sameeye.


Helitaanka Haydarojiin:

Haydrojiintu waxay adduunka u jirtaa iyada oo waxyaaloo kale ku darsan, iyo iyada oo aan waxba ku darsanayn. Haydarojiin aan waxba ku darsanayn way jirtaa adduunka, hase yeshee aad bay u yar tahay, waxana laga helaa xagga sare ee atmoosfiyeyerkka iyo mar-mar ay ka soo baxdo fumkaanaa iyo godadka batroolka laga soo saaro. Haydarojiinta wuxuu jiritaankeedu u badan yahay iyadoo iskudhisyo ku jirta. Culas ahaan biyaha waxa ku jira 1/9 oo haydarojiin ah. Haydarojiinta waxa kale oo laga helaa asiidhada, khudaarta iyo maatarka xayawaanka iyada oo ay u dheer tahay batroolka iyo neefaha dabiiciga ihi. Boqolleyda haydarojiinta ee ku jirta dhulka oogadiisa oo biyaha iyo hawaduba weheliyaan waa hal (1%).

Diyaarinta Haydarojiin:

Haydarojiinta dhowr siyood ayaa loo diyaariyaa oo ay ka mid yihiin kuwan soo socda:

b) Haydarojiinta biyaha laga soo saaro:

1. Biyaha Qabow:

Curiyeyaalka kaaliyam, kaalsiyam iyo naatriyam ayaa haydarojiinta ka saara biyaha qabow. Tusaale ahaan:

\[
2Na + H₂O → \text{NaOH} + H₂
\]

2. Biyaha kulul:

Haddii ay biyuhu kulul yihiin biraha ay ka mid yihiin magniisiyam iyo aluuminam ayaa iyana biyaha la falgala oo haydarojiin soo saara. Tusaale ahaan:

\[
\text{Mg} + 2H₂O → \text{Mg(OH)}₂ + H₂
\]

3. Biyaha uumiga ah:

Curiyeyaalka sink iyo xadiidku waxay la falgalaan uumiga biyaha, waxa ayna ka saaraan haydarojiin.

\[
3\text{Fe} + 4H₂O \underset{(falgalkani waa geddisme)}{\rightarrow} \text{Fe}_3\text{O}_₄ + 4H₂
\]
1) **Alkaliyada:** Haydarojiinta waxa laga soo saaraa alkaliyada. Haddii milan naatriyam haydarogsaydh ah la kulayliyo oo ay la falgalaan sink ama aluminam waxa ay soo saarayaan haydarojiin iyo milanno kala ah naatriyam sinkeyt iyo naatriyam aluminineyt.

\[
\begin{align*}
\text{Zn} + 2\text{NaOH} & \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2 \\
2\text{Al} + 2\text{NaOH} + 2\text{H}_2\text{O} & \rightarrow 2\text{NaAlO}_2 + 3\text{H}_2
\end{align*}
\]

j) Haydarojiinta waxa kale oo la soo saara marka la danabsooco milanno badan.

**Shaybaar ku diyaarinta haydarojiinta:**

Inkasta oo aynnu soo sheegnay dhowr darriiqo oo loo diyaariyo haydarojiinta, misana ta ugu habboon ee loogu diyaariyo shay-baarku waa falgalka ka dhaxeeya asiidhada badhxan ee salfiyuurik asiidh ama haydarokolorik asiidh iyo sink.

**Tijaabo 3.1:**

![Diagram](image)

\[
\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2
\]

**Sharbaar kudiyaarinta:** haydarojiin

**Darriiqo:**

Soo qaado dhalo, kuna xidh fur laba dalool ku kala wata masaf dhuunle iyo xidhiidhiso. Xidhiidhisaduna waxa ay isku xidhaysaa dhalada iyo moqoraafadda oo la dul dhigayoo koombada oo biyo ka buuxda. Quranuurux sink ah ku dhex rid dhalada kuna dar haydarokolorik asiidh ama salfiyuurik asiidh badhxan adiga oo sii dhex marinaya masafka.

**Fiirsasho:**

Marka asiidhu gaadho sink, waxa aad arkaysaa falgalkii oo bilaabmay. Dabeetana xunbooyin haydroyiina ayaa soo gaadhaya koombada, halkaasina ku ururaya: Neeftu biyaha ayay ku du ururaysaa kumana milmayso. Waxa kale oo aad arkaysaa in haydroyiinta ku jirta koombadu aanay midab lahayn.

**Gabagabo:**

Sink ayaa la falgalay salfiyuurik asiidh soona saaray haydararojiin iyo milan sink salfeyt ah. Sida sinkuba uu ula falgalay salfiyuurik asiidha ama haydarokolorik asiidha ee uu u soo saaray haydarojiin, ayaa biro kalena ula falgalaan asiidhadhaasi. Birahaasi waxa ka mid ah xadiidka, magniisamka iyo aluminamta.

\[
\begin{align*}
\text{Mg} + \text{H}_2\text{SO}_4 & = \text{MgSO}_4 + \text{H}_2 \\
\text{Fe} + 2\text{HCl} & = \text{FeCl}_2 + \text{H}_2
\end{align*}
\]
Haddii loo baahdo haydarojiin qallalan, soocna ah, waa in la sii dhex mariyaa dhuun-U oo ay kaalsiyam koloraydh isku-dhalaashani ku jirto. Sida loo ururiyaana waa hab hoos ka baro-bixin hawo.

JT. 3.2

Hubsashada Haydarojiin:
Sida caadiga ah oo loo hubsado haydarojiintu waa iyadoo olool la taabsiyoo oo qarax «bab» ahi samayso.

Tijaabooyin astaamaha haydarojiinta ku saabsan:
Waxa aad ururisaa dhawr koonbo oo ka buuxa haydarojiin, dabadeetona u hubso neefoos haddii hoos ku qoran:
1) Neefto miyey leedahay ur iyo midab?
2) Qori oloolaya geli koonbo la foorariyay oo ay haydarojiin ka buuxdo.
4) Haydarojiin dul mari feeq ee olaydh kulul oo ku jira dhuun.
5) Hubso haydarojiin adood taabsiinaya olool, bal in uu sameeso qarax
6) Haydarojiin gub si ay u sameeyso biyo (eeg tijaabada tusaysa in biyuhu yiihiin olaydh haydarojiin).

Astaamaha Duleed:

b) Haydarojiintu waa neef aan midab lahayn, sidaa awgeedna aan muuskan.
t) Haydarojiintu ur ma la haddii ay sooc tahay.
j) Haydarojiintu biyaha kuma milanto; sidaa awgeeda, ba biyaha loogu dul ururiyaa.
x) Haydarojiin way la cufnaan yar tahay hawada, waana neefo ugu fudud ee la yaqaanno.

1) Haddii haydarojiinta la dhex mariyoo milan saabuun ah, waxa samaysmaya xunbooyin haydarojiina oo kor u kacaya. Haddii olool la taabsiyoo xunbooyinka, waxa la maqlayyaa qarax codkisu yahay «BAB».

2) Haydarojiintu in ay fududahay waxa lagu garanayaa dhakhsay kor ugu kacdaa. Marka laba koonbo oo ta hoose haydarojiin ku jirto la is dul dhigo waxa la ogaanayaa in haydarojiintu koonbada sare ay ku ururayso.
JT. 3.3
Astaamaha Kimikaad:

b) Haydarojiintu ma caawiso gubashada sida ogsiijinta, laakiin si dhib yar ayay oloka u qabsataa.

t) Marka la gubo haydarojiinta midabka ololkeedu waa buluug waxaana sameysma biyo.
  \[
  2H_2 + O_2 = 2H_2O
  \]

j) Haydarojiintu waa yareeye. Tusaale ahaan, ogsaydhyaa biraha waxay u yaraysaa birahooda, sida:

\[
ZnO + H_2 = Zn + H_2O
\]

Yarayn

Ogasidehayntu waa ka daridda waxa lagu dario ogsiijin, ama laga saaro haydarojiin

\[
2Cu + O_2 = 2CuO
\]

Ogsidehayntu yaraan

X) Haydarojiintu waxay ay ku darsantaa bir-ma-ahayaalka.

kh) Haydarojiintu waxay ku darsantaa biraha, waxaanay samaysaa haydaraydhyo.

\[
2Na + H_2 = 2NaH
\]

\[
Ca + H_2 = CaH_2
\]

Diyaarinta warsheedee ee haydarojiin:

1. Habka Boosh:

Uumi biyoood sii dul mari kowk aad u kulul oo heerkulkiisu yahay 100°C. Waxa sameysmaya iskujir haydarojiin iyo kaarboon hal-ogsaydh ah.

\[
C + H_2O \xrightarrow{1000°C} CO + H_2
\]

Iskujirkan ayaa la sii dhex marinaya uumi biyo ah oo fara badan, falgalkana waxa kalkaalinaya feerik ogsaydh. Heerkulka falgulkuna waa 450°C. Maxsuulku wuxuu noqonayaay haydarojiin iyo kaarboon laba-ogsaydh.

\[
CO + H_2O \xrightarrow{Fe_3O_4 \, 450°C} CO_2 + 2H_2
\]
Kaaroob oo laba-ogaysadhu waa ay ee ku milmaa marka cadda diska la gaadhshiiyo ilaa 30 atmoosfiyey; waxana soo baxaysa neef haydarojiina oo badan.

\[
\begin{align*}
\text{CO}_2 + \text{H}_2\text{O} & \xrightarrow{30 \text{ atm}} \text{H}_2\text{CO}_3 \\
\text{Na}^+ + 2\text{Cl}^- + 2\text{H}^+ + \text{OH}^- & \leftrightarrow \text{H}_2 + \text{Cl}_2 + \text{NaOH}
\end{align*}
\]

**Danabsoocid:**

Dheeraad ahaan ayaa loo helaa haydarojiinta marke la danabsoco milan naatriyam coloraydha ah ee la soo saaray naatriyam haydarogsaydha. Meelaha uu danabku rakhisa ku yahay, haydarojiinta waxa laga soo saaraa biyaha oo in yar oo salfiyuuruk asidh ah lagu daro.

\[
\text{H}_2 + \text{Cl}_2 \xleftrightarrow{2} 2\text{HCl}
\]

**Waxtarka Haydarojiin:**

1. Haydarojiinta oo la ogadaan in ay tahay neefta ugu fudud neefahaa, ayaa lagu isticmaalaa buufimaha hawada loo dito.
2. Marka haydarojiin lagu dhex gubo neef ogajiiina oloolka ka soo baxaa wuxuu yeelaynaa heerkul sare ee ku habboon isticmaalka alxanka biraha.
3. Haydarojiintu waxay ku darsantaa kaarboon hal ogsaydh iyo miteyn uu weheliyo kaarboon hal ogsaydh, kuwaasi oo dhammaan la shito.
4. Samayska hadarakolorik asidhah:
   Haydarojiin ayaa lagu dhex gubaa koloriin; taasi oo markay ku milantay biyo, samaynaysa haydaroikolorik asidh.

   \[
   \text{H}_2 + \text{Cl}_2 \xrightarrow{2} 2\text{HCl}
   \]

5. **samayska Aamnooniya marka la raaco habka Heybar.**


\[
3\text{H}_2 + \text{N}_2 \xrightarrow{450°C, 200 \text{ atm.}} 2\text{NH}_3
\]

6. **Beddeladda salidda loo beddelayoo baruur:**

Saliidaha, ta nibiriga iyo ta iniinta cudbiga ayaa lagu daree haydarojiin si loogo rogaxiis. Wuxuu saliidayaa haydarojiinta ku darsamaan marka la kulayliyo ilaa 200°C lana cadaadiyo, iyadoo uu falgalka kalkaalinayo nikal aad loo jabiibey. Saliidahaasi cuntooni looma isticmaalo, laakiin baruurta soo baxda aad baa loo cunna.

7. **Marka kowlka loo beddelayoo batrool:**

Biyuhu waa ogsaydhka haydarojiin:

Haddii biyuhu yiiin iskudhis ka samaysan haydarojiin iyo ogsajin, waa in ay suuragal noqotaa in biyaha laga samayn karo labadaasi neefood.

Jaantuska 3.4 wuxuu tilmaamaya saabanka la isticmaalayso si biyo loo diyaariyo. Haydarojiinta waxa lagu diyaarinayaa qalabka kib oo sink iyo salfiyuuriik asiidh badhxami ku jiraan.

\[
Zn + H_2SO_4 = ZnSO_4 + H_2
\]

Haydarojiintu waxa ay sii dhex maraysaa saddexda dhuun-U ee B, T, J, kuwaasi oo laga buuxiyay kaalsiyam koloraydh isku-dhalaashan si ay neeftu u qallasho. Beeb (x) ayaa lagu xirayaa dhuumaha-U ta ugu danbaysa, si neefta loogu guboo. Oloola haydrojiintu wuxuu ku dul dhacayaa dhalacalooleedda (d) ee biyaha qaboobi dhex marayaan. Dhalada (d) waxa lagu dul arkayaa dhibco hoor ah oo markay isku soo darsamaan ku ururaaya bakeerga (f). Taa macnaheedu waxa weeye, marka ay haydarojiintu gubato ogsajin bay ku darsamaysaa, dabadeetana hoor ayaa samaysma.

\[
2H_2 + O_2 = 2H_2O.
\]

Hubshasho:

Haddii aad waxooga hoorka samaysmay ku shubto kubram salfeytka cad oo oomane ah, waxa soo baxaya kubram salfeytka cokan oo midabkiisu yahay buluug.

\[
CuSO_4 + 5H_2O \rightarrow CuSO_4 \cdot 5H_2O
\]

Caddaan buluug

Marka waxaad ogaanaysaa in hoorka samaysmay u yahay biyo.

Layli 3.1:
1) Wax ka qor waktarka haydarojiin?
2) Ka faallood sida aad haydarojiinta ugu diyaarin lahayd shay-baarka iyo warshadaha?
3) Sawir qalabka kib, sheegna marka neefaha lagu diyaariyo ee laga doorbido dhalada?
4) Caddee in biyo samaysmayaan marka haydarojiin la gubo? Biyaha samaysmay ma sooqbaa?
5) Maxaa foojignaa ah ee loo baahan yahay marka haydarojiin la gubayo?
6) Sidee ayaa u tusaysaa in haydarojiintu tahay neef fudud?
7) Sidee ayaa loo hubsadada haydarojiinta?
8) Wax ka qor helitaanka haydarojiinta?
9) Kuma ayaa bixiyay magaca haydarojiin, maxaanu ku keenay?

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Baabka Afaraad

CULAYS - ISUDHIGAN IYO
CULAYS - ATAM

Xeerka samayska (ama saamiga) go'an ee aynnu horre u soo dhiiganay, waxa aynnu ku aragnay in samayska isku-dhisku uu madoorsoo yahay si kastaba ha loo diyaariyo ama meel kastaba ha laga helo iskudhiskaas. Tusaale ahaan, saamiga ay had iyo goor culaysyo magnissiyay ah iyo kuwa ogsijin ihi isugu darsamaan waa Mg : O = 3 : 2. Sinki ogaysdhna saamiga ay had iyo jeer culaysysaadu sinku iyo ogsijintu isugu darsamaan waa Zn : O = 65 : 16. Kimirxaiyaanaddii qarnigii 19aad waxa ay sameeyeen tijaaboooyin badan oo ay ku raad-inayeen culaysyada isu dhigma ee ay curiyeaalka kala duwani isugu darsami karaan. Si ay taasi ugu suurtagashana, waxa ay halbeeg ka dhigteen haydarojiin oo ay siiyeen halbeeg culays oo hal ah. Culaysyada isu dhigma ee curiyeaalka ee isku darsami karana waxa ay u bixiyeen culays-isdughignanna curiyeaasha. Culays-isdughiganka curiyan, waxa loo qeexi kara: "inta jeer ee culays ahaan curiye ku darsami karo ama uu barabixin karo hal garaam oo haydarojiin ah." Isdughiganka waa tiro mutuxan, laakiin marka laga hadlayo culays-isdughiganka waxa la raaciyaahay halbeeg culays oo ah garaan, waxaana loo qoray garaam-isdughiganka culaysseed. Marka aynuu leenahay garaam-isdughiganka ogsijin waa 8 garaam waxa aynnu ujeednaa 8 garaam oo ogsijin ah ayaax ku darsama ama ka bar-bixiya iskudhis hal garaam oo haydarojiin ah. Haloos waxa aynnu ka arki karnaan in garaam-isdughiganko uu la mid yahay isdughiganka oo lagu tiibaxay garaammo. Mar haddii uu culays-isdughiganku ku xidhan yahay inta garaam ee la barbixin karo ama walax kale ku darsami karto, waxa aynuu halkaa ka gaadhi karnaab laba siyaabood oo culays-isdughignan loo soo saari karo:

1) toos ugu darsanka haydarojiin.
2) barbixinta haydarojiin.

1. Toos ugu darsanka haydarojiin:

Dariqqadani marka la isticmaalayo, culays la yaqaan oo curiye ah ayaa la qaataa oo dabadeed haydarojiin toos loogu geeyaa, si ay isula falgalaan. Marka falgalku dhammaadanka iskudhiska samaysmay ayaa la miisaamnaa. Halkaasna waxa laga soo saaraa culayska curiyyaha ee la falgeli kara hal garaam oo haydarojiin ah. Tusaale ahaan haddii x g, oo curiyyaha ihi uu ku darsamo y g oo haydarojiin ah, isdughiganka curiyyuhu waxa uu noqonayaa x y.

Dariqqadani aad looma isticmaaloo, sababta oo ah curiyeeyalaa aan badnayn ayaa toos ugu darsama haydarojiinta, kuwa ku darsamaana badanaabaa waa neefo, miisaamidaa neefuhuna way dhibaato badan tahay.

2. Barbixinta Haydarojiin:

Biraha oo dhammi kama saari karaan haydarojiin asiidhada ee qaar ka mid ah ayyuu baa la falgala asiidhada oo dabadeedna haydarojiinta ka saara. Biraha jaadkaasi ah, waxa isdughigankaad loo soo saaraa sida soo socota: Culays la yaqaan oo ah birta la doonayo in culays-iskudhigankaade la soo saaro ayaa lagu daraa asidhka, haydarojiinta soo baxdana waa la ururiyaa, halkaasna culayskeeda ayaa laga soo saaraa. Culayska haydarojiinta toos looma soo saari karo, wayna adag tahay si loo miisaamaa, laakiin waxa laga heli karaa oo xisaab ahaan looga soo saari karaa mugga haydarojiintaa ee soo baxay. (Sida culayska neeye day looga soo saaro muggeeda waxa aad ku dhigandoontaa qaybta neefaha.) Marka aad heshid culayska haydarojiinta ayaa dabadeed la xisabiyaay culayska curiyyaha (oo ah culays-isdughignaas) ee la falgeli laaha hal garaam oo haydarojiin ah.

Waxa muuqata in isticmaalka dariqqadani uu ku kooban yahay biraha haydarojiin asiidhada ka barabixiya sida sink, feeram, magniiyiim iwm.
Dariqqoyin kale oo lagu soo saaro culays-isudhiganka:

Labada darioq ee aynnu kor ku soo sheegnay, dhawr curiye oo keeli ah ayuun baynu ku soo saari karna culays-isudhigankooda. Waxase jira curiyeaall kale oo aan haydararojiinta toos ugu darsamin, barabixinna karin. Sidaa awgeed waa in aay jiraan dariqqoyin kale oo lagu soo saari karo culays-isudhiganka curiyeaasha.

Waxa aynnu soo sheegnay in isudhiganka ogsijiintu uu yahay 8. Taasina waxa ay tahay in 8 g oo ogsijin ihi ay ku darsami karto ama ka barbixin karto iskuubis hal garaam oo haydarojin ah. Isla markaana waxa la ogyahay in ogsijiintu ay la falgasho curiyeaall fara badan. Haddaba marka x g oo curiye uu ku darsamo 8 g oo ogsijin ah, waxa aynnu u qaadan karraa in ay la mid tahay iyadoo ay x g oo curiyaaha ihi ay la falgaleen 1 g oo haydarojin ah. Sidaa darteedna g isudhiganka curiuyuh waxa uu noqonayaa x g. Tusaale ahaan 31.8 g oo kubram ihi waxa ay ku darsantaa 8 g oo O₂ ah.8 g oo ogsijin ibina waxa ay ku darsantaa 1 g oo H₂. Sidaa awgeed 31.8 g oo kubram ihi waxa ay ku darsami lahayd ama ay barabixin lahayd (haddii ay isla falgalaanba) 1 g oo haydarojin ah. Sidaa awgeed g-isudhiganka kubram waa 31.8 g. Tijaabo ahaan waxa la helay in 1 g oo haydarojin ihi ay toos ugu darsanto 35.5 g oo koloriin ah. Sidaa awgeed g-isudhiganka koloriin 35.5 g. Marka la samaynayo iskuudhiska kubrik koloraydh culays-isudhiganka curiyeaasha waxa aynnu ku kordhin karna kuwa soo socda:

3. Toos ugu darsanka ogsijiin:

Culyays la yaqaan oo curiyyaha ah ayaa la gubaa si loogu beddelo ogsaydhkiisa. Ogsaydhka ayaa dabadeedna la misaamaa; halkaasna waxa laga soo saaray inta garaam ee curiyyahaas ah ee la falgashay 8 garaam oo ogsijiin ah.

4. yaraynta ogsaydhaha biraha:

Marka dariqadana la isticmaalayo, waxa la qatataa culays la yaqaan oo ogsaydh ah, waxana ogsaydhka loo roogaayi iyo iyada oo la kululaynayo, neef haydarojin ahna, ama yareeye kale, la dal marinyo sidii tojabadaba 1.1

Marka ogsaydhku uu bir isu rogo ayaa la miisaamadha birta samaysantay, dabadeednu labadaasii culays ayaa laga soo saaray culayska ogsijiinta ah ee la falgalyayo birta si ay u sameeyaa ogsaydhka. Marka intaas la helo waxa halkaas si dib yar looga soo saari karaa culayska birta ee ku darsami kale 8 garaam oo ogsijiina. Culayskiisina waxa uu yahay culays-isudhiganka birtaas.

5. Barabixinnta ay biri, bir kale barabixiso:

Dariqadani waxa ay ku xiran tahay ka saarista ay bir la yayaan culays-isudhigankeedu, ka saarayso bir kale milanka. Tusaale ahaan, haddii culays la yaqaan oo sink ah lagu rido milan kubram salfeyt ah, kubramta ayaa laga barabixinayaa milankeeda; waxana soo baxaya ruushi cas oo kubram ah. Ruushigaasi cas ayaa dabadeetu la miiran oo la qallajiyaa. Marka ruushiga la misaamonaa, waxa halkaas ka soo baxaya culayska kubramta ah ee uu culayskiisii sinka ahaa ka saaray milanka. Halkaasina waxa si fudud looga heli karaa culayska sinka ah ee barabixin kara 31.8 garaam (isudhiganka kubaramta) oo kubram ah.
Tijaabooyin lagu raadin karo isudhiganka curiyeaasha:

b) Raadiska isudhiganka magniisiyam iyada oo la isticmaalayo Dariiqada saddexaad

Tijaabo 4.1:

Miisaan dhaalka iyo daboollisiisaba, dabadeedna mar labaad miisaan marka aad ku riddid daliig magniisiyam ah. U meerar saabaankana sida jaantsuka 4.1 ku tusaayo, dabadeedna aad u kuluulay adiga oo hadba marmar ka qaaday daboollka si ay hawadu u soo gasho. Marka magniisiyamka intii badani uu isu rogo dambas ka qaad daboollka, aadna uu sii kululee.

Gubashada magniisiyamka kama dhalanaayo ogsaydhka oo keli ihi ee waxa isna samaysmayga isudhiska la yidhaahdo magniisiyam naytaraydha. Magniisiyam naytaradku waxa uu ka dhashay falgalka ka dhex dhecaaya neefta naytarojiin ee hawada ku jirta iyo magniisiyamka.

\[
\begin{align*}
2\text{Mg} + \text{O}_2 & \rightarrow 2\text{MgO} \\
3\text{Mg} + \text{N}_2 & \rightarrow \text{Mg}_3\text{N}_2
\end{align*}
\]

Sidaa dartooyinka waxa habboon marka dhaalku qaboobo in lagu daro waxoogayo biyo ah si waxa dhaalku ka jira oo dhan loogu rogo magniisiyam haydarogsaydh.

\[
\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg(OH)}_2
\]

iyo

\[
\text{Mg}_3\text{N}_2 + 6\text{H}_2\text{O} \rightarrow 3\text{Mg(OH)}_2 + 2\text{NH}_3
\]

Marka dhaalka (daboolku ma saarina) mar labaad aad loo kululeyona, magniisiyam haydarogsaydhkii samaysmay ayaa isu rogaya magniisiyam ogsaydh.

\[
\text{Mg(OH)}_2 \xrightarrow{\text{kul}} \text{MgO} + \text{H}_2\text{O}
\]

Dabadeddu ka mid dhaalka iyo daboollisiisaba qallajiye si ay halkaasi ugu qabowdo; marka uu qabobana miisaan dhaalka oo daboollisa wata iyo waxa ku jiraba. Ku celi kulaylinta, iyo miisaamidda dhaalka ilaa saddex jeer.

Ccelceliska saddexdaas miisaanu u qaado miisaanka saxa ah. halkaasina waxa aad ka soo saartaa isudhiganka magniisiyamka.

Natiijoyinkii laga helay tijaabo lagu sameeyey qolka shaybaadhkuna waa sida hoos ku taalla:
Culayska dhaalka + daboolka = 11.21 g
culayska dhaalka + daboolka + magnisiyam = 11.72 g

:. culayska magnisiyam
cul. magnisiyam ogsaydh + daboolka+ dhaalka = 12.06 g
culayska magnisiyam ogsaydh
culayska ogsijiinna = 0.85 g

= 0.34 g

Halkaasina, waxa aynnu ka arkaynaa in 0.34 g oo ogsijin ihi ku darsamaysa 0.51 g oo Mg. ah. 8 g oo ogsijin ihina waxa ay ku darsamaysaa \( \frac{8 \times 0.51}{0.34} \) = 12 g oo magnisiyam ah isudhiganka magnisiyamku = 12.0

t) Tijaabo 4.2:
Raadiska isudhiganka kubramta iyadoo la isticmaalayo dariiqada 5aad:

JT. 4.2
Ku rid seesar 5 garaam oo kubram salfeyt ah, kuna dar waxoogay biyo ah. Diiri si wiriqaha kubram salfeytku u wada milmaan. Dabadeedna waxa aad ku dartaan damaalanka kubram salfeytka ah ilaa hal garaam oo sinka ah. Markiiba sinka ayaa kubramta ka barabiloxaaya ilanka; ruushi cas oo kubram ahina gunta ayuu fadhigisayaa. Wuxuqgoy dheeraad ah oo kubram salfeyt ah ku dar si aad u hubisid in sinkii oo dhammi uu ka qayb qaataa falgalka. Dabadeedna ku miir ruushiga warqadda miirta ah oo culayskeeda la yaqaan. Biyo badan oo xareed ahna hadba ku xal ruushiga ku hadha miirtada, ilaa wixii midab buluugga ahay oo dhammi baabaa’. Marka aad qallajisid ruushigana miisaan warqadda miirtada ah iyo waxa ku jiraba. Halkaasina waxa kaaga soo baxayaa culayska kubramta ah ee uu barabixiyey culayskii sinka ahay ah aynnu qaadanu.

Natiijooyinka laga helay tijaabo lagu sameeyey qolka shay-baadhkana waa sida hoos ku taala:
Culayska sinka = 1.03 g
Culayska kubramta ee la barabixiyey = 1.01 g
Isudhiganka sinka = 32.5

1.03 g oo sinka ah ayaa barabixiyey 1.01 g oo kubram ah,
32.5 g oo sinka ahina wuxuu barabixin doonaa:

\[ \frac{32.5 \times 1.01}{1.03} = 31.8 \text{ g oo kubram ah} \]
Hase yeeshee waxa aynnu soo aragnay in marka falgal dhacaayo, ay falgalayashu ama curiyeaashuba isugu darsamaan saamiga isudhigannadooda.

Isudhiganka kubram = 31.8
(markka kaftoonkiisu yahay 2)

J) Tijaabo 4.3 :

Raadiska isudhigan birere (kubram) adiga oo isticmaalaya dariiqada 4aad.

Soo qado miisaan go’an oo kubram ah oo ku jira dhalo, dabadeedna u meerar saabaanka sida uu jaantuska 4.3 ku tusaayo. Inta aadan kululayn ogsaydhka, horta dhexmari in muddo ah maayad haydarojiin si ay uga wada saarto dhuunta wixii hawo ah ahaa ee ku jiray. Neefta haydarojiinta ah marka hore ku sii qallaji salfiyyurik asiidh rib ah oo ku jirto dhalo. Marka haydarojiinta la dhex mariyo dhuunta ay ku jirto salfiyyurik asiidhux, wax allaale wixii uumi biyood ah ahaa baa ka hadhaaya, waxaana soo baxaaya haydarojiin qallalan.

Marka haydarojiintu ka saarto dhuunta wixii hawo ah ahaa ee ku jiray, kulayli dhuunta. Waxaad arki doontaa ogsaydhkii oo bilaabay ifid. Ogsaydhku waxa uu isu rogi doonaa kubram oo bir ah, sababtoo ah haydarojiinta ayaa yareeye ah. Marka aad aragtigd ogsaydhkii oo isu regay kubramna dabka demi laakiin haydarojiintu sideedii ha ugu socoto.

Marka dhuunta iyo waxa ku jirabba qabobaana, ka soo saar dhaalka oo miisaan. Labada miisaanna waxa kaaga soo baxaaya culayska ogsijintaa ee kubramta la falgalay, halkaasina waxa aad si fudud ugalaa soo bixidoontaa isudhiganka kubramta.

Haddii aad si habsami ah u samaysid tijaabadan, waxa aad heli doontaa isudhiganka kubramta oo ah 31.8.

In kasta oo ay kala hawl badan yiihin, kuna kala habboon yiihinna isudhiganka biraha, haddana dariiqooyinka kale oo dhanna tijaabo ahaan waa la isticmaal karaa.

Xidihiidhka ka dheexeya cul-atamka, isudhiganka
iyo kaftoonka :

Bal tusalee aan u qaadanno biyaha oo maanta la yaaqanno in ay naanaystoo tahay H\textsubscript{2}O. Sidaa darteedna waxa halkii molikiyyuul ee biyo ah ku jira laba atam oo haydarojiin ah iyo hal atam oo ogisiijin ah; saamiga ay culaysyadoodu isu yiihinna waa 2:16 ama 1:8. Haddii aynaan wax kale aqoonin intaa mooyaanee, waxa aynnu u qori lahayn naanaysta biyaha HO, culays-ataamka ogisiijintuna waxa uu ahaan lahaa 8, halka uu hadda ka yahay 16ka. Laakiin maanta tirada 8 ah waxa ay tahay-isudhiganka ogisiijinta. Intii ka horreeysay 1860kiina way isku khaldi jireen isudhiganka iyo culays-ataamka curiyeysaasha, sababtuna waxa ay ahayd iyada oo aan la aqoonin naanaysaha dhabta ah ee iskudhisyyada.

Culays-ataamka curiyyuhi, sida aad ku aragtid tusaalaha sare weligiis wuxuu yahay tiro ah dhufsanaha isudhiganka curiyya. Tusaaale ahaan, culays-ataamka ogisiijinta waxa aynnu u qori karnaa sida soo socota:

\[ \text{Cult-At} = 2 \times \text{cul-isudhigan} = 2 \times 8.00 = 16.00 \text{ tirada ah 2 waxay la mid tahay inta atam ee haydarojiina ee hal atam oo ogisiijinta ka darsamay. Tiradaasi idil sida 2 ee sheegeysa awooodda uu curiye kula falgalo curiyeysaasha kale ayaa la yidhaa kaftoonka curiyya. Waxaana loo qeexaa inta atam ee haydarojiinka curiyya. Waxaan loo qeexaa inta atam ee haydarojiin ah ee hal atam oo curiye kale ahi ku darsami karo ama barbixin karo. Kaftoonkana waxa laga soo saaraa isudhiganka curiyya. Wuxuuna xidhiidh la leeyahay culays-ataamka iyo isudhigankaba sida aad hoos ku aragtid.} \]

\[
\begin{align*}
\text{Cult-At.} & = \frac{\text{Kaaftoon} \times \text{isudhigan}}{\text{culays-ataamka curiye}} \\
\text{Kaaftoon} & = \frac{\text{isudhiganka curiyya}}{\text{Cult-At.}} \\
\text{isudhigan curiye} & = \frac{\text{Cult-At.}}{\text{Kaaftoon}}
\end{align*}
\]

Sida aad ku aragtid isle'egta sare, haddii kaftoonka curiyyuhi uu isbeddelo waxa isna isbeddelaaya isudhiganka curiyya. Tusaaale ahaan, curiyya kabram oo culays-ataamkiisu yahay 63.6 wuxuu leeyahay laba kaftoon oo kala ah 1 iyo 2. Isudhiganka kabram marka uu leeyahay kaftoon ah hal (1) wuxuu noqonayaa:

\[
\text{Isudhigan} = \frac{\text{Cult-At.}}{\text{Kaaftoon}} = \frac{63.6}{1} = 63.6
\]

\[
\text{Marka uu leeyahay kaaftoon ah laba (2) waa :}
\]

\[
\text{Isudhigan} = \frac{\text{Cult-At.}}{\text{Kaaftoon}} = \frac{63.6}{2} = 31.8
\]

Culays-ataam:

Kubramtu waxa ay samaysaa laba ogsaydh oo kala geddisan, mid budo madow ah iyo mid budo cas ah. Isudhiganka kabramta waxa la soo saaraa marka ogsaydhka la yareeyo. Waxana la soo saaray in isudhiganka kabramta ee ku kala jirta ogsaydhka budada madow iyo ta casi ay kala yihiin 31.8 Iyo 63.6 sida ay u kala horreeyaan. Mar haddii kubramtu samayn karto laba ogsaydh oo kala duwan, waa in ay jirtaa laba siyaaboood oo kubramtu ula falgasho ogisiijinta. Ratibaadda ugu fudud ee ogsaydh kubram ihina waxa ay tahay hal atam oo kubram ah iyo hal atam oo ogisiijin ah oo isu tegay, ama laba atam oo kubram ah oo u tegay hal atam oo ogisiijin ah. Isutaggaas ka dhex dhacaaya ogisiijinta iyo atamyada kubramta, ee tiradoodu kala duwan tahay, ayaa keentay samaysanka labadaa ogsaydh ee kala duwan.

Labadaas iskudhisna waxa ay waafaqsan yiihin tijaabooyinkii lagu sameeyey iskudhisyyadaas.

32
Aragtidii atamka waxa aynnu ku soo aragnay in molikiyuul kasta ay ku jiraan tiro idil oo atamyo ah, atamyadaana aan la kale jejebin karin. Waxa aynnu soo aragnay oo kale in atam kastaa uu leeyahay culays go'an oo u gaar ah. Hase yeshee atamka, oo aad iyo aad u yar awgeed, way adag tahay si culayskiiisa loo soo saaro. Waxaase suuragal ah culayska atamyada in la isgarab dhigo, si la isugu eego culays-atamyada curiyeaashana waxa loo baahday culays beeggal ah oo looga qiyaas qaadan karo atamyada kale. Waxana ugu horrayn la isku raacay in atamka haydarojiin loo qaato halbeeg. Sidaa awgeedna culays-atamka waxa loo qeexay culays-atamka curiye waa inta jeer ee hal atam oo curiyeaahaa ihi uu ka culus yahay hal atam oo haydarojiin ah.

\[ \text{Cul. - At} = \frac{\text{cul. hal atam oo curiye}}{\text{cul. hal atam oo haydarojiin}} \]

Sida jidka sare aynnu ku aragno culays-atamka kubramtu waa madoorsome sida curiyeaalka kale. Hase yeshee isudhiganka kubramtu waa doorsomme, wuuna isbeddelaa isagoo ku xidhan hadba sida uu ula falgalo ogsijinta iyo bir-ma-aheyaasha kaleba. Si loo soor saaro culays-atamka uu curiye leeyahay waa in la isticmaalaa xeerka Dhaaloong iyo Bitit. Xeerkaasi wuxuu odhanayaa Curiyeaalka adkaha ah badankooda, marka culays-atamka curiyeaha lagu dhuusto kulqaadka kiiloogaraamkiiba ee curiyeaha waxa la hellayaa madoorsome ugu dhowaan 6.4 ah.

Culays-atam \times Kulqaadka kiiloogaramkiiba = 6.4

Haddii aynnu adeesganno xeerkaas, waxa aynnu soo saari karna, ugu dhowaan, culays-atamaya curiyeaasha adkaha ah, waayo tibaaxdaas xisaabead, (cul-At \times kulqaadka kiiloogaramkiiba = 6.4), waxa aan la garanayni waa culays-atamka oo keliya, isagana si dhib yar ayaa loo saari karaa.

Bal aynnu tusaale u qaadanno kubramta: Kulqaadka kiiloogaraamkiiba waa 0.095. Culays-atamka kubramtana waxa loo soo saari karaa sida soo socota:

\[ \text{cul-At.} \times \text{kulqaadka kiiloogaramkiiba} = 6.4 \]

\[ \text{cul-At.} = \frac{6.4}{\text{kulqaadka kiiloogaramkiiba}} = \frac{6.4}{0.095} = 67. \]

Culays-atamka dhabta ah ee kubramka waxa la ogaaday in uu yahay 63.6, waxana laga soo saaray xidhiidhka ah:

\[ \text{Cul-At.} = \text{Isudhigan} \times \text{Kaaftoon} = 31.8 \times 2 \]

\[ \text{Cul-At.} = 63.6 \]

Sidaas oo kale ayaa culays-atamaya biraha kalena loo soo saari karaa. Marka culays-atamka curiyeaasha neefaha ah la soo saarayo, waxa la adeegsadda xeerka Afgoardo, waxana aad si tafatiran ugu baran doontaa qatbya neefaha.

**Beeggalka Culays-atamka:**

Beeggalka culays-atamka curiyeaashu waxa uu soo maray heerar badan oo marba curiye gaar ah loo qaadanayey halbeeg. Beeggalkii ugu horreeey waxa loo qaattay haydaroojiin oo la siyey hal. Mar labaad ayaa la beddelay oo loo qaattay ogsijin halbeega iyadoo la siyey 16. Sababaha loogu qaattay ogsijinta halbeeggana waxa ka mid ah: Ogsijinta oo curiyeaasha badankooda si toos ah ula falgasha, taasina waxa ay innoo suurtagelinaysaani la isu eego culaysyada atamyada isutegaaya, isla markaana culays-atamada curiyeaasha kale oo dhammi waxa ay yeeshaan tiro ku dhow mid ilid marka loo qaato ogsijin halbeeg.

Sidaa awgeed, waxa hadbaa loo qeeexaa culys-atamka: culays-atamka curiye waa inaad jeer ee uu cufka hal atam oo curiyaahi ihi ka culus yahay labaa iyo toban meelood meel ahaan (1.12) cufka hal atam oo kaarboon-12 ah.

**Laylì :**

1) Qeex isudhiganka curiye? Waxaadna sheegtaa waxa uu kaga duwan yahay garaam-isudhiganka?
2) Sheeg shan dariiyo oo isudhiganka curiyeeyaasha lagu raadin karo? Dabadeedna adiga oo tusaaale u qaadanaya curiyaha xadda dha ah sharax mid ka mid ah?
3) Marka 1.2 g bir ah lagu gubbo ogsiijin waxa soo baxa culays ah 2.00 g. Raadi isudhiganka birta?
4) Haddii curiye isudhigankiisu yahay 31.8, soo saar culayska ogsaydhka samayska marka 1.00 garaam oo curiyahaas ah dhammaan la ogsidheeyo?
5) Salfar wuxuu sameeyaa labaa ogsaydh. Ogsaydhada midkood waxa ku jira 50% culays ahaan oo ogsiijin ah, ka kalena 60% culays ahaan oo ogsiijinaya. Raadi labada isudhigan ee salfarka.
6) 4 g kubram ah ayaa lagu daray naytarik asiiidh. Milanka kubrik Naytareytka ah ee samaysmayna waa la uumibixiyey, waxa soo hadhana aad ayaa loo kululeeyey ilaa culays go'an la helay. Raadi culayska hadhaaga ah ee samaysma haddii isudhiganka kubramku yahay 31.8?
7) Sheeg xeerka Daalong iyo Bitit, sharaxna sida loogu soo saari karo culays-atamka iyo kaftoonka curiyeeyaasha?
8) Curiye ayaa kulqaadka kiiloogaraamiikisu yahay 0.03, isudhigankiisuna waa 103.5, waa meeqa culays-atamka curiyuuhu?
9) Curiye bir ah ayaa leh laba isudhigan oo kala ah 27.9 iyo 18.6. Kulqaadka kiiloogaramkiisuna waa 0.11. Raadi culays-atamka birta iyo laba kaftoon ee curiyuuhu leeyahay?
10) 3.00 garaam oo maganisiyam ah ayaa lagu dhex riday milan kubram salfeyt ah oo kulul. Ruushiga kubramta ah ee soo baxana marka la miro ee la qallajiyoo, culayskiisu waxa uu noqonayaay 7.95 g. Haddii isudhiganka kubramtu uu yahay 31.8, waa meeqa isudhiganka maganisiyamku?
11) Qeex (b) culays-atam, (t) isudhigan. Waa maxay xidihiidhka ka dhexceeyana. Sidee baa kulqaadka kiiloogaraamiikiba ee curiye uu u caawin karaa raadiska culays-atamka curiyaha.
12) Haddii 1.00 garaam oo bir ihi uu samaynaayo 1.67 garaam oo ogsaydha ah marka la gubo, waa meeqa culayska koloraydhka ah ee ay samayn karaan 2.00 garaam oo curiyahaasi?

13) 2.789 g oo ogsaydha bireed ah ayaa loo xareeyey bir, wuxuuna culayskii birto noocday 2.496 g. Kulqaadka kii loogaraamkiiba ee birto waa 0.03. Adiga oo adeegsanaya xeerka Daalong iyo Bitit soo saar Culays-atamka birta. Dabadeedna ku sax natijada aad heshid adiga oo adeegsanaya xidhiidhka ah (Cul-At. = isudhigan × kaftoom).
Baabka Shanaad

GARAAM-ATAMKA IYO Moolka

Garaam-Atam:

Halbeeggaa culayska ee la isticmaalayaa, marka walax la miisaamayo, waa in uu ahaadaa mid ku habboon waxalaxda la miisaamayo. Haddii aynuu rabno in aynuu walax culus miis-aanno; waxa aynuu isticmaali karnaai kiioloogaraamo, marka aynuu walax fudud miisaam-ayno, waxa aynuu isticmaali karna garaamo ama miligaraammo. Culimada kimistarigu waxa ay u baahan yihii in ay ogaadaan culayska iyo tirada atammadada ee ku jira curiyaha marka uu falgal kiimiko ah ka qaybqato. Halbeeggaa culayska ee ku habboon miisaamidda atammadada waxa loo yaqaan garaam-ataam.

Mar haddii atammadada culayskoodu uu aad iyo aad u yar yahay wax allale wixii la miisaamo oo dheemina ha ahaadeen iskudhisiyo ama curiyeyaal, waa in ay ku jiraan tiro aad u fara badan oo atammo ahi. Tusaale ahaan, marka la samaynaayo iskudhiska ah kaarboon hal-ogsaydh, suuragal ma aha in la miisaamo hal atam oo ah kaarboon iyo hal atam oo ogsiijina, waayo in allalee inta miisaan geli karta oo ah kaarboon iyo ogsiijina, waxa ku jira tiro aad u badan oo atammo ah. Hase yeeshee waa suuragal in la helo tiro isleeg oo ah atammo kaarboona iyo kuwa ogsiijina, haddii la adeegsado culays-atakma curiyeaashaasi Culays-attamadda, (C = 12, O = 15.999), waxa aynuu ka arki karnaan in hakkii atam ee kaarboon ihi 12/15.999 oo jeer culays culus yahay hal atam oo ogsiijina. Xagga kale marka laga eegana, cuf kasta oo kaarboon ah oo culayskiisu yahay 12/15.999 oo jeer culayska ogsiijinna waa in ay ku jiraan tiro atammo ah oo leeg tirada atammadada ogsiijiinta ku jirta. 12 garaam oo kaarboon ah waxa ku jira tiro atammo kaarboon ah oo leeg tirada atammadada ku jira 15.999 garaam oo ogsiijina. Guud ahaan, marka aynuu qaadanno culaysyo la mid ah culays-atamadda curiyeaasha waxaynu weligeen haysanaynaa atammo tiradoodo isleeg tahay.

Garaam-ataam waxa loo qeexaa: cutub atammo ah oo wadarta culayskoodu ay tahay inta garaam ee tiro ahaan la mid ah culays-atakma curiyaha. Sidaa awgeed mar haddii culays-atakma salfar uu yahay 32.064, cuntaat ammoo ah oo salfar ah oo culayskoodu yahay 32.064 g waxa ay noqonaysaa hal garaam-ataam oo salfar ah. Sidaasii oo kale ayaa 55.85 garaam oo xadiid ahina, ay ula mid tahay hal garaam-ataam oo xadiid ah. Sida aad tusaalaha sare ku aragtid; cutubaya atammadada ee curiyeaasha kala duwan waxay leeyihiin culaysyo kala geddisan. Hase yeeshee hal garaam-ataam oo curiye kastaba ah waxa ku jira tiro isleeg oo atammo ah. Tiradaas madoorsooma ahna waxa la yidhaa tirada Afgoaard; waxana ay la mid tahay 6.0225 × 10²³.

Fikraddaas garaam-atakmku waxay innoo suuragelinaysaa sida aynnu u dooran lahayn tiro habboon oo atammo ah marka laba walxood la isu geynaayo. Tusaale ahaan ka soo qaad in aynuu rabno in aynuu samaynno iskudhis ka kooban atam oo salfar ah iyo atam oo xadiid ah. Haddii aynnu qaadanno hal garaam-ataam oo salfar ah iyo hal garaam-ataam oo xadiid ah, waxa mid walba ku jira tiro atammo ah oo isleeg. Halkii atam ee salfar ahaana, waxa loo helayaal hal atam oo xadiid ah oo la falgala. Taa ka sokow, culayska aynnu qaadannay waa kuwo suuragal ah in lagu miisaamoo qalabka qolka shay-baarka yaalla. (u fiirso halkii garaam-ataam, waxa uu la mid yahay culays-atakma oo lagu tibaaxay garaammo). Mar haddii tirada garaam-ataammadah ee ee isleeg ee curiyeaasha kala duwan, ay ku jiraan tirooyin isleeg oo atammo ah, waxa habboon in culayska curiyaha lagu tibaaxo garaam-ataammo.
Tusaale :

1) Immisa garaam-ataam ayaa ku jira 3.2 g oo salfar ah?

Furfurid :

\[
32.064 \text{ garaam oo salfar ahi waa } 1 \text{ garaam-ataam} \\
3.2 \text{ garaam oo salfar ahina waa } \frac{3.2}{32.064} \times 1 = 0.10 \\
0.10 \text{ garaam-ataam}
\]

2) Immisa garaam ayaa ku jira (b) 0.5 garaam-ataam oo naytarojiina.

a. 5 garaam-ataam oo ogsijiini?

b. 1 garaam-ataam oo N\textsubscript{2} waxa culayskiisu yahay 14 g.

\[
\text{. . . . 0.5 garaam-ataam oo N}_2 \text{ waa } \left(\frac{0.5 \times 14}{1}\right) = 7 \text{ g.}
\]

\[
\text{. . . . t. 1 garaam-ataam ee ogsijiini wuxuu la mid yahay 16 g.}
\]

\[
\text{. . . . 0.5 garaam oo ogsijiini waa } \left(\frac{16 \times 0.5}{1}\right) = 80 \text{ g}
\]

3) Waa meeqa inta garaam-ataam ee fosfoor ah ee ku jira 100 garaam oo fosfiina (PH\textsubscript{3}).

\[
\text{culays-ataamka fosfoor } = 31 \\
\text{Haydarjiin } = 3 \times 1 = 3 \\
\text{culays-molikiyuul fosfiin } = 34 \\
\text{culays fosfoorka ee ku jira 100 g oo fosfiini } = \frac{100 \times 31}{34} = 91.1 \text{ garaam.}
\]

Hase yeeshee halkii garaam-ataam ee fosfoor ihi waa 31 g. Taasina waxay u dhigan tahay in 31 g oo fosfoor ihi la mid yihii 1 garaam-ataam.

\[
\text{. . . . 91.1 garaam fosfoor ihina wuxuu la mid noqonayaa :}
\]

\[
91.1 \times 1 = 2.94 \text{ garaam-ataam}
\]

Layli 5.1 :

1) Waa maxay micnaha erayga ah garaam-ataam?

2) Maxaa looga jeedaa oo ay tahay tirada la yiraahdo tirada Afogaardo?

3) In kasta oo aan la miisaami karin culaysia hal atam, haddana waa suuragal in la helo falgal ka dhax dhaca hal atam ooogsijiina iyo hal atam oo kaalsiyam ah. Siday taasi u dhaacadha?

4) Falgalka ka dhax dhaca litiyam iyo salfar si uu u samaysmo iskudhis naanaystiiisu tahay Li\textsubscript{2}S, saamiga ay isu yihii atammada litiyam iyo kuwa salfar waa 2 : 1. Sidee baad saamigaan go'an u heleysaa?

5) Meeqa garaam ayaa ku jira (b) 4.2 garaam-ataam oo haydarjiina (t) 0.001 garaam-ataam oo salfar ah?

6) Musbaar xadiid ah (Fe) ayaa culayskiisu yahay 5.58 garaam. Soo saar inta garaam-ataam ee ku jirta?
7) Meeqa atam ayaa ku jira (b) 1 garaam-atum oo curiye (t) 2.2 garaam-atum oo ogsijii. (j) 0.25 garaam-atum oo salfar ah, (x) 2.4 garaam-atum oo haydarojiina, (kh) 8 garaam oo salfar ah, (d) 32 garaam oo ogsijiiin?

8) Waxaad soo saartaa inta garaam-atum oo curiye kastaba ah ee ku jira 196 garaam oo H$_3$PO$_4$ah?

**M O O L**

Culays-molikiyuula iskudhisyadu waa wadarta culays-atammada curiyeaasha uu ka kooban yahay. Tusaale ahaan culays-molikiyuulka naariyam koloraydho oo ah 58.5 waa culays naariyam (23) oo loo geeay culays-atamka kolorin (35.5). Culays-molikiyuulka sonkontu (C$_{12}$H$_{22}$O$_{13}$) waa 342. Waxayna la mid tahay 12 jeer culays-atamka kaaraan oo loo geeyo 22 jeer culays-atamka haydarojiin, oo loo sii geeyo 11 jeer culays-atamka oggijii. Garaam-molikiyuulka waxa loo qeexaa xaddiga walax ee culayskiisu uu tiro ahaan la mid yahay culays-molikiyuulka oo lagu tibaxay garaammo. Garaam-molikiyuulka waxa loo qoraa garaam-mool ama mool. Sidaa darteed 342 garaam oo sonkor ah waxay ay la mid tahay hal mool oo sonkor ah. 34.2 garaam oo isla sonkortaasi ihi waxa ay la mid noqonaysaa 0.1 mool (0.1 = $\frac{34.2}{342}$)

Halkaasina waxa aynnu ka arkaynna in xaddiga mool ee ku jira iskudhish, uu la mid yahay culayska iskudhiska oo loo qaybshay culays-molikiyuulka iskudhiska.

Tirada mool = $\frac{Culayska iskudhiska}{Culays-molikiyuulka iskudhiska}$

ama $n = \frac{m}{M}$

$n = $ waxa ay u taagan tahay tirada mool.

$m = $ culayska walaxda.

$M = $ culays-molikiyuulka walaxdaas.

Bal hadda aynnu u fiirsanno in wax xidhiidh ihi ka dhexeeyo tirada Afogaardo iyo moolka. Tusaale ahaan u fiirso iskudhiska S$_2$Cl$_2$. Halkii mool ee S$_2$Cl$_2$ ahaa culayskiisu waa 135 g, waxana ku jira 64 g oo salfar ah iyo 71 g oo kolorin ah. 64kii garaam ee salfarka ahaa (culays-atamkeedu waa 32) waxa ku jira 64/32, ama 2, garaam-atum oo salfara; 71kii garaam ee kolorinti ahaana (culays-atamkeedu waa 35.5) waxa ku jira 71/35.5 ama 2, garaam-atum oo kolorinah. Mar haddii halkii garaam-atum ay ku jiraan tirada Afogaardo oo atammo ihi, labadii garaam-atum ee salfar ahna waxa ku jira 2 $\times$ 6.02 $\times$ 10$^{23}$ atam oo salfar ah, labadii garaam-atum ee koloriin ahna waxa ku jira 2 $\times$ 6.02 $\times$ 10$^{23}$ atam oo kolorin ah. Naanaysta molikiyuulka S$_2$Cl$_2$ waxa ka muuqda in 2 atam oo salfar ah iyo 2 atam oo koloriin ihi ay soo saaraayaan 1 moolikiyuul oo S$_2$Cl$_2$ ah.

Sidaa awgeed 2 $\times$ 6.02 $\times$ 10$^{23}$ atam oo salfar ah iyo 2 $\times$ 6.02 $\times$ 10$^{23}$ atam oo kolorin ah, waxa ay soo saaraayan 6.02 $\times$ 10$^{23}$ oo molikiyuul oo S$_2$Cl$_2$ ah. Sidaa awgeed halkii garaam-mool ama mool ee iskudhish, waxa ku jira tirada Afogaardo oo molikiyuul oo. Moolkuna kuma kooobra molikiyuullada oo keliya, ee waxa kale oo lagu isticmaali karaa tirada Afogaardo oo atammo ah, ama elektaroonno ah ama aayoonabaa ah. Sidaa awgeed waxa loo qeexaa moolka: moolku waxa weeye culayska walax ee ay ku jiraan tiro atammo ah, ama molikiyuullo ah, ama aayoonno ah oo isku wada mid ah oo la culays ah tirada atammada ah ku jirta 12.00 g oo kaarboon-12 ah.

38
Tusaale:

1) Meeqa mool ayaa ku jira 196 garaam oo H$_3$PO$_4$?
Marka ugu horraysa soo saar culays-molikiyuulka.

\[
\begin{align*}
\text{Wadarta culays-atamka haydarojiin} & = 3 \times 1 = 3 \\
\text{» » » Fosfoor} & = 1 \times 31 = 31 \\
\text{» » » Ogsijiiin} & = 4 \times 16 = 64 \\
\text{culays-molikiyuulka iskudhiska} & = 98
\end{align*}
\]

\[
\text{tirada mool ee H$_3$PO$_4$} = \frac{\text{culays iskudhiska}}{\text{culays-molikiyuulkiisa}} = \frac{196}{98} = 2
\]

\[
\text{tirada mool ee H$_3$PO$_4$} = 2
\]

2) Meeqa mool ayaa ku jira 28.5 garaam oo ah Al$_2$(SO$_4$)$_3$?

\[
\begin{align*}
\text{Wadarta cul-atamka} & \quad \text{Al.} = 2 \times 27 = 54 \\
\text{» » » Salfar} & = 3 \times 32 = 96 \\
\text{» » » Ogsijiiin} & = 12 \times 16 = 192 \\
\text{cul-molikiyuulka iskudhiska} & = 342
\end{align*}
\]

\[
\text{tirada mool ee iskudhiskuna (n)} = \frac{m}{M} = \frac{28.5}{342} = \frac{1}{12} = 0.083
\]

\[
\text{tirada mool ee Al}_2\text{(SO}_4\text{)}_3 = 0.08
\]

Layli 5.2:

1) Waa maxay ujeedadda ama micnaha ereyga ah garaam-molikiyuul ama mool?

2) Immisa molikiyuul ayaa ku jira: (b) hal mool (t) 0.2 mool (j) 80 garaam oo naat-riyam haydarogsaydh ah?

3) Raadi inta mool ee ku jirta 0.730 garaam oo HCl ah.

4) Meeqa mool ayaa ku jira 284 g oo Na$_2$SO$_4$ ah?

5) Raadi inta mool ee ku jira 100 garaam oo ah (b) PH$_3$(t) H$_3$PO$_4$(j) H$_4$PO$_7$(x) CaCO$_3$(kh) NaCl (d) Ca(NO$_3$)$_2$.

6) Soo saar inta garaam ee ku kala jira (b) 0.4 mool CO$_2$(t) 0.2 mool K$_2$SO$_4$(j) 5.14 mool NH$_3$.

7) Meeqa atam oo curiye kastaba ah ayaa ku jira 5.00 mool oo H$_4$P$_2$O$_7$ (Bayroofosfoorik asiidh)?

8) Haddii culayska hal atam oo qudha oo curiye ihi uu yahay 3.053 $\times 10^{-22}$ garaam, waa imisa culays-atamka curiyahaasi?

9) Raadi inta atam oo curiye kastaba ah ee ku jira iskudhiska HNO$_3$.

10) Haddii 6.588 garaam oo koroomiyan ihi uu ka soo saaro 0.253 garaam oo haydarojiin ah asiidhka HCl, raad; (b) Iskudhiganka koroomiyam (t) Garaam-isudhigankiisa (j) Inta garaam-atom uu la mid yahay.
Baabka Lixaad

NAANAYSAHA IYO ISLE'EGYADA KIIIMIKAAD

Raadiska naanaysta iskudhiska

b. Naanaysta fudud ee iskudhiska:

Waxa ay nuu casharradii hore ku soo aragney sida loo helo samayska iskudhiska ee boqolleed. Bal hadda aynuu isku dayno sida loo helo saamiga tirada atamyada curiyeysaasha uu ka kooban yahay iskudhisku, marka aynuu haysanno samayska iskudhiska ee boqolleed. Curiyeysaasha iskudhisku, ka kooban yahay marka loo qoro saamigooda ah, tirada idil ee ugu yarna. waxa la helaa naanaysta iskudhiska. Naanaystaana waxa loo yaqaan naanaysta fudud ee iskudhiska, waana ta ugu fudud ee iskudhisa li siin karo. Naanaysta fududi waxa ay tustaa oo keliya, saamigalka ay atamyada curiyeysaasha kala duwani ugu kala jiraan iskudhiska. Tusaale ahaan, haddii aynuu ognahay in ogsaydh salfar ah ay culayskiisa 50% tahay salfar, waxa isla markaaba innoo caddaynaya in 50ka hadhay uu oggiijin yahay. Haddii atamyada salfarka iyo kuwa oggiijintu ay culays isku mid ah lahaan lahaaeyen, tirada atamyada salfarta ah, iyo kuwa oggiijinta ah ee ku jiri lahaa molikiyuuul ogsaydhka ah isku mid ayay ahaan lahaaeyen. Hase yeeshee culays-ataamka oggiijinta waa 16, ka salfartuna waa 32 (Laban laabka culayska ogdiijin. Sidaa darteed culayska ogsaydhka, 50ka qaybood ee culays ahaan salfarta ah waxa ku jira 50/32 garaam-atam oo salfar ah. 50ka qaybood ee culays ahaan oggiijinta ahna waxa ku jira 50/16 garaam-atam oo oggiijin ah. Waxa kale oo aynuu ognahay in garaam-ataamku uu saamigal qumman u yahay tirada atamyada, sidaa darteed atamyada salfarka ah iyo kuwa oggiijinta ah ee ku kala jira ogsaydhka waa 50/32 iyo 50/16 sidaa ay u kala horreeyaan. Tirooyinkaasi kala ah 1.56 iyo 3.12 ma noqon karaan tirooyinka dhabta ah ee atamyada ku jira iskudhiska; waayo atamyada jajab ma yeesheen, waxayse tirooyinkaasii yihiin kuwa tusayo saamigalkood oo keliya. Halkaana waxa aynuu markiiba ka akhri karraa in saamiga tirada atamyada oggiijinta iyo salfartu ay yihiin 1:2, sida ay u kala horreeyaan, haddii labada tiroba loo qaybiyo 1.56. Sidaa darteed naanaysta ogsaydhku waxa uu noqon kara SO₂. Hase ahataab ee isla markaas wax sabab ah uma haynno waxa ay u noqon weyday naanaysaha ah: S₂O₄, S₃O₆, ama S₄O₆ waayo mid kastaaba way waaqaaysa saamigatamyada oggiijinta iyo salfartee ee iskudhisku ka kooban yahay. Naanaystaas iskudhis qaadan karo, ee ay saamiga isugu tegayaan uu ugu yar yahay ayaa la yidhaa naanaysta fudud. Inta badan lagama yaabo in aad mar walba heshid tirooyinka saamiga atamyada iyada oo ah tiro idil, haddii se taasi dhacdo tirooyinka ta ugu yar ayaa loo qaybiyaha tirooyinka oo dhana; tusaaalooyinka soo socda ayaan inna tusaya sida loo soo saaro naanaysta fudud ee iskudhis leeyahay.

Tusaale 1:

Iskudhis ayaa waxa ku jira 56.5% oo kaaliyam ah, 8.7% oo kaarboon ah iyo 34.8% oo oggiijin ah culays ahaan. Raadii naanaystisuiga ugu fudud.

Furfurid:

<table>
<thead>
<tr>
<th>Kaaliyam</th>
<th>Kaarboon</th>
<th>Ogsijin</th>
</tr>
</thead>
<tbody>
<tr>
<td>% culkays ahaan inta</td>
<td>56.6</td>
<td>8.7</td>
</tr>
<tr>
<td>saamiga tirada atamyada</td>
<td>56.5/39</td>
<td>8.7/12</td>
</tr>
<tr>
<td>oo la mid ah</td>
<td>1.45</td>
<td>0.725</td>
</tr>
<tr>
<td>u qaybi tirada ugu yar taasina waxa ay u dhigan tahay</td>
<td>1.45/0.725</td>
<td>0.725/0.725</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Kaaliyam</th>
<th>Kaarboon</th>
<th>Ogsijin</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
Naanaysta fududi waa $K_2CO_3$.
(U fiirso saamiga tirada atamyada ee curiyeaashu waxay noqonayaan hoosgalayaal).

**Tusaale 2 :**

Iskudhis ah ogsaydh kiboob oo culayskiisu yahay 11.47 garaam ayaa marka la yareeyo bixiya 9.16 garaam oo kiboob ah. Raadi naanaysta fudud ee iskudhiska (Cul-At. Cu = 63.5 O = 16).

**Furfurid:**

Mar haddii uu iskudhisku kooban yahay kiboob iyo ogsijiin oo qudha, culayska ogsijiinta ah ee iskudhiska ku jiraa waa 11.47 — 9.16 garaam = 2.31 garaam.

Tirada garaam-atam ee curiye kasta ku jirta = Culayska curiyaha/culays-atamkiisa.

\[
\text{Tirada garaam-atam ee kubramtu} = \frac{9.16}{63.5} = 0.144
\]

\[
\text{Tirada garaam-atam ee ogsijiin} = \frac{2.3}{16} = 0.144
\]

Saamiga tirada garaam- atamyada Cu : O = 0.144 : 0.144 (ama saamiga tirada atamyadu)

Saamiga ugu yar ee tirooyin idil ihina = 1 : 1

Naanaysta fudud ee ogsaydhku waa CuO

(T) Naanays-molikiyuulka Iskudhiska:

Naanaysta inna siinaysaa tirada dhiiba ah ee atamyada curiyeaasha uu ka kiboob yahay iskudhis ayaa la yidhaa naanays-molikiyuulka, waxa loo qeexaa naanaysta tusta tirada dhiiba ah, ee atamyada kala duwan, ee ku jira hal molikiyiuul oo iskudhis. Saaftidda waxu xoo ay inna siinaysa oo keli ah naanaysaha fudud, hase yeeshee lagama yaabo in naanaysahaasi ay mar walba yihiin kuwa dhiiba ah ee iskudhisyada. Tusaale ahaan waxa aynnu soo aragnay in naanaysta fudud ee salfar laba-ogsaydh ay tahay $SO_2$ laakiinse. Sidii aynnu hore oo soo sheegnay naanaysaha ah dhiifsanaha $SO_2$, oo dhammi ($S_2O_3$, $S_2O_6$ $S_4O_6$ iwm.) way waafaqsan yihiin saamigii ahaa $S : O = 1 : 2$. Haddaba arrinta taagani waxa ay tahay, sidee ayaa loo heli karaa naanays-molikiyuulka dhiiba ah ee iskudhis. Illayn iskudhis kastaaba waxa uu leeyahay dhismaha qudha oo u gaar aha.

Ma suurtogelaysa in markiba la ogada naanaysta dhiiba ah ee iskudhis leeyahay, iyada oo la soo saaro culays-molikiyuulka iskudhiska mooyane, culays-molikiyuulka iskudhisyada tijaabo ahaan ayaa lagu helaa. Marka aad heshid culays-molikiyuulka iskudhiska, waxa ay hawl yar tahay in la helo dhiifsanaha dhiiba ah ee naanaysta fudud ee la mid ah naanays-molikiyuulka. Taasina waxa aynnu ku heli karaa, haddii aynnu dhiifsanaha fudud aynnu u taagno hoogsalaha n, dabadeetana aynnu hoogsalaha ku wada dhiifanno tirada atamyada ee curiye kastaba ah ee ku jira naanays-molikiyuulka iskudhiska.

\[
\text{(naanaysta fudud)} = \text{culays-molikiyuulka}
\]

Tusaalooyinka soo socda ayaa xidhiidhkaas inoo faahfaahindoona.
**Tusaale 1:**

Iskudhis ayaa waxa ku jira 75% culays-ahaan oo kaarboon ah, iyo 25% culays ahaan oo haydarojiin ah. Soo saar naanaysta fudud ee iskudhiska. Haddii culays-molikiyuuulu uu yahay 16, raadi naanays-molikiyuuul iskudhiska?

Tirada garaam-atam ee haydarojiin \( = \frac{25 \text{ g oo } H_2}{1.01 \text{ g oo } H_2} = 24.8 \)
Tirada garaam-atam ee kaarboon \( = \frac{75 \text{ g oo } C}{12 \text{ g oo } C} = 6.25 \)
Saamiga tirada atamyada C : H \( = \frac{6.25}{6.25} : \frac{24.8}{24.8} = 1:4 \)

\[ \text{Naanaysta fudud} \quad = \quad \text{CH}_4 \]
\[ \text{Naanaysta-molikiyuuul} \quad = \quad (\text{naanaysta fudud})_n \]

\[ \text{Culays - molikiyuuul} \quad = \quad \frac{\text{culayska CH}_4}{16} \]
\[ = \quad \frac{(12 + 4)_n}{16} \]
\[ = \quad \frac{16}{n} \]

\[ n \quad = \quad 1 \]

Taasi waxay tahay in naanays-molikiyuuulka iskudhisku uu yahay \((\text{CH}_4)_n\) ama \(\text{CH}_4\).

Sidaa awgeed naanaysta fudud ee miteyn waxa ay la mid tahay naaneys-molikiyuuulkeeda.

**Tusaale 2:**

Haydarojiin beerogsayd ahay markii la saafay, waxa la ogaaday in ay ku jiraan 5.9% haydarojiiniyo 94.1% ogsijii ah. Culays-molikiyuuulka iskudhiskuna waana 34. Soo saar naanaysta dhabta ah ee iskudhiskaasi leeyahay.

**Furfurid:**

Tirada garaam-atam ee haydarojiin \( = \frac{5.9}{1.01} = 5.8 \)

Tirada garaam-atam ee ogsijii \( = \frac{94.1}{16} = 5.9 \)

Saamiga tirada atamyada H : O \( = \frac{5.8}{5.9} : \frac{5.9}{5.9} \)

\[ \text{naanaysta fududi} \quad = \quad \frac{\text{HO}}{\text{HO}} \]
\[ \text{(culayska HO)}_n \quad = \quad \text{culays-molikiyuuulka} \]
\[ \text{(culayska HO)}_n \quad = \quad 34 \]
\[ (1 + 16)_n \quad = \quad 34 \]
\[ 17_n \quad = \quad 34 \]
\[ n \quad = \quad 2 \]
\[ \text{naanays-molikiyuuulka} \quad = \quad (\text{naanays fudud})_2 \]
\[ \text{naaneys-molikiyuuul} \quad = \quad (\text{HO})_2 = \text{H}_2\text{O}_2 \]
L a y l i 6.1:

1) Iskudhis ayaa markii la saafay waxa la ogaaday in ay ku jiraan 32.81% Cr iyo 67.19% Cl. Soo saar naanaysta fudud ee iskudhiskaas.

2) Iskudhis ka kooban aluuminam iyo koloriin ayaa waxa ku jira 9.00 garaamo oo aluuminam ah iyo 35.5 garaamo oo koloriin ah. Soo saar naanaystiiisa fudud. Haddii culays-moliyuuulku yahay 267, waa maxay naanayst-moliyuuulkiisu?

3) Iskudhis ayaa waxa la ogaaday in ay ku jiraan 21.8% Mg, 27% P iyo 50.3% O. Raadi naanaysta fudud ee iskudhiska.

4) Cusbo cokan oo ka kooban magnisiisim iyo koloriin ayaa waxa ku jira 11.9% Mg, 35.0% Cl iyo 52.2% H₂O. Soo saar naanaysta iskudhiska. (ogow hal mool oo gooni ah sideed, uga shaqeeq qaybta biyaha ah)

5) Soo saar naanaysta fudud ee iskudhisyada soo socda:

<table>
<thead>
<tr>
<th>Iskudhis</th>
<th>C</th>
<th>H</th>
<th>O</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) 52.2gm</td>
<td></td>
<td>13.0</td>
<td>34.8</td>
<td></td>
</tr>
<tr>
<td>t)</td>
<td></td>
<td>2.13</td>
<td>68.0</td>
<td>29.8</td>
</tr>
<tr>
<td>j)</td>
<td></td>
<td>8.1</td>
<td>43.3</td>
<td></td>
</tr>
<tr>
<td>x)</td>
<td></td>
<td>58.5</td>
<td>4.07</td>
<td>26.0</td>
</tr>
<tr>
<td>d)</td>
<td></td>
<td>49.3</td>
<td>9.60</td>
<td>21.9</td>
</tr>
</tbody>
</table>

Iisle'egta Kimikaad:

Sida ugu fudud ee loo tisi karoo falgalalla kimikaada ah waa jiyago lagu qoro isle'egyo ereyo ah. Isle'egyada caayinkas ihiina waxtar weyn ayay leeyihiin, waayo waxa ay innoo suurtagelinayaan in aynnu si kooban u tusno walxaha falgalka ka qayb qaataay iyo walxaha samaysmayba.

Tusaale ahaan waxa aynuuna naqaan, in biyo samaysmaan marka haydarojiin iyo ogsijiin la isku qarxiyo, isle'egta ereyada ah ee falgalka tusaysaana waa sida hoos ku qoran:

Haydarojiin + Ogsijiin ................................................................. Biyo.
Waxaana loo akhriyaay, haydarojiin oo loo geyey ogsijiin, waxa ka dhasha biyo. Isle'egtaasi waxa ay innoo caddeynaysaa in biyo keli ihi ka dhashaan isugeynta neefaha ogsijiin iyo haydarojiin. Sidaa awgeedna isle'egtu waxa ay sheegtaa xaqiiqo tijaabo lagu helay. Hase yeeshhe waxa kama sheegyeyso xaaladaha falgakku u baahan yahay si uu u dhaco iyo xaddiyada isla falgelayaabaa.

Haddii aynunu magacyada falgelayaasha, ee ah ogsijiin iyo haydarojiin, iyo ka maxsuulka oo ah biyo ku beddelo summadahooda, waxa aynuuna helaynaa isle'egta soo socota:

$$2H_2 + O_2 \rightarrow 2H_2O$$

Iisle'egta caayinkaas ah, ee ku qoran naanaysa waxa hadlay isla falgelaya iyo kuwa maxsuulka dhasha, waxa la yidhaa "Iisle'eg Kimikaad". Isle'egtana waxa kala qaybiiya leeb (\(\rightarrow\)) ama calaamadda isle'ekaanta (=); wixii xagga bidix ku qoran waxa la yidhaa falgelayaaf, kuwa xagga midigtana maxsuul. Leebka caaradiisina waxa ay tilmaamaysaa dhinaca uu socodka falgalku u badan yahay. Leebabka kala ah (↑) iyo (↓) waxa ay ayna tusaayaan neef soo baxaysa iyo ruush guntu fadhiistay sida u kala horreeyeaan.

Waxa aynunu ku soo aragnay xeerka waaridda cufka in wadarta culayska falgelayaashu ay la mid tahay wadarta culayska maxsuulka. Taasina waxa ay inna tusaysaana in aan la abuuri karin lana baabi'in karin. Haddii aynay taasi jiriina xidhiidhka ka dhaxeeya culayska falgelayaasha iyo ka maxsuulka waxba iska beddeli laaha. Sidaa awgeed isle'egta kimiko waa in ay waafaqsanaataa xeerkaas waaridda cufka; mana jirto falgal iyo isle'eg oo lid ku ah xeerkaasi.
Si isle'egta kimiko loo waafaqsiyo xeerkaasina, waxa lagu dhufaa naanaysaha falgelayaasha iyo kuwa maxsuulladaba weheliyeyaal. Tusaa leh isle'egta ah,

\[2H_2 + O_2 \rightarrow 2H_2O\]

way waafaqsan tahay xeerka waaridda cufka. Haddii aynnu isu eegno wadarta tirada atamyada falgelayaasha iyo ta maxsuulka waxa aynnu arki karnaa arrintaasi. Labada molikiyuul ee haydarojiinta ah, waxa ku jira afar atam oo haydarojiina. Sidaas oo kale ayaa laba atam oo ogjiini ah ugu jiraan halka molikiyuul ee ogjiinta ah. Isla markaasna labada molikiyuul ee biyaha ah waxa ku jira 4 atam oo haydarojiina iyo 2 atam oo ogjiini. Sidaa awgeed tirada atamyada ee falgelayaasha, waxa ay la mid yihiin kuwa maxsuulka.

Isle'egta kimiko waxa ay innoo sheegysaa waxyaabo aanay innoo sheegi karayn isle'egta ereyada ku qorani. Tusaa leh isle'egta ah:

\[2H_2 + O_2 \rightarrow 2H_2O\]

waxa ay innoo sheegysaa:

1) saamigalka ay falgelayaasha iyo maxsuulka isugu jiraan;
2) in laba molikiyuul oo haydarojiin ihi ay la falgelayaan hal molikiyuul oo ogjiini ah, si ay u sameeyaan laba molikiyuul oo biyo ah.

Mar haddii halkii mooll ee iskudhis ahba ay ku jiraan tiro molikiyuullo ah oo le'eg tirada Afogaardo, tirada molikiyuullada iyo moolku waxa ay isku yihii saamiga qumman. Sidaa awgeedna isle'egtu isla markaas waxay inna tusaysaa.

3) in laba mool oo haydarojiin iyo hal mool oo ogjiini ay sameeyeen laba mool oo biyo ah.

Culayska hal mool oo iskudhis, waxa uu le'egyahay Culays-molikiyuulkiisa, sidaa awgeedna waxa kale oo ay isle'egtu sheegysaa:

4) in 4 garaam oo haydarojiin ihi la falgalaan 32 garaam oo ogjiini, si ay u sameeyaan 36 garaam oo biyo ah.

Hase yeeshee culaysyadaasi ma aha kuwa keliya ee ay ogjiini iyo haydarojiin isugu tagaan, waxase weeye saami ka mid ah kuwa ay isugu tagaan. Sidaa awgeedna isle'egtu waxa kale oo ay innoo sheegysaa:

5) in culays kasta oo haydarojiin iyo ogjiini ihi, oo saamigoodu yahay 1 : 8 sida ay u kale horreeyaan, ay isla falgeli karaan si ay u sameeyaan biyo. Inkasta oo aynnu tusaaile u qaadanay falgalka ka dhex dhaca O_2 iyo H_2 si ay u sameeyaan. H_2O, haddana isle'eg kastaaba shantaas arrimood ee aynnu kor ku soo sheegnay way muujisaa.

**Qodobbada lagama maarmaanka ah marka isle'eg kimiko la qorayo:**

Isle'eg kimiko ah wax qiimo ah ma yeelan karto iyada oo si kastaba u hagaagsan mooyaane. Saddex qodo ayaana loo baahan yahay in la xusuusnaado marka la qorayo isle'eg kimiko.

1) Isle'egtu waa in ay sheegto oo muujiso xaqiiqo tujaabo lagu helay. Haddii aynnu rabno in aynnu qorno isle'eg kimikana, waa in aynnu ogaanaa falgelayaasha iyo maxsuulka oo dhan. Kimisteriyaqannaaduna waxa ay xaqiiqada ku helaa tijaabooyin, waxa ayna isle'eg kimiko ku qoraan falgaladda ay hubaan in ay dhacayaa.

2) Isle'egta waa in ay dhacayaan ku jiraan summadaha curiyeaalka iyo naanaysaha iskudhisyada ka qayb qaadanaya falgalka iyo kuwa maxsuulada soo baxaaba. Waana lagama maarmaan in la yaqaannoo oo la hubiyo in ay summadahaasi iyo naanaysahaas
isle'egta ku jiraa, ay hagaagsan yihiin. Curiyeaalka molikiyuulladoodoo laba atamleyaalka yihiinna waa ogsijii, naytarojiin, haydarojiin, foloriin, koloriin, boromiin, iyo aayodhiin. Curiyeaalka kale oo dhanna waxa loo qoraa hal'atamleyaal, marka isle'eg kimika ah la qoraayyo. Isla markaa kaaftoonka curiyeaasha caanka ah waa in la yaaqanaa, waayo waxa ay innagu caawinayaan sidii naanaysta iskudhisyada si hagaagsan loogu qorii lahaa.

3) Isle'egtuu waa in ay waaafaqsanaataa xeerka waaridda cufka. Waa in tiro atamyoh oo isku mid ah oo curiye kastaba ihi ku jiraa labada dhinac ee isle'egta. Taasina waxa la helaa marka weheliyeaasha naanaysaha falgalayaasha iyo kuwa maxsuulkaba la sallaxo. Hase yeeshee waa in aad mar walba qaadatada tirada idil ee ugu yar ee waafiqi karta xeerka waaridda cufka.

Tusaale ahaan labada isle'eg ee kala ah:

\[
\begin{align*}
\text{Zn} + 2\text{HCl} & \rightarrow \text{ZnCl}_2 + \text{H}_2 \\
\text{Zn} + 4\text{HCl} & \rightarrow 2\text{ZnCl}_2 + 2\text{H}_2
\end{align*}
\]

way waaafaqsan yihiin xeerka waaridda cufka. Hase yeeshee labada isle'eg, ta xarey ayaa hagaagsan, waayo weheliyeasaheyda ayaa tiro ahaan ka yar ta isle'egta hoose.

Bal hadda aynnu isku dayno in aynnu falgalka kimikaad ee ka dhexdhacaya naaatriyam iyo biyaha, aynnu ku qorno isle'eg kimikaad, annaga oo raacaynada saddexda qodob ee kor ku qoran:

Qodobka 1aad:

Naatriyam + biyo \rightarrow naatriyam haydarogsaydh + haydarojiin. Falgalayaashu waa naatriyam iyo biyo, waxaana ka dhasha naatriyam haydarogsaydh iyo haydarojiin oo keli ah.

Qodobka 2aad:

\[
\text{Na} + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2
\]

Kaaftoonka haydarojiin waa + 1, ka ogsijinna waa — 2, sidaa awgeed naanaysta biyuhu waxa ay noqonaysaa H$_2$O. Sidaa oo kale naanysta naaatriyam haydarogsaydh waa NaOH, waayo kaaftoonka naaatriyam waa + 1, ka haydarojiin waa + 1, ka ogsijinnan waa — 2.

Qodobka Saddexaad:

Inkasta oo aynnu naanaysaha falgalayaasha iyo kuwa, maxsuulkaba aynnu si hagaagsan u qornay, haddana isle'egtu ma miisaanha mana dhamma, waayo tirada atamyada falgalayaasha iyo kuwa maxsuulkaha isma le'eka. Sidaa awgeedna waa in la raadiyaa weheliyeaal marka lagu dhufto naanaysaha falgalayaasha iyo maxsuulkaba, waaafaqsinaya xeerka waaridda cufka. Isle'egtuna kaddib waxa ay noqonaysaa:

\[
2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2
\]

Xusuus:

1) Marka isle'eg kimikoaad dhammaystireysid (ama miisaamaysid) ee aad waaafaqsinaysida xeerka waaridda cufka, waa inaadan beddelin hoosgalayaasha curiyeaalka naanaysta, waayo taasi waxa ay beddeleysaa naanaysta iskudhiska. Haddii naanaysta iskudhiska ay doorsoontana waxa burada qodobka 2aad ee xukumayay qoridda isle'egta kimiko.

2) In kasta oo aanay jirin xeer go'an oo la raaco marka la miisaamayo isle'egta kimiko; haddana waxa hawl yar oo badanaa lagu bilaabaa isle'ekyasiinta atamyada haydarojiinta ama kuwa ogsijinta ee isle'egta ku jira.
Soo saaris ku lug leh isle'egta kimikaad:

Mar haddii isle'eg kimiko ay sheegeyso saamiga ay culays isugu darsamayaan falgelayaashu si ay u sameeyaan culays go'an oo maxsuul ah, culaysyada isla falgelayaa ama samaysmayaa waa laga soo saari karaa isle'egta, haddii culayska falgelayaasha ama ku maxsuullada midkood la haysto. Laba dariiqo ayaana la isticmaalaa marka la soo saarayo culaysyadaas. Labadaasi dariiqo waxa ay kala yihii:

1) Dariiqada moolka 2) iyo dariiqada saamigalka.

Tusaaloooyinka soo socda ayaana arrintaas innoo faahfaahin doona.

Tusaale 1:

Raadi inta garaam ee kaalsiyam ogsaydh ah ee samaysanta marka 50 garaam oo kaalsiyam kaarbooneyt ah la kululeeyo.

Dariiqo moolka:

U fiirso waxa lagu siyay culayskii falgalalaha, waxaana lagaa rabaa in aad soo saartid culayska maxsuulka. Afar tallaabo ayaa la raacaa, marka laga shaqaynaayo su'aashan oo kale.

Tallaabada 1aad:

Qor isle'egta kimiko oo waafaysan xeerka waaridda cufka.

Tallaabada 2aad:

Qor waxa lagu siyay iyo waxa lagaa rabo in aad raadisid, wixii lagu siiyeyna culayskiisa naanaysta iskudhiska ku kor qor.

Tallaabada 3aad:

Tus. oo ku hoos qor naanays kastaba inta mool ee ay isle'egta miisaamani tusayso.

Tallaabada 4aad:

Soo saar oo ku qor naanaysta ama summadda walax kasta oo ka qayb qaadanaysa xisaabta, inta garaam ee ku jirta halkii mool ee walxadaas ah.

Dabadeetana uga shaqee su'aasha sida soo socota:

\[
\text{Tallaabada (1aad) } \text{CaCO}_3 \rightarrow \text{CaO + CO}_2 \\
\text{Tallaabada (2aad) } 50 \text{g} \\
\text{Tallaabada (3aad) } 1 \text{mool} \\
\text{Tallaabada (4aad) } 1 \text{mool oo } \text{CaCO}_3 = 100 \text{g} \\
\quad 1 \text{mool oo } \text{CaO} = 56 \text{g} \\
\text{Tirada mool ee ku jira } 50 \text{g oo } \text{CaCO}_3 \\
\]

\[
\frac{\text{Culayska iskudhiska}}{\text{Culays-molikiyuulkiisa}} = \frac{50 \text{g}}{100 \text{g/mool}} = 0.5 \text{mool.}
\]

Hase yeesehee, sida aynnu isle'egta kimiko ku aragno, 1 mool oo \text{CaCO}_3 ah waxa ka soo baxa hal mool oo \text{CaO}, marka la kululeeyo.

\[
0.5 \text{mool oo CaCO}_3 ah waxa uu soo saarayaa 0.5 \text{mool oo CaO ah. Laakiin 1 mool oo CaO waxa uu la miisaan yahay 56 garaam, 0.5 moolna waa } \frac{0.5}{1} \times 56 \text{g} = 28 \text{garaam.}
\]

46
Sidaa awgeedna inta garaam ee CaO ah ee ka dhalanaysa 50 garaam oo CaCO$_3$ ihi = 28 garaam.

**Tusaale 2aad:**

Raadi inta garaam ee kaalsiyam koloreyt ah ee marka la kululeeyo soo saarta 30 garaam oo ogisiin ah.

**Dariiqada Moolka:**

<table>
<thead>
<tr>
<th>Tallaabada (2aad)</th>
<th>$\times$ g</th>
<th>30 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tallaabada (1aad)</td>
<td>$2\text{KClO}_3$</td>
<td>$2\text{KCl} + 30$_2$</td>
</tr>
<tr>
<td>Tallaabada (3aad)</td>
<td>2 mool</td>
<td>2 mool 3 mool</td>
</tr>
<tr>
<td>Tallaabada (4aad)</td>
<td>1 mool oo $\text{KClO}_3 = 122.6$ g</td>
<td>1 mool oo $\text{O}_2 = 32$ g</td>
</tr>
</tbody>
</table>

Tirada mool ee ku jirta 30 garaam ee ogisiin ahina:

$$\frac{32 \text{ g mool}}{30 \text{ g}} = \frac{32}{30 \text{ mool}}$$

Hase yeeshee sida aynnu isle'egta kimiko ku aragno, 3 mool oo $\text{O}_2$ ihi waxa ay ka dhashaan 2 mool oo $\text{KClO}_3$,

\[ \frac{30}{32} \text{ Mool oo } \text{O}_2 \text{ ihina waxa ay ka dhalanayaan:} \]

$$\frac{30 \text{ mool}}{32 \text{ mool}} \times \frac{2 \text{ mool}}{3} = \frac{5}{8} \text{ mool oo } \text{KClO}_3 \text{ ah.}$$

Laakiin 1 mool oo $\text{KClO}_3$ waxa ay la mid tahay 122.6 g. 5/8 mool oo $\text{KClO}_3$ ihina waxa la mid noqonaysaa:

$$= \frac{5}{8} \times 122.6 \text{ g} = 76.6 \text{ g oo } \text{KClO}_3$$

Sidaa awgeedna 76.6 garaam oo $\text{KClO}_3$ ah ayaa loo baahan yahay.

**Tusaale 3:**

Soo saar culayska naatriyam haydarogsaydhka ee samaysma marka 5.00 garaam oo naatriyam ah lagu rido biyo.

**Dariiqada Saamigalka:**

Saddexda tallaabo ee ugu horreeya waxa ay la mid yihiin in kuwi dariiqada moolka, hase yeeshee tallaabada afaraad ayaa waxa la qaataa culays-molikiyuullada ay isle'egta kimiko tusayso.

<table>
<thead>
<tr>
<th>Tallaabada (2aad)</th>
<th>5 g</th>
<th>$x$ g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tallaabada (1aad)</td>
<td>$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$</td>
<td></td>
</tr>
<tr>
<td>Tallaabada (3aad)</td>
<td>2 mool</td>
<td>2 mool</td>
</tr>
<tr>
<td>Tallaabada (4aad)</td>
<td>46 g</td>
<td>80 g</td>
</tr>
</tbody>
</table>

\[ \therefore \quad 46 \text{ g oo Na ihina waxa ay sameeyaan } 80 \text{ g oo NaOH marka biyo lagu rido.} \quad 5 \text{ g oo Na ihina waxa ay samayndoontaa:} \]

$$= \frac{5 \text{ g oo Na}}{46 \text{ g oo Na}} \times 80 \text{ g oo NaOH} = 8.7 \text{ g oo NaOH.}$$
Tusaale 4:

Immisa garaam oo ogsijin ayaa loo baahan yahay si 140 garaam oo feeram ah loogu rogo feerik ogsaydh?

Dariiqada Saamigalka:

<table>
<thead>
<tr>
<th>Tallaabada (2aad)</th>
<th>140 g</th>
<th>x g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tallaabada (laad)</td>
<td>$4Fe + 3O_2$</td>
<td>$2Fe_2O_3$</td>
</tr>
<tr>
<td>Tallaabada (3aad)</td>
<td>4 mool</td>
<td>3 mool</td>
</tr>
<tr>
<td>Tallaabada (4aad)</td>
<td>223.2 g</td>
<td>96</td>
</tr>
</tbody>
</table>

\[ \therefore 223.2 \text{ g oo Fe ayaa la falgala 96 g oo } O_2 \text{ ah} \]

\[ 140 \text{ g oo Fe ihina waxa ay la falgelidoonaan:} \]

\[ = \frac{140 \times 96 \text{ g oo } O_2}{223.2 \text{ g}} = 60.3 \text{ g oo } O_2 \]

Layliso 6.2:

1) Qor isle'egta kimiko ee waafaqsan xeerka waridda cuufka ee
   a. feeram + salfar = feeras salfaydh.
   b. naatriyam koloraydh + arjantam naytareyt = arjantam koloraydh + naatriyam naytareyt.
   j. kaalsiyam oqdaydh + biyo = kaalsiyam haydarogsaydh.
   x. naatriyam haydarogsaydh + kaarboon laba-ogsaydh = naatriyam kaarboneyt + biyo.
   kh. feeras salfaydh + haydarokolorik asiidh = haydarojiin salfaydh + feeras koloraydh.
   d. feerik ogsaydh + kaarboon hal-ogsaydh = feeram + kaarboon laba-ogsaydh.

2) Dhammystir isle'egyada erey ahaaneeed ee soo socda, ka dibna inta aad u rogtid isle'eg kimiko ah, waafaji xeerka waridda cuufka.
   b. kubram + ogsijiin
   t. sink + saltiyuurik asiidh
   j. kubirk oqdaydh + haydarojiin
   x. kaaliyam + biyo
   kh. arjantam naytareyt + naatriyam koloraydh

3) Sida isle'egta hoose ku tusayso
   \[ 4\text{NH}_3 + 5O_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O} \]
   soo saar culayska ogsijinta ah ee la falgeli karta 100 garaam oo Ammoniya ah (NH$_3$).
   (waxa aad isticmaashaa dariiqada moolka).
4) Falgalka kimiko ee hoos ku qoran
\[ 2C_3H_2 + 5O_2 \rightarrow 4 CO_2 + 2H_2O \]
waxa aad ka soo saartaa culayska ogisiinta ah ee loo baahan yahay in ay gubto 10 mool oo \( C_3H_2 \). Istitmaal dariiqada saamigalka.

5) 60 garaam oo CuS ayaa lagu daray asiidh ah HNO\(_3\), dabadeedna waxa dhacay falgalka hoos ku qoran.
\[ 3CuS + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O + 3S \]
Soo saar:

b. inta garaam ee Cu (NO\(_3\))\(_2\) ah ee samaysantay.

t. inta garaam ee S ah ee dhashay.

6) Soo saar:

b. inta garaam ee ogisiin ah ee soo baxda marka 2 mool oo kaaliyam koloreyt ah la kululeeyo.

t. iyo inta garaam ee kaaliyam koloraydh ah ee ka dhasha falgalkaas.

7) 25 garaam oo HgO ah ayaa aad loo kululeeyay.

b. soo saar inta mool ee ku jirta 25 kaa garaam.

t. soo saar inta mool ee ogisiin ee ka soo bixi karta.

j. raadi inta garaam ee ogisiin ee soo bixi karta.

8) 130 garaam oo sink ah ayaa lagu daray 100 garaam oo HCl ah. Markii falgalkii dhammaadayna 41 garaam oo sink ah ayaa hadhay. Soo saar inta mool ee haydarojiin ah ee soo baxday.

9) Markii falgal ka dhex dhashay ogisiin iyo salfar ayaa waxa soo baxay 80 garaam oo salfar laba-ogsaydh ah. Raadi xaddigii salfarka ahaa ee la falgalay ogisiinta.

10) b. raadi inta garaam ee naatriyam salfeyt ah ee samaysmay markii 150 garaam oo H\(_2\)SO\(_4\) ihi la falgalay naatriyam koloraydh.

i. isla markaas soo saar inta garaam ee naatriyam koloraydh ah ee ka qayb qaataf falgalka;

j. iyo inta garaam ee haydarojiin koloraydh ah ee samaysantay.

11) Soo saar inta garaam ee arjantam ah ee ruushi ahaan u soo baxaysa marka 40 garaam oo kubram ihi la falgalay milan arjantam naytareyt ah.

12) Haddii 10 garaam oo feeras salfaydh ah lagu daro asiidh haydarokolorik ah, soo saar inta:

b. mool;

t. garaam ee haydarojiin salfaydh ah ee soo baxa?
Baanka Todobaaad

**AASIIDO, BEYSYO IYO CUSBOOYINKA**

Ilaa iyo waqti aan la xasuusan karin, waxa jiray alaab dhadhankaoodu xamud ah. Alaabtaasi waxa ka mid ahaa cinabka ceydihiinka ah, liinta, khalka iyo caanaha suusaca ah. Dhawr qarni doobadeed walaadka keeno addan dhadhankaasi xaamudka ah ayaa loo bixiyey "asiidh". Iskuudeyadaasii magaceedahay, wuxuu loo aqay magaca laatiinka ah "actiim" oo loo akhriyo asidhiyam, lana macna ah dhadhan kulul.

Waxa la ogagaad in khalka ay aseetic asidhid ku jirto, liintana sitirik asidhid ku jirto. Hase yeeshee kimistiriyahannadii Facihi Dhexe waxa ay isku dayeen in ay asidhoo kale baadhaan; waxaanay soo saareen asidhada laga sameeyo macdanta dhulka laga soo faqo. Asidhadaasi waxa la yidhaahdaa asidhada macdanta; kuwaasi oo aan sidooda looga helin adduunka. Kuwa kale ee ku jira waxa nool, waxa la yidhaahdaa asidhada orgaaniga ah.

Asidhada macdanta waxa ka mid ah:

I) Salfiyyuurik asidhid oo laga sameeyo salfarta:

\[
\begin{align*}
  S + O_2 & \rightarrow SO_3 \\
  2SO_2 + O_2 & \rightarrow 2SO_3 \\
  SO_3 + H_2O & \rightarrow H_2SO_4
\end{align*}
\]

II) Naytarik asidhid oo la helo marka la isku daro salfiyyuurik asidhid iyo kaaliyam naytareyt, ee dabadeetana la xareeeye.

\[
2KNO_3 + H_2SO_4 \rightarrow K_2SO_4 + 2HNO_3
\]

III) Haydarokolorik asidhid oo la soo saaro marka ay isla falgalaan asidhid iyo naatriyam koloraydh ee weliba la xareeeye.

\[
2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl
\]

VI) Fosfoorik asidhid oo laga sameeyo fosfoor:

\[
\begin{align*}
  P_4 + 5O_2 & \rightarrow P_4O_{10} \\
  P_4O_{10} + 6H_2O & \rightarrow 4H_3PO_4
\end{align*}
\]

**Asiidhada iyo Bir-ma-ahayaalka**:


**Tusaale ahaan**:

\[
\begin{align*}
  SO_3 + H_2O & \rightarrow H_2SO_4 \\
  CO_2 + H_2O & \rightarrow H_2CO_3 \\
  P_2O_3 + 3H_2O & \rightarrow 2H_3PO_4
\end{align*}
\]

Falgalladan kor ku qoran haddii guud ahaan loo eego waxa la odhanayaa asidhoo ayaa samaysma marka ogsaydhyada bir-ma-ahayaalka biyo lagu miloo. Waxase jira asidhoo aan ogsijin ku jirin sida haydarokolorik asidh (HCl) oo aan ku samaysmin sidan.
Asiidhada:

Asiidhadu waxa ay guud ahaan leeyihiin astaan u sal ah, taasi oo ah bixinta ay bixiyan ayoon haydarojiin ah marka biyo lagu daro. Sidaa awgeed waxa loo qeexaa asiidhada sidan hoos ku qoran:

Qeexid:

Asiidhu waa iskudhis marka lagu milo biixo bixiya ayoonka keliya ee togan oo ah H⁺.

Tusaale ahaan:

Haydarokolorik asiidh HCl = H⁺ + Cl⁻
Salfiyuurik asiidh H₂SO₄ = 2H⁺ + SO₄⁻²
Naytrik asiidh HNO₃ = H⁺ + NO₃⁻

Haddii sida saddexda asiidh ee kor ku qoran ayonoobidda iskudhisku dhan tahay asiidhaasi waxa la odhanayaa asiidh xooggan. Haddiiise ayonoobidda iskudhisku ay kala dhantaalan tahay, asiidhaasi waa asiidh daciih ah. Waxaana lagu kala gartaa xoogga asiidhada hadba siday u gudbiyaan danabka. Haddii ay asiidhu si fiican u gubiso danabka waa asiidh xooggan haddii kalese waa daciif.

Masalan, ayonoobidda asetik asiidh waa 0.4%, waxanay la micna tahay in kunkii molikiyuuul ee asetik asiidha, ay afar molikiyuuul oo keli ihi ka ayonoobeyso. Sidaa awgeedna waa asiidh daciih ah.

\[
\begin{align*}
\text{CH}_3\text{COO}^- & \rightleftharpoons \text{CH}_3\text{COOH} + \text{H}^+ \\
996 & \quad 4
\end{align*}
\]

Astaamaha asiidhada:

Asiidhadu guud ahaan waxa ay leeyihiin oo lagu gartaa astaamahooda hoos ku qoran:

1. Dhadhan Xaamud ah:

Astaanta asiidhada ee markaaba la soo saarayaa waxa weeye dhadhankaooda xaamuuudka ah. Haddii walaxi yeelato dhadhankaas oo kale waxa la garanayaa in ay asiidh ku jirto.

2. Raadka asiidhadu ku leeyihiin tilmaamayaalka:

Waxa la ogaaday in midabka litmasku had iyo jeer casaan yahay markii lagu daro asiidh. Midabka mitayl oranjikuna wuxuu isu beddelaa casaan haddii asiidh lagu daro, laakiin midab ma laha fenofaliinku haddii u asiidh ku jiro.
3. Falgalka Asiiadhada iyo Biraha Firfircoone:

Asiiadhadu waxay la falgalaan biraha firfircoone ee ay ka mid yihiin xadiidka, sink, aluuminam iwm. Waa ayna soo saaraan haydarojiin.

\[
Fe + 2HCl \rightarrow FeCl_2 + H_2.
\]

Asiiadhadu waa walxo haydarojiin ku jirto. Haydarojiinta asiiadhada waxa saari kara biraha firfircoone. Waxase jira iskudhisyo haydarojiin ku jirto sida sonkorta \((C_{12}H_{22}O_{11})\) oo aan asiih ahayn. Sababtoo ah:

1) ma laha dhadhan xamud ah;
2) haydarojiinta ku jirtana biraha firfircooni ma saari karaan.

\[\text{Haydarojiin} \quad \text{Asiih} \quad \text{Bir}\]

JT. 7.2

4. Falgalka asiiadhada iyo beysyada:

Astaanta ugu muhiimsana astaamaha asiiadh waa ifsasaqa ka dhexeeya asiiadhada iyo beysyada. Ifsasqaasi, waxa ka soo baxa iskudhisyo saddexaad oo la yidhaahdo cusbooyin iyo weliba biyo. Tusaale ahaan, asiiadhada oo dhammi waxa ay la falgalaan kaalsiyam haydarogsaydhka, Ca(H)_2, iyaga oo samaynaya cusbooyinka kaalsiyam iyo biyo.

\[
\text{Ca(OH)}_2 + 2\text{HCl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O} \quad \text{Ca(OH)}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + 2\text{H}_2\text{O}
\]

5. Raadka ay asiiadhadu ku leeyihiin kaarbooneytyada:


\[
\text{CaCO}_3 + 2\text{HCl} = \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2
\]

\[
\text{MgCO}_3 + \text{H}_2\text{SO}_4 = \text{MgSO}_4 + \text{H}_2\text{O} + \text{CO}_2
\]

Asiih iyo Kaarbooneynt

\[\text{Xidhiidhiso} \quad \text{Biyo Nuuradeed} \quad \text{Ca(OH)}_2 \quad \text{Taageere iyo} \quad \text{Xajije}\]

52  JT. 7.3
6. **Gubinta danabka:**

Waxaad soo qaaddaa bakeeri asiidh ku jirto, laba qotin oo kaarboon ah, guluub iyo beytari, dabadeetana saabaanka u meerar sida jaantsuska 7.4 ku susayo.

![Image of a beaker](image)

**Millan Haydarokoloorik**

Asiidh ah

**JT. 7.4**


**Tijaabooyin:**

1. **Falgallada asiidhada badhxan:**

Fiiri isbeddelka ku dhaca asiidhada badhxan ee haydarokolorik, salfiyuurik iyo naytatiik, marka lagu daro walxaha hoos ku yaal:

   b. Litmas.
   t. Magnisiyam — hubso haydarojiin.
   j. Naatriyam kaarbooneyt — hubso kaarboon laba ogsaydh.
   x. Far iyo suul ku qaad kubrik ogsaydh madow, kuna dar asiidhada mid walba mar, woxoogaana diiri.

2. **falgalka asiidhada badhxan iyo biraha:**

Sida hoos ku qoran biraha ku kala dar saddexda asiidh. Hubso in haydarojiin ka soo baxayso, go'aankana ku qor tusaha:

<table>
<thead>
<tr>
<th>Bir</th>
<th>Haydarokolorik asiidh</th>
<th>Salfiyuurik asiidh</th>
<th>Naytarik asiidh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sink</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnisiyam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xadiid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balaambam</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**JT 7.5**
3) Hubso milannada soo socda, adoo isticmaalaya litmas buluug ah.
   b. Khalka.
   t. Muudka liinta.
   j. Caanaha suusaca ah.

4) warqadda litmaska soo qaado, dabadeetana ku day dheecaanka dhirta magaalada aad joogto ka baxda. Tusale ahaan, geedka «Saqaasaaqaha» dheecaankiisu wuxuu warqadda litmaska buluuga ah u beddelaa casaan.

**Beysoyo:**

Sidii aynnu isugu xidhnay asiiadhada iyo bir-ma-ahayaalka, ayaa xidhiidh uga dheexeyaa biraha iyo iskudhisyada la yidhaahdo beysoyada. Beyska ugu horreeyay ee la yaaqannay wuxuu ahayaa kaalsiyam haydarogsaydh oo laga samayn jiray didibka. Dhagaxa didibka marka la kulayliyo waxa ka soo baxa nuurad (Kaalsiyam ogsaydh), oo haddii biyo lagu daro samaynaysa kaalsiyam haydarogsaydh, Ca (OH)₂,


Kimistariyahaannadii hore waxa ay soo saareen beyso kale oo ay ka mid yihiin naatriyam haydarogsaydh iyo kaaliyam haydarogsaydh oo astaamahoodu isku dhow yihiin.

**Beysoyada iyo biraha:**

Haddii birta liitiyam la gubo, waxa samaysmaya iskudhis la yidhaahdo Litiyam ogsaydh. Litiyam ogsaydhku waa beys.

\[ 4Li + O_2 \rightarrow 2Li_2O. \]

Haddii biyo lagu daro liitiyam ogsaydhka, waxa soo baxaya alkali la yidhaahdo litiyam haydarogsaydh.

\[ Li_2O + H_2O \rightarrow 2LiOH. \]

Marka bir lagu daro ogsijii waxa samaysma beys. Beysyaduna way kala firfircoon yihiin, taasoo ku xidhan firfircoonida biraha ay ka samaysan yihiin. Tusaele ahaan, beysyada naatriyam iyo kaaliyam way ka xooggan yihiin beysyada aluuminam iyo sink.

**Qeexid:**

Beysku wuxuu weeye ogsaydhka ama haydarogsaydhka biraha ee fasaqa asiidha, sameeyana cusub iyo biyo.

\[ \text{ZnO} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2\text{O} \]
\[ \text{Zn(OH)}_2 + 2\text{HCl} \rightarrow \text{ZnCl}_2 + 2\text{H}_2 \]
\[ \text{PbO} + 2\text{HNO}_3 \rightarrow \text{Pb(NO}_3)_2 + \text{H}_2\text{O} \]
\[ \text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O} \]

Ogsaydhxyada biruhu waa wada beysoyo, laakiin badankoodoo biyaha kuma milmaan. Ogsaydhxyada biyaha ku milmaa waxay sameeyaan haydarogsaydh la yidhaahdo Alkaliyo.

**Tusaele:**

\[ 2\text{Ca} + \text{O}_2 \rightarrow 2\text{CaO} \]
\[ \text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 \text{(ogsaydh)} \]
\[ \text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 \text{(alkali)} \]
Alkaliyada waa beysyo biyaha ku milma, kuwa aad loo yaqaannaana waxa weeye:

1) natiriym haydarogsaydh — NaOH
2) kaaliym haydarogsaydh — KOH
3) amooniym haydarogsaydh — NH₄OH
4) kaalsiyam haydarogsaydh — Ca(OH)₂

Waxtarka alkaliyada:

1) natiriym haydarogsaydh — samayska warqadaha
2) kaaliym haydarogsaydh — xariirta
   — saabuunta
3) kaalsiyam haydarogsaydh — dhismaha
4) amooniym haydarogsaydh — nadiifinta alaabta

ASTAAHMAHA BEYSYADA.

1. Dhadhanka beysyada:

   Beysyada badankooda lama dhandhamiyo, sababtuna waxa weeye iyagoo dilaya ruqurrada dhadhanka ee carrabka. Laakiin, beysyada dacifika ah ee orgaanikada ah ayaa la dhadhamin karaa, waana qadhaadh. Tusaale fiicanina waa kiniinka kaneecada loo cuno.

2. Raadka beyska ku leeyahay tilmaamayalka:

   Beysyadu raad ayay ku leeyihiin midabka tilmaamayalka. Tusaale ahaan, haddii litmas cas lagu daro beys wuxuu noqonayaa buluug, halka uu casaan ka yahay marka asiidh lagu daro.

3. falgalka asiidhada iyo beysyada:

   Sidii horaba aynnu u soo sheegnay, beysyadu way la falgalaan asiidhada iyagoo baab-i'inya astaamahaa lagu yaqaano asiidha, asiidhuna beyska ayay faasaqdaa, waxana falgalkaak ka dhasha cusbo.

   \[2\text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}\]

4. Gudbinta danabka:

   Soo qaado qalabkan:

   1) Beytary;
   2) Guluub;
   3) Laba qotin;
   4) Bakeeri aad ku shubto beys.

JT. 7.6

Haddii guluubka u siraadmo, waxa aynnu ogaaneynaa in beyska labada qotin ee kaarboonka ah u dhaaxeeyaa uu gudbinayo danabka, sidaa awgeedna ay mareegta danabku isugu xidhmayo. Taasina waxa ay inna tusaysaa in beysyadu ay gudbiyaa danabka. Waxa kale oo beysyada lagu yaqaannaan ugu yahay ay ogjsijjaan ku soo saaraan qotinka togaan, marka danab la dhaxmariyo.
Saddex tilmaamayaal iyo isbeddelka ku dhaca.

<table>
<thead>
<tr>
<th>Tilmaame</th>
<th>Raadka asidhu ku leedahay tilmaamaha</th>
<th>Raadka beysku ku leeyahay tilmaamaha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litmas</td>
<td>Casaan</td>
<td>Buluug</td>
</tr>
<tr>
<td>Mitayl Oranj</td>
<td>Casaan</td>
<td>Huruud</td>
</tr>
<tr>
<td>Fiinoftaliin</td>
<td>Midab ma laha</td>
<td>Casaan</td>
</tr>
</tbody>
</table>

JT. 7.7

Ifsaqaasi asidhada iyo beysyada:

Astaanta muhiimka ah ee ka dhaxaysa asidhada iyo beysyadu waa isburinta ay wadaag-aan ee mid waliba midka kale uu fasaqayo. Falgaskaasi oo kale ayaa la ridhaa isfsaqa. Haddii saamigal hagaagsan la isugu daro milanno kala ah naatriyam haydarogsaydh iyo haydarokolorik asidh, astaamaha asidha iyo kuwa beyskuba way baabaa'ayaan. Milanka ka soo baxa falgalkuna waa mid dhanaan oo haddii la uumibixiyaa, cusbada, naatriyam koloraydh, ay ka soo hadhayso.

\[
\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}
\]

Waxaa kaloo la mid ah falgalkani:

\[
\text{Mg(OH)}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + 2\text{H}_2\text{O}
\]

Guud ahaan waxa dhalanaya cusbo iyo biyo. Falgalkani ifsagaas ufurka wuxuu isku xidhiidhaya asidhada, oo iskudhisyo bir-ma-ahayaal ah ka samaysan iyo beysyada oo ay biyo ku jiraan. Marka falgalka is-fasaqa ihi dhaco, cusbooyin ayaa samaysma kuwaasi oo ah iskudhisyo ka samaysan biro iyo bir-ma-ahayaal. Saddeexdaasi iskudhis, wuxu isku noqdaan kuwa ugu badan iskudhisyada kimikada ee macdanta ah.

Qeexid:

Ifsaqa waa falgalka dhexmara asidhada iyo beysyada, cusbo iyo biyo keli ihina ay ka dhashaan.

Qaybinta asidhada:

Waxa aynnu soo aragnay in asidhada bixiyaan ayoon haydarojiin ah, marka biyaha lagu milo. Waxa aad arkaysaa in ayoonka haydarojiin ihi uu la mid yahay borotoon. Atamka haydarojiin waxa uu ka kooban yahay hal borotoon iyo hal elektaron. Marka uu ayoon noqdana waxa uu lumiyaa halka elektaron, waxa soo hadhaana waa borotoon.

Tirada haydarojiin ayoon ee molikiyuul asidh ih ixiyo ayaa lagu kala qaybin karaa asidhada. Tusaale ahaan halkii molikiyuul ee haydarokolorik asidh ah (HCl) waxa ku jira hal haydarojiin, sidaa awgeed waxaa uu bixin karaa hal borotoon oo qudha, hase yeshee molikiyuulka salfiyuurik asidh ah (H_2SO_4), waxa ku jira laba haydarojiin sidaa awgeedna waxa uu bixin karaa laba borotoon. Haddii aynnu uu fiirsanno molikiyuulka asetik asidhka (CH_3COOH), waxa aynnu arkaanay in ay ku jiraan afar haydarojiin laakiin marka biyo lagu milo, waxa uu bixiyya hal borotoon oo keliya. Sidaa darteed inta borotoon ee uu asidhku bixiyyaa kuma xidha inta haydarojiin atam ee molikiyuulka asidhah ku jirta, ee waxa ay ku xidhan tahay inta haydarojiin ayoon ee uu molikiyuulku bixiyo.
Asiidhada bixiya hal ayyoon oo haysdarojiin ah waxa la yidhaa hal-borotoonle, kuwa labada ama saddexda bixiyana waxa loo yaqaan laba-borotoonle iyo saddex-borotoonle sida ay u kala horreeyaan.

<table>
<thead>
<tr>
<th>Asiidh</th>
<th>Qaybta</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCl $\rightarrow$ H$^+$ + Cl$^-$</td>
<td>Hal-borotoonle</td>
</tr>
<tr>
<td>H$_2$SO$_4$ $\rightarrow$ 2H$^+$ + SO$_4$$^{2-}$</td>
<td>Laba-borotoonle</td>
</tr>
<tr>
<td>H$_2$CO$_3$ $\rightarrow$ 2H$^+$ + CO$_3^{2-}$</td>
<td>Laba-borotoonle</td>
</tr>
<tr>
<td>H$_2$PO$_4$ $\rightarrow$ 3H$^+$ + PO$_4^{3-}$</td>
<td>Saddex-borotoonle</td>
</tr>
<tr>
<td>CH$_3$COOH $\rightarrow$ H$^+$ + CH$_3$COO$^-$</td>
<td>Hal-borotoonle</td>
</tr>
</tbody>
</table>

**Cusbooyin:**

Waxa aynuu soo aragnay in biruhu haysdarojiinta asiidhada ku jirta ka saari karaan, iskudhisyada ka soo baxana la yidhaa cusbooyin.

Marka asiidh biyo lagu daro waxa uu u kala baxaa ayyoonno haysdarojiin ah oo togan iyo ayyoonno bir-ma-ahayaal ah oo taban. Sidaasi oo kale ayaa alkaliyaduna ugu kala baxaan ayyoonno haysdarogsaydha ah (OH$^-$) oo taban iyo ayyoonno biro ah oo togan. Marka ay asiidhada iyo beysyadu isfasaqaqanna, biyo aya ka dhasha isutaggaa ayyoonnada haysdarojiinta ah ee asiidhada iyo ayyoonka haysdarogsaydhaa ah ee beysyada. Milankana waxa ku hadhay ayyoonno biro ah iyo ayyoonno bir-ma-ahayaal ah, sida falgalka soo socda tusayo:

\[
\begin{align*}
\text{HCl} & \rightarrow \text{H}^+ + \text{Cl}^- \\
\text{KOH} & \rightarrow \text{K}^+ + \text{OH}^- \\
\end{align*}
\]

\[
\text{HCl} + \text{KOH} \rightarrow \text{K}^+ + \text{Cl}^- + \text{H}_2\text{O}
\]

Haddii la uuqumixiyo milanka, waxa dhacaya in ay isa soo jiitaan ayyoonnada biraha ah iyo kuwa bir-ma-ahayaalka ah ee milanka ku jiray, dabadeetana ay dhaliyaan cusbooyin. Sidaa awgeed cusbada waxa loo qeexaa: Cusbadu waa iskudhisi ka samaysan ayyoonno ama xididshe togan iyo ayyoonno bir-ma-ahayaal ah oo taban. (ogow waxa jira xadidshe keliya oo togan, waana ka ammooniyamka NH$_4$$^+$).

**Cusbooyinka caadiga ah iyo kuwa asiidhka ah:**

Marka hal molikiyuul oo asiidh ihi soo saaro in ka badan hal ayyoon oo haysdarojiin ah, waxa suuragal ah in kolba mid, milanka laga saaro marka lagu daro bir ama beys. Sidaa awgeed, salfiyuurik asiidh oo laba-borotoonle ah, haddii naatriyam haysdarogsaydha lagu daro, marka hore waxa samaysmaya naatriyam haysdarojiin salfeyt (NaHSO$_4$) marka labaadna waxa samaysmaya naatriyam salfeyt. Cusbooyinka la mid ah naatriyam haysdarojiin salfeyt waxa ay falqallada uga qayb qaataan sida asiidhada; sababtuna waxa weeye marka biyo lagu milo ayay soo saaraan ayyoonka haysdarojiin (H$^+$) ee ku jira.

\[
\begin{align*}
\text{NaHSO}_4 & \rightarrow \text{Na}^+ + \text{HSO}_4^- \\
\text{HSO}_4^- & \rightarrow \text{H}^+ + \text{SO}_4^{2-} \\
\end{align*}
\]

\[
\begin{align*}
\text{NaHSO}_4 & \rightarrow \text{Na}^+ + \text{H}^+ + \text{SO}_4^{2-} \\
\end{align*}
\]

Waxa la yidhaa cusbooyinka caynkaasi ahna cusbooyin asiidh ah. Laakiin kuwa kale ee naatriyam salfeyt (Na$_2$SO$_4$) ka mid tahay ee marka biyaha lagu milo aan soo saarin ayyoonka haysdarojiin ayaa la yidhaa cusbooyin caadi ah. Cusbooyinka caadiga ahi waxay samaysmaan marka haysdarojiinta asidiha oo dhan la saaro ee biruhu barbixiyyaan.

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**Magaca cusbooyinka iyo asiidhadya ka samaysmeen**

<table>
<thead>
<tr>
<th>Asiidhada</th>
<th>Cusbooyinka</th>
<th>Ayoonnada Asiidhada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salfiyuurik Asiidh</td>
<td>Salfeytyada</td>
<td>SO$_4^-$</td>
</tr>
<tr>
<td>H$_2$SO$_4$</td>
<td>Haydarojiin salfeytyada</td>
<td>HSO$_4^-$</td>
</tr>
<tr>
<td>Salfiyuuras Asiidh</td>
<td>Salfaytyada</td>
<td>SO$_3^-$</td>
</tr>
<tr>
<td>H$_2$SO$_3$</td>
<td>Haydarojiin Salfaytyada</td>
<td>HSO$_3^-$</td>
</tr>
<tr>
<td>Kaarboonik Asiidh</td>
<td>Kaarboonytyada</td>
<td>CO$_3^-$</td>
</tr>
<tr>
<td>H$_2$CO$_3$</td>
<td>Haydarojiin Kaarboonytyada</td>
<td>HCO$_3^-$</td>
</tr>
<tr>
<td>Fosfoorik Asiidh</td>
<td>Fosfeytyada</td>
<td>PO$_4^-$</td>
</tr>
<tr>
<td>H$_3$PO$_4$</td>
<td></td>
<td>HPO$_4^-$</td>
</tr>
<tr>
<td>Naytarik Asiidh</td>
<td>Haydarojiin Fosfeytyada</td>
<td>NO$_3^-$</td>
</tr>
<tr>
<td>HNO$_3$</td>
<td>Naytaretyada</td>
<td>Cl$^-$</td>
</tr>
<tr>
<td>Haydarokolorik Asiidh</td>
<td>Koloraydhyada</td>
<td></td>
</tr>
</tbody>
</table>

**JT. 7.8**

**Dariiqooyinka guud ee loo diyaariyo cusbooyinka:**

Dhawrka dariiqo ee loo diyaariyo cusbooyinku waxay ku xidhan yiihiin xeerarka milmidda.

**Xeerarka cusbooyinku biyaha ugu milmaan**

<table>
<thead>
<tr>
<th>kuwa ku milma biyaha</th>
<th>kuwa aan ku milmin biyaha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cusbooyinka naatriyam, kaaliyam, iyo ammoniyam</td>
<td></td>
</tr>
<tr>
<td>2. Naytaretyada biraha oo dhan</td>
<td></td>
</tr>
<tr>
<td>3. Koloraydhyada oo dhan marka laga reebo</td>
<td>argantam koloraydh, meerkuras koloraydh, iyo balambam koloraydh</td>
</tr>
<tr>
<td>4. Salfeytyada oo dhan marka laga reebo.</td>
<td>beeriyam salfeyt, balambam salfeyt iyo kaalsiyam salfeyt oo in yar biyaha ku milma.</td>
</tr>
<tr>
<td>5. Kaarboonytyada oo dhan kuwa xeerka kowaad ku qoran mooyaane.</td>
<td></td>
</tr>
</tbody>
</table>

**JT. 7.9**

Marka la ogaado xeerarka milmidda, waxa la garanayaa habka loo diyaarinayo cusbada loo baahan yahay. Haddii cusbo biyaha ku milmaysa la diyaarinayo waa in la raaca habka wiriqaynta, haddiiise cusbadu tahay mid aan biyaha ku milmayn, waa in ruushi ahaan loo soo saaray.

**1. Diyaarinta cusbooyinka biyaha ku milma marka la isticmaaloo asiidh iyo bir:**

Sida caadiga ah marka la isticmaaloo asiidh iyo bir, waxa lagu tala gelayaa in cusbo biyaha ku milmaysaa samaysmayso, bir badan ayaana la isticmaalaa si asiidha
oo dahmmi u dhammaato. Birta inta dheeraadka ihina waxay noqotaa hadhaa marka la miro milanka.

Miirtuna waa milanka cusbada la raadinayo oo haddii la uumibixiyo wiriqhiisu soo baxayaan.

**B. Diyaarinta niamunad kubrik salfeyt ah (Tutuwe) iyadoo la isticmaalayo maar (Cu) iyo salfiyyururk asiiidh:**


1) kubrik salfeyt oo ruushi ah.
2) kubrik salfaydh oo falgalka ka garab samaysmay.
3) Maar (Cu) dheeraad ah.
4) Salfiyyurik asiiidh rib ah haddii ay soo hadho.

Ujeedadeennu waxa weeye in niamunad tutuwe ah laga soo saaro iskujirkan. Ugu horrayn iskujirkaa ka dharuur asiiidha iyo biyaha, dabadeetana waxa ku soo hadha bakeeriga waa in kubrik salfaydhka iyo maartha laga saaraa. Kubrik salfaydhka iyo maartuba kuma milmaan biyaha, laakiin kubrik salfeyktu (tutuwwu) wuul ku milmaa biyaha. Sidaa awgeed, waxa lagu darayaa biyo fara badan, wuxuu gaana waa la kulaylinaya (Sababtu waxa weeye milmida oo la korodha heerkulka). Marka la qaso ee la miiro, waxa badhaan noqonaya maartha iyo kubrik salfaydh, tutuwuhuna mir ahaan ayuu u soo baxayaan. Milanka tutuwuhu waa buluug, kaasi oo haddii la uumibixiyo oo aan biyaha laga wada saarin ay ka soo baxayaan wiriiqiihii tutuwaha oo buluug ah.

\[
\begin{align*}
Cu + 2H_2SO_4 & \rightarrow CuSO_4 + 2H_2O + SO_2 \\
CuSO_4 + 5H_2O & \rightarrow CuSO_4 \cdot 5H_2O \\
Cu + 2H_2SO_4 + 5H_2O & \rightarrow CuSO_4 \cdot 5H_2O + 2H_2O + SO_2
\end{align*}
\]

**T. Diyaarinta sink salfeyt laga diyaarinayo birta sink iyo salfiyyururk asiiidh badhxan:**

Quruurux sink ah haddii lagu rido bakeeri salfiyyurik asiiidh badhxan ku jirto, birta waxay la falgelayaaa asiiidha si ay u soo saarto haydaroojiin, cusbada sink salfeynta u samaysanto.

\[
Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2
\]

Haddii sinku dhammaado, waa in lagu kordhiyaa in kale ilaa u dheeraad soo hadho.

Marka la kala miiro, sinku wuxu noqonayaah hadhaa. sink salfeytkuna miir. Wuxu gaana kulayli miirta inta aad ku shubto sarsar ilaa uu rib noqooyay milanku, dabadeetana raac habka wiriqaynta ee tijaabadii hore. Wiriqo sink salfeyt ayaa soo baxayaa.

\[
ZnSO_4 + 7H_2O \rightarrow ZnSO_4 \cdot 7H_2O
\]

Cusbooyinka ay ka mid yihiin feerisalfeeyt iyo magniisiyam salfeeyt, waxa lagu diyaarin karaa sida dariiqadkaa kor ku qoran.
J. Diyaarinta wiriqaha feeras salfeyt:

Haddii la isticmaal taar ama jidhiidh xadiid ah iyo salfiyuurik asiidh badhaxan, waxa la helayaa milan feeras salfeyt ah oo wiriqihiisu cagaar yiiin.

\[
\begin{align*}
Fe + H_2SO_4 & \rightarrow FeSO_4 + H_2 \\
FeSO_4 + 7H_2O & \rightarrow FeSO_4 \cdot 7H_2O \\
Fe + H_2SO_4 + 7H_2O & \rightarrow FeSO_4 \cdot 7H_2O + H_2
\end{align*}
\]

JT. 7.10

X. Diyaarinta wiriqaha magniisiyam salfeyt (MgSO\(_4\) \cdot 7H_2O)

Waxa soo baxaya milan magniisiyam salfeyt ah iyo wiriqihiisa oo aan midab lahayn, marka la isku daro birta magniisiyam iyo salfiyuurik asiidh badhaxan.

\[
\begin{align*}
Mg + H_2SO_4 & \rightarrow MgSO_4 + H_2 \\
MgSO_4 + 7H_2O & \rightarrow MgSO_4 \cdot 7H_2O \\
Mg + H_2SO_4 + 7H_2O & \rightarrow MgSO_4 \cdot 7H_2O + H_2
\end{align*}
\]

KH. Diyaarinta Naytareytyada Biraha:

Marka la isku daro biyo iyo naytarki asiidh badhaxan ama rib ah waxa samayma milan ah naytarey:ka birta oo marka la uumibixiyo ay ka soo baxaan wiriqaha cusbada. isticmealka naytarki asiidh badhaxan ama rib ah wuxuu ku xidhan tahay firfircoonaanta biraha. Tusaa ahaan, falgal kama dhici dhici karoo naytarki asiidh aad u badhaxan iyo maar. Hase yeshee xadiidku wuxuu la falgalaa naytarki asiidh badhaxan, maartuna waxay la falgeli kartaa naytarki asiidh rib ah.

\[
\begin{align*}
3Fe + 8HNO_3 & \rightarrow 3Fe(NO_3)_2 + 2NO + 4H_2O \\
& \quad \text{(badhaxan)} \\
Cu + 4HNO_3 & \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O \\
& \quad \text{(rib ah)}
\end{align*}
\]

I. Diyaarinta cusbooyinka marka asiidh iyo beys isfasaqaan:

Isfasaqaasiidhada iyo beysyadu wuxuu dhaliiyaa cusbo iyo biyo keliya. isticmealka habkani wuxuu ku xidhan yahay in beysku biyaha ku milmo oo uu akali yahay iyo in kale. Haddii uu beysku milme yahay waxa loo baahan yahay in la cabbiro mugga asidha iyo ka beyska. Laakiin haddii uu beysku ma-arime yahay wax cabbiraad ah looma baahna.

II. Diyaarinta cusbooyinka marka la isticmaal alkali (Beyska biyaha ku milma)

Cusbooyinka naatriyam, kaaliyam iyo ammoomiyam ayaa sidatan lugu diyaariyaa, iyadoo la isticmaalayo naatriyam haydarosaydh, kaaliyam haydarosaydh, ammoomiyam haydarosaydh iyo kolba asidha ku habboon.

60
JT. 7.11

Diyaarinta naatriyam koloraydh laga diyaarinayo naatriyam haydarogsaydh iyo haydarokolorik asiidh:

Haydarokolorik asiidh badhxan ka buuxi mitiyaha. 20 ama 25 sm³ oo naatriyam haydarogsaydh ah ku shub bakeeri, woxoogaa litmas ahna ku dar. Asiidha ku sii daa bakeeriga naatriyam haydarogsaydhku ku jiro ilaa midabka litmasku isbeddelo oo aad ogaatid barta fasaqa. Milanku markaa wuxuu noqonayaa dhexdhaxaad.

\[
\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}
\]

Marka la ogaado mugga asiidha ee fasaqi kara beyska ayaa la diyaarin karayaa cusbo aan litmas ku jirin. Milanka soo baxana marka la uumbixiyo, waxa soo hadhaya naatriyam koloraydh.

Sidaa si la mid ah ayaa loo diyaarin karayaa cusbooyinka hoos ku qoran:

B. kuwa kaaliyam

\[
\begin{align*}
\text{KOH} + \text{HCl} & \rightarrow \text{KCl} + \text{H}_2\text{O} \\
\text{KOH} + \text{H}_2\text{SO}_4 & \rightarrow \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O} \\
\text{KOH} + \text{HNO}_3 & \rightarrow \text{KNO}_3 + \text{H}_2\text{O}
\end{align*}
\]

T. kuwa naatriyam

\[
\begin{align*}
2\text{NaOH} + \text{H}_2\text{SO}_4 & \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O} \\
\text{NaOH} + \text{HNO}_3 & \rightarrow \text{NaNO}_3 + \text{H}_2\text{O} \\
\text{NaOH} + \text{HCl} & \rightarrow \text{NaCl} + \text{H}_2\text{O}
\end{align*}
\]

J. kuwa ammooniyam

\[
\begin{align*}
\text{NH}_2\text{OH} + \text{HCl} & \rightarrow \text{NH}_4\text{Cl} + \text{H}_2\text{O} \\
2\text{NH}_2\text{OH} + \text{H}_2\text{SO}_4 & \rightarrow (\text{NH}_4)_2\text{SO}_4 + 2\text{H}_2\text{O} \\
\text{NH}_4\text{OH} + \text{HNO}_3 & \rightarrow \text{NH}_4\text{NO}_3 + \text{H}_2\text{O}
\end{align*}
\]

II. Diyaarinta cusbooyinka marka la isticmaalo beys aan biyaha ku milmin:

Tusaale ahaan:

Diyaarinta tutuwaha marka la isticmaalo beyska kubrik ogsaydh:

Kubrik ogsaydhka madow ku dhex rid bakeeri, kuna dar salfiyuurik asiidh badhxan, woxoogaana diiri si falgalku u dhakhsado.

\[
\text{CuO} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}
\]
Waa in kubrik ogsaydhka la badiyaa, haddii uu dhammaadana la kordhiya si asidhah loo wada isticmaalo. Marka uu falgalku istaago, kala miir tutuwaha iyo kubrik ogsaydhka. Miirtu waa milan tutuweed oo wiriqiiisana loo heli karoo sidii aynnu horey u soo sheegnay.

III. Diyaarinta cusbooyinka marka asiidh lagu daro kaarbooneytyada biraha:

Kaarbooneytyada biruhu waxay la falgalaan asidhada macdanta ah, waxana ka dhasha cusbada birta, biyo iyo kaarboon lab-ogsaydh.

Tusaale ahaan:

\[
\begin{align*}
\text{ZnCO}_3 + \text{H}_2\text{SO}_4 & \rightarrow \text{ZnSO}_4 + \text{H}_2\text{O} + \text{CO}_2 \\
\text{PbCO}_3 + 2\text{HNO}_3 & \rightarrow \text{Pb(NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2 \\
\text{CaCO}_3 + 2\text{HCl} & \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2
\end{align*}
\]

B. Diyaarinta balambam naytareyt, marka la isku daro balambam kaarbooneyt iyo naytarki asiidh:

Bakeeri ku dhex rid woxoogaal balambam kaarbooneyt ah, kuna dar naytarki asiidh badhaxan. Kaarbooneytyku wuxuu ku dhex baaba’ayaa asiidh waxana soo baxaya xunbo kaarboon laba-ogsaydh ah.

\[
\begin{align*}
\text{PbCO}_3 + 2\text{HNO}_3 & \rightarrow \text{Pb(NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2
\end{align*}
\]

Kolba ku dar in kale oo kaarbooneyt ah si ay asiidh u wada dhammaato, woxoogaana kulayli haddii loo baahdo. dabadeetana miir iskujiirka oo wiriqaha miirta soo saar.

---

JT. 7.12

T. Diyaarinta kaalsiyam koloraydh laga diyaarinayo kaalsiyam kaarbooneyt.

Woxoogaay yar oo haydarokolorik asiidh ah ku shub sarsar qarsha ah, kaalsiyam kaarbooneyt budo ahna hadba in yar ku dar. Waxa aad arkaysaa xunbo aad u fara badan. Ku wad kaalsiyam kaarbooneytka ilaa wax xunba ah aad arkiweydid, wixii kaalsiyam kaarbooneyt ah ee dheeraad ahintu uu i fadhiisto si aad u hubiso in ay asiidhii dhammaatay waxoogaa yar kulayli ilaa xunbo dambe soo bixi weydo. Kala miir iskujiirka. Miirta kuu soo baxdaa waan milan kaalsiyam koloraydh ah oo marka la uumbiixiyo wiriqo caddi ka soo baxaan. Wiriqaha kaalsiyam koloraydh ah haddii ay woxooga dibadda yaallin biyo ayay hawada ka nuugayaan dabadeetana way milmayaan. Sidaa awgeed kaalsiyam koloraydhku waa sayexe-milme, waxaana lagu isticmaalaa qallajinta neefaha.

\[
\begin{align*}
\text{CaCO}_3 + \text{HCl} & \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2
\end{align*}
\]
IV. Diyaarinta cusbooyinka aan biyaha ku milmin:

Waxaan soo aragnay dhawr dargiio oo loo diyaariyo cusbooyinka biyaha ku milma, laakiin dargiigooyin kale ayaa loo diyaariyaa cusbooyinka aan biyaha ku milmin. Dariigyooyinkaasi waxa ugu muhiimsan ruushiyeynta.

Ruushiyeynta waxa caadi ah in la isku daro laba iskudhisi oo biyaha ku milma oo dabadeetana ay ka soo baxaan mid biyaha ku milma iyo mid aan ku milmin. Cusbooyinka samaysma, ta loo baahan yahay waa ta aan biyaha ku milmin, sababtu waxa weeye iyadoo si dhib yar loo heli karayo marka la miiro. Sidaa awgeed cusbooyinka aan biyaha ku milmin ayaa dariqadan lagu diyaariyaa.

Diyaarinta namuunad balambam salfeyt ah:

Waxa la isticmaalayaa laba iskudhisi oo biyaha ku milma oo midna soo saaro ayoonada balambam, ka kalana ayoonnada salfeytka. Iskudhisyada ku habboon diyaarintani waa balambam naytareyt iyo salfiyuurik asidh badhaxan.

\[ \text{Pb(NO}_3\text{)}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 \downarrow + 2\text{HNO}_3 \]

Marka uu soo baxo ruushi cad oo balambam salfeyt ah, waa in iskujirka la miiraa si balambam salfeytku uu u noqdo hadhaa. Hadhaagaa waxa dhowr jeer lagu maydhayaa biyo, dabadeetana waxa lagu engejinayaa warqadda wax lagu kala miiro.

Cusbooyinka kale ee lagu diyaarin karo habkani waxa ka mid ah:

Beeriyam salfeyt:

\[ \text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 \downarrow + 2\text{HCl} \]

Balambam koloraydh:

\[ \text{Pb(NO}_3\text{)}_2 + 2\text{NaCl} \rightarrow \text{PbCl}_2 \downarrow + 2\text{NaNO}_3 \]

Kaalsiyam kaarboonkeyt:

\[ \text{CaCl}_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{CaCO}_3 \downarrow + 2\text{NaCl} \]

JT. 7.13

V. Diyaarinta cusbooyinka marka laba curiye toos la isugu geeyo:

Cusbooyinka labada curiye ka samaysan waxa lagu diyaariyaa iyadoo toos la isugu geeyo labada curiye ee iskudhisku ka samaysna yahay.

Tusaale ahaan:

\[ 2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl} \]

\[ 2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3 \]

\[ \text{Fe} + \text{S} \rightarrow \text{Fes} \]

Diyaarinta feerik koloraydh:

U meerar saabaanka tijaabada sida aad jaantsuka 7.14 ku aragtid.
JT. 7.14

Feerik koloraydh engegsan ayaa soo baxaya haddii koloriin la dhex mariyo xadiid jajab ah oo la kululeeyey iyadoo la raacayo habka jaantuska u meeraran yahay.

\[
2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3
\]

Laylis 7.1 :

1) Qeex erayada soo socda :
   a) asiidh;
   t) asiidh xooggan;
   j) asiidh daciih ah;
   x) beys.
2) Maxaa raad ah ee ay asiidhada iyo beysyaduba kaga tagaan litmaska, mitayl oranjka iyo fiinoftaliinka.
3) Adoo isle’eg ku tusaya, waxaad sheegta waxa looga jeedo isfasaqa?
4) Sharax waxa loo yidhi kaarboonik asiidh waa asiidh daciih ah?
5) Waxaad magacawdaa afar asiidh, afar beys iyo afarta cusbo ee ka samaysma?
6) Tax shan dariiqo oo cusbooyinka lagu diyaariyo, adoo laba ka mid ah saani u sharaxaya?
7) Sidee ayaad naatriyam koloraydh u diyaarinaysaa, adoo haysta naatriyam haydarog-saydh iyo haydarokoloror asiidh?
8) Ma laga diyaarin karaa cusbada kubrik salfeyt, adoo isticmaalaya kaalsiyam kaarbooneeyt iyo salfiyuurik asiidh?
9) Waa maxay tilmaamuhu, sidee ayaa looga faa’iidaystaay marka cusbo laga diyaarinayo asiidh iyo beys?
10) Diyaari cusbada aan biyaha ku milmin ee balambam salfeyt, adoo haysta cusbo balambam naytareeyt ah?
11) Waxaad sharaxdaa waxa looga jeedo cusbada caadiga ah iyo ta asiidhka ah?
12) Sheeg astaamaha asiidha iyo kuwa beyska?
Baabka Siddeedaad

N E E F A H A

Saamigelid:

Marka laba xaddi xidhiidh ka dhexeeyo, xidhiidhkaasi wuxuu noqon karaa mid labada xaddi ay saamigal qumman isu yihiin ama mid labada xaddi saamigalkoodu rogaal qumman isu yihiin.

Saamigal qumman:

Haddii laba xaddi xidhiidh ka dhexeeyo oo marka uu mid bato, ka kalena uu bato, ama markuu mid yaraado ka kalana uu yaraado, xidhiidhkaasi waxa weeye mid ay labada xaddi saamigal qumman isku yihiin.

Tusaale ahaan, haddii wiil dhererkiisu ku xidhan yahay da’diisa, oo marka uu sannad u kordhaha in go’an oo dhererkiisa ihi kordheysa, waxa la odhanayaa dherarka wiilku saamigal qumman ayuu u yahay da’diisa. Sidaasii oo kale ayaa meeriska goobaduna saamigal qumman u yahay dhexroorkiisa, xisaab ahaanna waxa loo qoraa, M α D. Tibaaxda saamigalkuna waxa ay isu geddiyeysaa isleeg caadi ah, marka madoorsoomaha (π) lagu dhuunto dhexroorka. M = π D.

Saamigal rogaal qumman:

Haddii laba xaddi xidhiidh ka dhexeeyo oo marka uu mid bato ka kalena uu yaraado, ama marka uu mid yaraado ka kalena uu bato, xidhiidhkaasi waxa uu noqonayaa mid ay labada xaddi saamigalkoodu rogaal qumman isu yihiin.

Tusaale ahaan, haddii xawaaraha aad meel ku gaadhi lahayd aad laban laabto, waxa yaraanaya amminta aad u socon lahayd ilaa meeshaaasi. Xidhiidhkana waxa lo odhanayaa: Xawaaruhu saamigal ayuu u yahay rogaalka amminta.

\[ Xawaara \ \frac{1}{\text{amminta}} \]

\[ s \alpha \frac{1}{t} \Rightarrow s = k/t \]

\[ \therefore \ s \cdot t = k \] (k = madoorsoome, s = xawaare, t = amminta)

ASTAAAMAHA XADDIYEED EE NEEFAHA

1. Cufka neefaha:

Inkast oo kulayska la cabbiray qarnigii 17aad dabayaaqadiisi, waxa dhibaata noqotay sidii kulayska neefaha si sagan loogu cabbiri laaha. Hase yeeshee horumarka kimistariga ayaa keenay cabbiraadda neefaha iyadoo la isticmaalayo miisaanno sugan. Haddii dhal madhan aad miisaanto, dabadeetana aad ku buuxisid neef oo haddana aad dib u miisaanto, waxa aad arkaysaa in fara q dhexeeyo labada culays. Faraqaasina waa kulayska ama cufka neefta.

2. Cadaadiska neefaha:

Tusaalaha soo socda ayaa si fücan u tilmaamaya cadaadiska neefaha. Haddii waxoogaa neef ah lagu shubo buufin, dabadeedna lagu dhe x ridoo gambise madhan, waxa la arkayaa buufintii oo iskadiisa. Waxana ugu wacan iyadoo neefta buufinta ku jirtaa ay hoos ka soo cadaadinayo, wax cadaadis ah oo buufinta guudkeeda ku dhacayaan aanu jirin. Taasina waxa ay inna tusaysaa in neefuhu cadaadis leeyihiin.
Sidaasi oo kale, haddii aad soo qaado daasad fur wadata oo xaddi neef ihi ku jirto, waxa aad aqoonsanaysaa in neefta gudhaha ku jirtaa ay hoos ka soo cadaadinayso daasadda, cadaadiska hawaduna uu guudka kaga dhacayo oo ay labadu isdheelitirayaan.

**JT 8.1**

Haddii buufiyey lagaga saaro neefta daasadda ku jirta waxa aad arkaysaa daasaddii oo buus-buus-santay. Sababtuna waxa weeye cadaadiska gudaha oo ka yar ka dibadda. cadaadiska waxa lagu qiyaasaa atmoosfiyee, sentimitar ama milimitar.

**JT 8.2**

3. Mugga neefaha:

Sidoodaba neefuhu ma laha qaab iyo mug go'an toona, sababtuna waxa weeye iyadoo neefuhu isdhxgala, diismana. Mugga neefuhu waxa uu u dhigmada hadba weelka ay ku jiraan. Tusaale ahaan, haddii haydarojiin ku jiro dhalo hal litir ah, mugga neeftaasi haydarojiinta ihi wuxuu noqonayaa hal litir haddii ayna isbeddelin cadaadiska iyo heerkulku. Sida caadiga ah waxa mugga lagu qiyaasaa litrrro (1), militirro (ml), ama santimitir saddex jibbaaran (sm³).

Xeerka neefaha:

Marka aynnu ka hadlaynno neefaha waa in mugga ama cufka midkood la isticmaalaa. Inta badan waxa la isticmaalaa mugga, waayo cabbiraadda mugga ayaa ka hawl yar ta cufka. Hase yeeshee cufka neefuhu ma doorrooomo, laakiin muggu wux isbeddelaa. Sidaa awgeed waa in aynnu ogaan waxyaalaha mugga beddela, kuwaasi oo ah cadaadiska iyo heerkulka. Tusaale ahaan, tibbaaxaha ah «1 m³» oo hawa ah waxa micna ah oo ay sheegaysaa ma jirto, iyadoo cadaadiska iyo heerkulkuba la sheego mooyee. Waayo 1 m³ oo hawa ah waxa la isugu diisi karraa dhawr sm³, waxa kale oo ay ku fidi kartaa oo ay buuxin kartaana qol weyn. Sidaasi oo kale haddii 1 m³ oo hawo ah la kulayliyo waxa dhacaysa in uu ku fido mug intaa ka badan, haddii la qaboojiyana uu ka yaraado.
Halkaasi waxa aynnu ka arkaaynaa in mugga neefuhu uu ku xidhan yahay hadba sida ay cadaadiska iyo heerkulku isu beddelaan. Xidhiidhkaasina waxa xukuma xeerar gaar ah. Xeerarkaasina waxa la yidhaahdaa «Xeerka Neefaha».

Xeerka Boo’iil :

Haddii kubbad neefi ku jirto la isku diso, mugga neefta ku jirta kubbaddu wuu yaraanayaa. Marka cadaadiska laga yareeyana jimidhka kubbaddu halkiiisii hore ayuu ku soo noqonayaa.

Roobart Boo’iil ayaa, isaga oo ka faa’iidaysanaya dhacdaadas iyo kuwa kale oo la mid ah, ugu horrayn tijaabo ahaan ku soo sawer xidhiidhka ka dhexeeya mugga iyo cadaadiska neefaha, tijaabada soo socota ayaana inna tusaysaa xidhiikaas.

Tijaabo 8.3 :

Waxa aad soo qaadaa dhuun qaab J leh, mastarad hal mitir ah iyo meerkuri, dabadeetana u meerar saabaanka sida jaantsuska 8.3 tusayo.

\[
\text{Dhuun - J} \\
\begin{array}{c}
\text{Mugga} \\
\text{hore}
\end{array} \quad \begin{array}{c}
\text{Mugga} \\
\text{dambe}
\end{array} \\
\text{(a)} \quad \text{(b)}
\]

\[
\text{Meerkuri} \quad \text{JT 8.3}
\]


cadaadiska (P) & Mug (V) & Taranka (X — Y) + b & (M — Y) & P \times V \\

1) Haddii meerkuri kale lagu kordhiyo maxaa dhacaya? \\
2) Marka cadaadiska kordho, maxaa ku dhacaya mugga neefta? \\
3) Taranka P \times V muxuu tusayaa?

Marka aad weydiisyadaasi ka jawaabtid waxa aad ogaanaysa in marka cadaadisku yaraado uu mugga neeftu badanayo, marka cadaadisku batana uu mugga neeftu yaraanayo. Xidhiidhkaasi ka dhexeeya cadaadiska iyo mugga waxa soo koobaya xeerka Boo’il. Xeerkaasi wuxuu leeyahay : ‘haddii heerkulka iyo cufka aanay isbeddelin mugga neeftu wuxuu saamigal qumman u yahay rogaalka cadaadiskiisa’.

\[
V = \frac{1}{P} (P = \text{cadaadiska}, \ V = \text{Mugga};)
\]

\[
V = K/P
\]

\[
\therefore \ PV = K.
\]
Marka cadaadiska ama mugga midkood hoos u dhaco, inta ka dhimman taa waxa ayla mid tahay inta ka kale ku kordheysa; sidaa awgeedna taranku waa madoorsoome.

Cadaadis × Mug = Madoorsoome.

\[
\begin{align*}
P_1 & \times V_1 = K \\
P_2 & \times V_2 = K \\
\therefore & \quad P_1 \times V_1 = P_2 \times V_2 = K \\
\end{align*}
\]

Garaafka jaantuska 8.4 ayaana xidhiidhkan tusay: Haddii:

\[
\begin{align*}
P_1 & = 5, & V_1 & = 2; & P \times V = 10 \\
P_2 & = 2, & V_2 & = 5; & P \times V = 10 \\
P_3 & = 1, & V_3 & = 10; & P \times V = 10 \\
\end{align*}
\]

**Tusaale 1:**

![Graph](image)

(V \alpha \frac{1}{P})

**JT. 8.4**

1) Neef ayaa muggeedu ahaa 228 \text{sm}^3 markii heerkulku ahaa 15°C, cadaadiskuna ahaa 750 mm. Intuu noqonayaan muggu marka cadaadiska laga dhigo 760 mm?

\[
\begin{align*}
P_1 & = 750 \text{ mm}. \\
V_1 & = 228 \text{ sm}^3. \\
T_1 & = T_2 = 15°C. \\
P_2 & = 760 \text{ mm}. \\
\end{align*}
\]

V_2 = ?

Adoo adeegsanaya xerka Boo'il, P_1 V_1 = P_2 V_2 waxaad raadisaa V_2.

\[
V_2 = \frac{P_1 V_1}{P_2} = \frac{228 \text{ sm}^3 \times 750 \text{ mm}}{760 \text{ mm}}.
\]

V_2 = 225 \text{ sm}^3

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2) Neef muggeedu ahaa 500 ml, cadaadiskuna ahaa 700mm, ayaa cadaadiskii laga dhigay 750mm. Muyygeeda raadi?

\[ P_1 = 700 \text{ mm} \]
\[ V_1 = 500 \text{ ml} \]
\[ P_2 = 750 \text{ mm} \]

\[ V_2 = \frac{P_1V_1}{P_2} \]

\[ V_2 = \frac{760 \text{ mm} \times 500 \text{ ml}}{750 \text{ mm}} = 466.7 \text{ ml}. \]

\[ V_2 = 466.7 \text{ ml} \]

3) Haddii cadaadiska 2 litir oo neef ihi uu ahaa 1 atm. meeqa ayuu noqonayaa, marka mugga laga dhigo 0.80 litir?

\[ P_1 = 1 \text{ atm.} \]
\[ V_1 = 2 \text{ litir.} \]
\[ V_2 = 0.80 \text{ litir.} \]

\[ P_2 = ? \]
\[ P_1V_1 = P_2V_2 \]

\[ P_2 = \frac{1 \text{ atm} \times 2 \text{ litir}}{0.8 \text{ litir}} = 2.5 \text{ atm.} \]

\[ P_2 = 2.5 \text{ atm.} \]

Layli 8.1:

1) Adoo isticmaalaya xeerka Boo’il waxaad soo saartaa cadaadiska ama mugga tusaha ka dhiman:

<table>
<thead>
<tr>
<th>Cadaadiskii hore</th>
<th>Mugga hore</th>
<th>Cadaadiska labaad</th>
<th>Mugga labaad</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. 2 atm</td>
<td>300 ml</td>
<td>1.5 atm</td>
<td>26 ml</td>
</tr>
<tr>
<td>t. 70 sm</td>
<td>250 ml</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. 760 sm</td>
<td></td>
<td>735 mm</td>
<td>10.24 l</td>
</tr>
<tr>
<td>x. 11.200 ml</td>
<td>71.5 sm</td>
<td>12.010 ml</td>
<td></td>
</tr>
</tbody>
</table>

2) Haddii neef muggeedu yahay 74 sm\(^3\), marka cadaadisku yahay 76 sm, soo saar inta uu noqonayo muggu marka cadaadiska laga dhigay 76 sm, haddii heerkulku aanu isbeddelin?

3) 4 ft\(^3\) oo ogsijiina ayaa ku jirtay koonbo, markii cadaadisku ahaa 100 atm. Imisa ayuu noqonayaa muggisu marka cadaadisku noqdo ka atmoosfiyeerka.

4) Haddii neef muggeedu ahaa 10 litir, marka heerkulku ahaa 25\(^\circ\)C, cadaadiskuna 1 atm, meeqa ayuu cadaadisku noqonayaa marka muggu noqdo 1.0 litir, haddii aanu heerkulku isbeddelin?

5) Haddii xaddi neef ah uu muggeedu ahaa 40 litir markii cadaadisku ahaa 2 atm, imisa ayuu cadaadisku noqonayaa haddii muggu labanlaabmo? (Heerkulku waa madoorsoome).
Xeerka Jaarlas:
Waxa aanu soo aragnay in mugga neeftu uu isla beddelo heerkulka. Sida uu isula beddelana, waxa ugu horrayn caddeeyey saynsiyahankii faransiska ahaa ee la odhan jiray Jaarlas, markuu sannadku ahaa 1782kii. Tijaabada soo socota ayaana inna tusaysa xidhiidhkaasi.

Tijaabo 8.2:
Waxa aad soo qaaddaa dhuun dhererkeeduna yahay 50 sm, dhexroorkeeduna 1 mm. In yar oo meerkuu ah ku rid dhuunta, dabadeetana labada af midkood xidh si woxoogaa neef ihi ay ugu xannibanto dhuunta afkeeda xidhan iyo meerkuriga dhexdooda. Dhuunta iyo mastarad mitir badhkiis isku xidh, dabadeetana ku qotomi weel biyo ku jiraan iyado dhuunta afkeeda furani uu biyaha ka baxsan yahay sida aad jaantsuska 8.6 ku aragtid. Heerkulbeeg biyaha ku dhex rid.

\[ P \times V = \text{Madoorse} \]

Xeerka Booil

\[ \text{Xeerka Booil} \]

\[ P \times V = \text{Madoorse} \]

JT. 8.5
Mar haddii dhexroorka dhuunta uu madoorse oomayahay, dhererku saamigal qumman ayuu u yahay mugga \((h \propto V)\). Sidaa awgeed cabbiraadda dhererka u dhexeeyda dhuunta afkeeda xidhan iyo meerkuriga xaggiisa hoose waxa loo qaadan karaa cabbiraadda mugga neefta.

Qaad heerkulka biyaha \((t_1)\) iyo mugga neefta \((V_1)\) oo la mid ah \((h_1)\). Kululee biyaha adigoo uumi biyo ah dhex marinaya ama weelka ku dhex ridaya biyo kale oo kulul. Qaad heerkulka labaad \(t_2\) iyo mugga neefta \((V_2 = h_2)\). (Ogow cadaadiska neeftu waa madoorse, waxanu mar walba la mid yahay cadaadiska atamosiifeerkii iyo ka meerkuriga oo la isu geeeyay.)

Heerkullo iyo mugag kala qaad. Marka mugagga iyo heerkullada kala duwan aad ku samaysid garaat, waxa aad helaysaa garaa xarriiq toosan ah. Haddii xarriiqda aad dib u sii jeexdida, waxa ay jari doontaa dhidhiba X; barta ay ka jaraysaana waa \(-273^\circ\text{C}\). Hase yeeshee taasi ma dhacdo, waayo heerkulkaasi, neef jiraysaa ma jirta, ee adke ayay noqotaa.

JT 8.6
Heerkulkaasi loo haysto in mugagga neefuhu gaadhayaan ibir ayaa la yidhaa ibirka sugan. Ibirkaa sugani wuxuu sal u yahay qiyaas heerkul oo cusub, waxana la yidhaa qiyaas sugan (ama Kelfin).

<table>
<thead>
<tr>
<th>Heerkulka selsiyas</th>
<th>Heerkulka kelfin</th>
</tr>
</thead>
<tbody>
<tr>
<td>273°C</td>
<td>$0^\circ K = ( - 273^0 + 273^0)$</td>
</tr>
<tr>
<td>272°C</td>
<td>$1^\circ K = ( - 272^0 + 273^0)$</td>
</tr>
<tr>
<td>270°C</td>
<td>$3^\circ K = ( - 270^0 + 273^0)$</td>
</tr>
<tr>
<td>10°C</td>
<td>$263^0 K = ( - 10^0 + 273^0)$</td>
</tr>
<tr>
<td>0°C</td>
<td>$273^0 K = ( 0^0 + 273^0)$</td>
</tr>
<tr>
<td>100°C</td>
<td>$373^0 K = ( 100^0 + 273^0)$</td>
</tr>
</tbody>
</table>

Sida aad ku aragtid tusaha sare, heerkulka selsiyaska waxa loo beddeli karaa heerkulka kelfin haddii madoorsoome ah + 273 lagu daro.

$T_0^\circ K = t^0 + 273^0$

Haddii aad labada saami ee $\frac{t_1}{t_2}$ iyo $\frac{V_1}{V_2}$ isu eegtid, waxad arkaysaa in aanay isku mid ahayn. Taasi waxay inna tusaysaa in mugga neefuhu aanu saamigal qumman u ahayn heerkulka selsiyas. Haddiise heerkullada lagu daro madoorsoome ah x, waxa la arkayaa in ay labadii saami isku mid noqonayaan.

$$\frac{t_1 + x}{t_2 + x} = \frac{V_1}{V_2}$$

Waxana la arkay in $x = 273$. Haddii aynnu u fiirsanno saamiga heerkullada, waxa aynnu arkaynaa (in $t_1 + x$) iyo ($t_2 + x$) ay la mid yihin heerkullada kelfin ee $T_1$ iyo $T_2$.

Sidaa awgeed xeerka Jaarliis waxa loo qoraa: «Mugga neef cufkeedu iyo cadaad-isku yahay madoorsoome.

Xisaab ahaan waxa loo qoraa:

$$\frac{V_1}{T_1} = K,$$

$$\frac{V_2}{T_2} = K,$$

\[ \therefore \frac{V_1}{T_1} = \frac{V_2}{T_2} = K \]
JT 8.8

(Xusuus: Si looga faa’ideysto xeerka Jaarlas, waa in heerkulka selsiyaska loo beddelaa ka Kelfin.)

1) Haddii neef muggeedu yahay 144 sm$^3$ marka heerkulku yahay 15$^\circ$C, mugga soo baxaa muxuu noqonayaa marka heerkulku noqdo 100$^\circ$C ?

\[ V_1 = 144 \text{ sm}^3 \]
\[ T_1 = (15^\circ\text{C} + 273^\circ\text{C}) = 288^\circ\text{K} \]
\[ T_2 = (100^\circ\text{C} + 273^\circ\text{C}) = 373^\circ\text{K} \]

\[ \frac{V_1}{T_1} = \frac{V_2}{T_2} \]

\[ \frac{144 \text{ sm}^3}{288^\circ\text{K}} = \frac{V_2}{373^\circ\text{K}} \]

\[ V_2 = \frac{144 \text{ sm}^3 \times 373^\circ\text{K}}{288^\circ\text{K}} = 186.5 \text{ sm}^3 \]

\[ V_2 = 186.5 \text{ sm}^3 \]

2) Iyadoo heerkulku yahay 20$^\circ$C ayay neefi ku jirtay mug ah 500 ml. Intuu noqonayaa muggu marka heerkulka laga dhiga 40$^\circ$C ?

\[ V_1 = 500 \text{ ml} \]
\[ T_1 = 293^\circ\text{K}. \]
\[ T_2 = 313^\circ\text{K}. \]

\[ V_2 = \frac{V_1 T_2}{T_1} = \frac{500 \text{ ml} \times 313^\circ\text{K}}{293^\circ\text{K}} \]

\[ V_2 = 534.1 \text{ ml}. \]
3) Meeqa ayuu heerkulku noqonayaa si mug litir ah oo heerkulkiisu ahaa 0°C, uu u noqdo 2.75 litir?

\[
\begin{align*}
V_1 &= 1 \text{ litir.} \\
T_1 &= 273^\circ\text{K} \\
V_2 &= 2.75 \text{ litir.}
\end{align*}
\]

\[
T_2 = ?
\]

\[
\frac{V_1}{T_1} = \frac{V_2}{T_2}
\]

\[
T_2 = \frac{V_2 T_1}{V_1}
\]

\[
T_2 = \frac{2.75 \text{ litir} \times 273^\circ\text{K}}{1 \text{ litir}}
\]

\[
T_2 = 750^\circ\text{K}
\]

1) Adoo isticmaalaya xeerka Jaarlas, waxa aad buuxisaa meelaha banaan ee tusaha soo socda:

<table>
<thead>
<tr>
<th>Mug hore</th>
<th>Heerkulka hore</th>
<th>Mug dambe</th>
<th>Heerkulka dambe</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. 100 ml</td>
<td>17°C</td>
<td>100 ml</td>
<td>20°C</td>
</tr>
<tr>
<td>t. 2.2 l</td>
<td>27°C</td>
<td>592 ml</td>
<td>82°C</td>
</tr>
<tr>
<td>j. 557 ml</td>
<td></td>
<td>162.8 ml</td>
<td></td>
</tr>
<tr>
<td>x. 0°C</td>
<td></td>
<td></td>
<td>49°C</td>
</tr>
</tbody>
</table>

2) Neef ayaa muggeedu ahaa 224 sm³ markuu heerkulku joogay 0°C. Waxa aad soo saartaa mugga neeftaasi marka heerkulku noqdo 15°C, haddii aanu cadaadisku isbeddelin?

3) Meeqa ayuu noqonayaa mugga neeftu marka heerkulku noqodo 0°C, haddii uu ahaa 58 sm³ marka heerkulku ahaa 17°C. Haddii heerkulku hoos u soo dhaco ilaa — 17°C, imisa ayuu noqonayaa mugga neeftu?

4) Neef ayaa muggeedu ahaa 25 ml, markii heerkulku ahaa 27°C. Ilaa heerkee ayaa la kulaylinayaa si Muggu u noqdo 632 ml?

5) Neef ayaa muggeedu ahaa 3 litir marka heerkulku ahaa 27°C, cadaadiskuna 1 atm. Haddii mugga laga dhigo 2 litir meeqa ayuu noqonayaa heerkulku?

Xeerka guud ee neefaha:

Waxa aynnu hore u soo aragnay in uu mugga neeftu isla beddelo cadaadiska iyo heerkulkaba. Sidaa awgeedna xeerka Boo’il iyo ka Jaarlas waa la isu geyn karaa.

Ka soo qaad in mugga bilowga ah ee neef cufkeeda la ogyahay uu yahay \( V_1 \) marka cadaadisku yahay \( P_1 \), heerkulka kelfinna uu yahay \( T_1 \). Waxa kale oo aad ka soo qaaddaa in mugga, isla cufkaa neefta ihi, uu yahay \( V_2 \) marka cadaadisku yahay \( P_2 \) heerkulkuna \( T_2 \). Marka hore u fiirso isbeddelka ku dhaca mugga marka aanu heerkulku isbeddelin (\( T_1 = T_2 \)).

\[
P_1 V_1 = P_2 V_2
\]

1) Xeerka Boo’il

\( V_2 \) waa mugga neefta marka uu cadaadisku yahay \( P_2 \), heerkulkuna \( T_1 \). Mar labaadka u fiirso isbeddelka mugga marka heerhulku isu beddelo. \( T_2 \) iyadoo cadaadisku aanu isbeddelin (\( P_2 = P_2 \)).
\[ \frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \text{2) Xeerka Jaarlas} \]

ama \( V_2 = \frac{T_1 V_1}{T_2} \)

Haddii aynnu gelinno isle'egta (1) qiimaha \( V_2 \) ee isle'egta (2), waxa aynnu heleynaa:

\[ P_1 V_1 = P_2 \cdot \frac{T_1 V_2}{T_2} \]

ama \( \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \text{3) \#} \)

Isle'egtan ayaa la yidhaa isle'egta guud ama xeerka guud ee neefaha.

**Xaaladaha beeggalka ah**:

Mar haddii mugagga neefuhu ay isla beddelan cadaadiska iyo heerkulka, waxa lagama maarman noqotay in la doorto xaalado beeggal ah oo cabbiradda neefaha looga qiyays qaato. Waxa la isku raacay in cadaadiska iyo heerkulka beeggalka ah loo qaato 76 sm oo joogga meerkuriga ah iyo 0°C (273°K) sida ay u kala horreeyaan.

Haddii la isticmaalo xishiidhka ka dheexeeya mugga, heerkulka iyo cadaadiska, mug kasta oo neefi leeadhay waxa loo rogi karaa mugga xaaladaha beeggalka ah. Isla markaa haddii la ogyahay mugga neefta ee xaaladaha beeggalka ah, waxa la soo saari karaa mugga neeftu qaadan karto heerkul kasta iyo cadaadis kastaba.

Sidaasi oo kale haddii muggu aanu isbeddelin heerkul kasta cadaadiskiisa waa la soo saari karaa. Heerkulka iyo cadaadiska beeggalka ah waxa had iyo jeer loo soo gaabiyaa H.C.B.

**Tusaale**:

1) Neef ayaa muggeedu ahay 211 sm³, marka uu heerkulku ahay 18°C, cadaadiskuna 740 mm. Imisa ayuu noqonayaa mugga neeftu haddii heerkulka iyo cadaadisku ay kala yihiin — 20°C iyo 770mm ?

\[ P_1 = 740 \text{ mm}, \]

\[ V_1 = 211 \text{ sm}^3, \]

\[ T_1 = 291^\circ\text{K} \]

\[ P_2 = 770 \text{ mm.} \]

\[ T_2 = 253^\circ\text{K} \]

\[ V_2 = ? \]

Adiga oo isticmaalaya isle'egta guud ee neefaha:

\[ \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \]

\[ V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} \]

\[ V_2 = \frac{740 \text{ mm} \times 211 \text{ sm}^3 \times 253^\circ\text{K}}{291^\circ\text{K} \times 770 \text{ mm}} \]

\[ V_2 = 176 \text{ sm}^3 \]

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2) Xaddi neef ah ayaa lagu ururiyay mug ah 95 sm$^3$ iyadoo heerkulku yahay 13°C, cadaadiskuna yahay 767 mm. Waxa aad soo saartaa inta uu muggu noqonayo marka xaaladda neeftu noqto heerkulka iyo cadaadiska beegan (H.C.B.)?

\[ P_1 = 767 \text{ mm.} \]
\[ V_1 = 95 \text{ sm}^3. \quad T_1 = 286^0\text{K}. \quad P_1 = 767 \text{ mm.} \]
\[ T_2 = 273^0\text{K}. \]

\[ V_2 = ? \]

\[ \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \text{(isle'eg guud ee neefaha)} \]

\[ V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{767 \text{ mm} \times 95 \text{ sm}^3 \times 273^0\text{K}}{286^0\text{K} \times 760 \text{ mm}} \]

\[ V_2 = 91.5 \text{ sm}^3 \]

3) 65 sm$^3$ oo haydarojiin qallalan ah ayaa lagu dul ururiyay meerkuri, iyadoo uu cadaadiska atmosfiyeerku yahay 750 mm, heerkulka qolkuna uu yahay 23°C. Haddii heerkulka qolkuna uu yahay 23°C. Haddii heerkulka iyo cadaadiska beeggalka ah (H.C.B.) ay cuftaanta haydarojiin tahay 0.09 g/l, meequu noqonayaa cufta neeftu?

\[ P_1 = 750 \text{ mm} \]
\[ T_1 = 296^0\text{K} \]
\[ V_1 = 65 \text{ sm}^3 \]
\[ P_2 = 760 \text{ mm} \]
\[ T_2 = 273 \]
\[ V_2 = ? \]

Cufta neeftu?

\[ \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \]

\[ V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{750 \text{ mm} \times 65 \text{ sm}^3 \times 273^0\text{K}}{760 \text{ mm} \times 296^0\text{K}} \]

\[ V_2 = 59.2 \text{ sm}^3 \]

Cufnaan = cuft/mug.

Cuf = mug × cuftaann

Cufta neeftu = 59.2 sm$^3$ × 0.00009 g/sm$^3$

Cufta neeftu = 0.0053 g.
Layli 8.3:

1) Meeqa ayuu noqonayaa mugga neeftu marka la isticmaalo heerkulka iyo cadaadiska beeggan haddii uu marka hore ahaa:

<table>
<thead>
<tr>
<th></th>
<th>mug</th>
<th>heerkul</th>
<th>cadaadis</th>
</tr>
</thead>
<tbody>
<tr>
<td>b.</td>
<td>170 ml</td>
<td>17°C</td>
<td>740 mm</td>
</tr>
<tr>
<td>t.</td>
<td>500 ml</td>
<td>288°K</td>
<td>1.5 atm.</td>
</tr>
<tr>
<td>j.</td>
<td>22.4 l</td>
<td>— 10°C</td>
<td>527 mm</td>
</tr>
</tbody>
</table>

2) Cuf go’an oo neef ah ayaa buuxiyay mug ah 146 sm³ marka heerkulka iyo cadaadisku yiihiin 18°C iyo 738 mm. Waxa aad soo saartaa mugga neefta marka la isticmaalo 760 mm oo cadaadiska iyo heerkulka 0°C (H.C.B.).

3) Neef ayaa buuxisay 246 sm³, marka heerkulku ahaa 38°C, cadaadiskuna ahaa 738 mm. Mugeeda raadi marka ay xaaladuhu beeggaalka yiihiin (H.C.B.)

4) Cuf neefeed oo heerkulkiiisa iyo cadaadiskiiisu kala yiihiin 15°C iyo 63 sm, ayaa buuxiyay mug ah 25 sm³. Haddii cadaadiska la kordhiyo ilaa 80 sm, mugga neeftuna uu noqdo 21 sm³, meeqa ayuu noqonayaa heerkulku?

5) Mar uu heerkulku ahaa 0°C, cadaadiskuna ahaa 600 mm. ayaa neefi ku jirtay mug 500 ml ah. Haddii cadaadiska laga dhigo 800 mm. meeqa ayuu noqonayaa heerkulku si uu muggu u noqdo 600 ml?

6) Arday ayaa diyaariyey 1520 ml oo ogsijiin qiilalan ah iyada oo heerkulku yahay 23°C, cadaadiskuna 74.48 sm. Meequu noqonayaa cadaadisku marka muggu noqdo 1372 ml, cadaadiskuna 0°C?

Cadaadiska iyo Cufka waa

ma doorsoome

JT. 8.9

Xeerka Daalton ee cadaadis qaybeed:

Haddii laba neefood ama in ka badan la isku daro, neef waliba waxa ay leedahay cadaadis u gaar ah. Cadaadiskeedaasina waxa uu la mid yahay ka ay neeftu yeelan lahayd, haddii ay keligeed weelka ku jirto. Cadaadiska guud ee neefaha weelka ku jiraana, waxa uu noqonayaa wadarta qaybaha cadaadiska neefaha.

Arrintaas waxa soo koobaya xeerka Daalton, waxuna odhanayaa:

Marka heerkulku madoorsoome yahay, wadarta cadaadiska ee iskuujir neefaa ihi, waxa uu la mid yahay cadaadisyada neefaha oo la isu geeyo.

JT. 8.10

H₂
6sm Hg
O₂
10sm Hg
H₂ iyo O₂
16sm Hg
Xeerkaas Daalton waxa muujinaya jaantska 8.10:

Saddexda sanduuq waa isku mug, meerkuriga dhuunta ku jira aytana cabbiray cadaadiska. Waxa aad ka soo qaadda in sanduuqyada midkood haydarojiin laga buuxiyay, cadaadiskuna 6 sm oo Hg yahay, ka labaadna ogsijin laga buuxiyay cadaadiskuna 10 sm oo Hg yahay. Haddii labada neefoodba loo warejjiyo sanduuq aaddexaad waxa la arkayaa in cadaadisku uu yahay 16 sm oo Hg ah. Tiraadahayn waxa ay la mid tahay wadarta cadaadisyada haydarojiinta iyo ogsijinta (6 + 10 = 16). Sidaa awgheex xeerka Daalton waxa loo qori karaa:

\[ P_\ast = P_1 + P_2 + P_3 (P_\ast, waa wadarta cadaadisyada: P_1, P_2, P_3, \ldots \ waa qaybahaa cadaadiska) \]

Neefaha lagu dul ururiyo biyaha:


\[ P_{\text{ogsiijin}} + U\text{umi biyoood} \]

\[ P_{\text{atm.}} \]

\[ P_{\text{Uumi biyoood}} \]

\[ P_{\text{Ogisiijin}} \]

\[ P_{\text{haydarojiin}} \]

\[ P_{\text{atm.}} \]

\[ P_{\text{umibiyoood}} \]

JT. 8.11

Haddii heerkha biyaha ee dhalada gudaheeda iyo ka dibaddu ay isle'eg yiihiin, waxa aynnu odhan karnaay:

cadaadiska atmoosfiyeerku = cadaadiska neefta + cadaadiska uumiga

\[ P \text{ atm.} \rightarrow P \]

\[ = \text{haydarojiin} + \text{uumibiyoood} \]

\[ \text{ama} \]

\[ P \text{ haydarojiin} \]

\[ = \text{atm.} \text{ umibiyoood} \]

Tusaale:

1) Tijaabo ayaa la sameeyay, waxana 85 ml oo ogiijiin ah lagu dul ururiyo biyo, markii heerkulku ahaa 22°C, cadaadiska ogiijinna ahaa 730 mm. Haddii cadaadiska uumiga biyuhu ahaa 19.9 mm, meeqa ayuu noqonayaa cadaadiska atmoosfiyeerku.

\[ P_1 = 730 \text{ mm}, \text{ cadaadiska ogiijiin.} \]

\[ P_2 = 19.8 \text{ mm}, \text{ cadaadisku uumiga biyaha.} \]

\[ P_\ast = \text{wadarta qaybaha cadaadiska = cadaadiska atmoosfiyeerka.} \]
Adoo isticmaalaya xeerka Daalton ee cadaadis qaybeed,

\[ P_r = P_1 + P_2 \]

\[ P_r = 730 \text{ mm } + 19.8 \text{ mm } = 749.8 \text{ mm} \]

2) 169 sm\(^3\) oo haydarojiin ah ayaa lagu dul ururiyey biyo iyada oo heerkulku ahaa 20\(^\circ\)C, cadaadiskuna ahaa 755 mm. Cadaadiska uumi-biyoojduna waxa weeye 17.6 mm isla heerkulkaa 20\(^\circ\)C ah. Meequu noqonayaa mugga haydarojiin marka ay H.C.B. ?

\[
\begin{align*}
P \quad & \quad H = \text{Cadaadiska atmoosfiyeerka} \quad \text{—} \quad \text{cadaadiska uumiga.} \\
P \quad & \quad H = P_1 = 755 \quad - \quad 17.5 \quad = \quad 737.5 \text{ mm} \\
T_1 \quad & \quad = \quad 293\text{K} \\
V_1 \quad & \quad = \quad 196 \text{ sm}^3 \\
T_2 \quad & \quad = \quad 273\text{K} \\
\hline
V_2 \quad & \quad = \quad ? \\
\frac{P_1V_1}{T_1} \quad & \quad = \quad \frac{P_2V_2}{T_2} \\
\frac{V_2}{V_1} \quad & \quad = \quad \frac{P_1V_1T_2}{P_2T_1} \\
V_2 \quad & \quad = \quad \frac{737.5 \text{ mm} \times 169 \text{ sm}^3 \times 273\text{K}}{293\text{K} \times 760 \text{ mm}} \\
V_2 \quad & \quad = \quad 125.8 \text{ sm}^3
\end{align*}
\]

Layli 8.4:

1) 85 sm\(^3\) oo neef ah ayaa lagu dul ururiyey biyo, iyada oo heerkulka iyo cadaadisku kala yiihin 20\(^\circ\)C iyo 765 mm. Meequu noqonayaa mugga neefta ee qallalani marka H.C.B. haddii cadaadiska uumibiyooodka dhargegsan uu yahay 17 mm isla 20\(^\circ\)C ?

2) 63 sm\(^3\) oo ogsiijiina ayaa biyo lagu guud ururiyey marka heerkulku ahaa 25\(^\circ\)C, cadaadiskuna ahaa 76 mm. Soo saar cufka ogsiijiinta ee la ururiyey (Cufnaanta ogsiijiinta waa 1.43g/l marka H.C.B., cadaadiska uumi biyooodkuna wuxuu yahay 23 mm marka heerkulku ahaa 25\(^\circ\)C).

3) 250 ml oo ogsiijiina ayaa lagu dul ururiyey biyo. Cadaadiska guud waa 730 mm marka heerkulku ahaa 25\(^\circ\)C. Waa meeqa cadaadiska ogsiijiin, haddii ka uumi-biyoooodku uu yahay 23.76 mm isla heerkulkaasi 25\(^\circ\)C ?

Xeerka Gey-lusaaq:

Casharkii hore ee xeerka Daalton, waxa aynnu u qaadannay in aanay neefahu isla falgelin marka la isku daro. Hase yeeshay, waxa dhici kara in ay mar-marka qaarkood isla falgalaan. Tusale ahaan, marka la isku qarxiyo iskujir haydarojiin iyo ogsiijiin ah iyada oo la isticmaalayo dhinbiil danab ah, waxa falgalkaay ka dhasha uumibiyoood. Sidaasi oo kale, marka iskujir ka kooban haydarojiin iyo ogsiijiin uu ilays ku dhaco, waxa falgalkaay ka dhasha neef haydarojiin koloraydh ah. Falgal kasta oo noocaasi ah ee ay falgalyaalka iyo maxsuul-lada neefta yiihin, waxa la arkay in mugga neefahaasi ee isla falgalaay ay isugu darsamaan saami tirooyin idil ah, haddii la qaato heerkul iyo cadaadis go'an.
Haddii aynnu ku noqonno tusaailihii hore, waxa aynnu arkaynaa in halkii mug ee ogisiin ihiba uu u baahan yahay laba mug oo haydaroojiin ah, marka ay isla falgalaan.

\[
2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}
\]

2 mug 1 mug 2 mug

Falgalka dhexmara haydaroojiin iyo koloriinna waxa uu inna tusayaa in halkii mug ee haydaroojiin ihiba uu u baahan yahay hal mug oo koloriin ah:

\[
\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}
\]

1 mug 1 mug 2 mug

Arrimahaasi waxa soo koobaya xeerka Gey-lusaaq, waxaanu odhanayaa : Mugaga neefaha ee isla falgalaayo iyo kuwa maxsuulada haddii ay neefo yiihin, marka lagu cabbiro xaalado isku mid ah oo cadaadis iyo heerkul, waxay isu noqonayaan saami fudud oo tirooyin idil ah.

**Tusaale**:

1) b) Waa imisa mugga ogisiinta ah ee loo baahan yahay in uu gub 100 litir oo H\textsubscript{2}S ah, marka la raaco isle'egta hoose:

\[
2\text{H}_2\text{S} (n) + 3\text{O}_2 (n) \rightarrow 2\text{H}_2\text{O}(n) + 2\text{SO}_2 (n) \quad \text{(Ogow cadaadiska iyo heerkullada neefaha oo dhammi waa isku mid).}
\]

t) Waa imisa mugga SO\textsubscript{2} ee samaysmay?

**Furfurid**:

b) Sidaa uu odhanaya xeerka Gey-lusaaq. H\textsubscript{2}S iyo O\textsubscript{2}, waxa ay isula falgalaan saami ah 2 : 3 mug ahaan, sidaa awgeed mugga ogisiin ee loo baahan yahaya waxa weeye:

\[
100 \text{ litir oo H}_2\text{S} \times \frac{3 \text{ litir oo O}_2}{2 \text{ litir oo H}_2\text{O}} = 150 \text{ litir oo O}_2
\]

t) Mar haddii 2 mug oo H\textsubscript{2}S ihi ay soo saarayaan 2 mug oo SO\textsubscript{2} ee soo baxaa waa:

\[
100 \text{ litir oo H}_2\text{S} \times \frac{2 \text{ litir oo SO}_2}{2 \text{ litir oo H}_2\text{S}} = 100 \text{ litir oo SO}_2
\]

2) Markii 15 sm\textsuperscript{3} oo haydaroojiina lagu dhex gubay ogisiin, wuxuu muggoodu isku noqday 25 sm\textsuperscript{3}. Haddii heerkulka iyo cadaadisku aanay doorsoomin, meeqa ayuu noqonayaan mugga neefta ee meesha ku hadhay?

Mugga haydaroojiin = 15 sm\textsuperscript{3}
Mugga ogisiin = 25 sm\textsuperscript{3} — 15 sm\textsuperscript{3} = 10 sm\textsuperscript{3}
Mugga ogisiin ee hadhay?

\[
2\text{H} + \text{O}_2 \rightarrow 2\text{H}_2\text{O}
\]

2 : 1

2 mug oo haydaroojiin ah ayaa ku darsama 1 mug oo ogisiinna si biyo u samaysmaan. Dabadeetana, meeqa sm\textsuperscript{3} oo ogisiin ah ayaa ku darsamay 15 sm\textsuperscript{3} oo H\textsubscript{2}.

\[
2\text{H}_2 \quad : \quad 10\text{O}_2
\]

15 sm\textsuperscript{3} : x sm\textsuperscript{3}, \quad X = \left( \frac{15 \text{ sm}^3}{2} \right) = 7.5 \text{ sm}^3

Mugga ogisiin ee hadhay = 10 sm\textsuperscript{3} — 7.5 sm\textsuperscript{3} = 2.5 sm\textsuperscript{3}
layli 8.5:

1) Iskuuir haydarojiin iyo naytarojiin ayaa lagu dhex gubay 50 sm³, oo ogsijiina. Neefta soo hadhay waa 40 sm³, laakiin 20 sm³ oo ogsijiina ayaa laga saaray, ee imisa ayuu noqonayaa samayski ikfurjirka hore. (Ogow ogsijiintu lamay falgalin naytarojiin).

2) 20 sm³ oo haydarojiina ayaa lagu dhex gubay 100 sm³ oo hawo ah oo 21% ogsijiin tahay. Haddii heerkuulkaga iyo caddadisku aanay doorsoomin, meeqa ayuu noqonayaa mugga neefta ee soo hadhay?

3) Meeqa litir oo uuumbiyood ah ayaa samaysmaya marka 20 litir oo haydarojiin ah ay la falgasho ogsijiin badan?

4) 30 litir oo haydarojiina ayaa lagu daray naytarojiin badan. Marka ay falgalaan, meeqa litir oo ammoomniya ah ayaa samaysmaya?

Xeerka Afogoardo:


Marka haydarojiin iyo koloriin ay isu tagaan maksuulka soo baxa oo ah haydarojiin koloraydh, waxa la arkay in uu ka kooban yahay tiro isle'eg oo atammo haydarojiin ah iyo kuwa koloriin ah, markii kimika ahaan loq saafay. Tiroyinkaa isle'eg ee ah atammo H ah iyo kuwo Cl ah, waxa ay ka yimaaddeeen markoodii hore molikiyuułlo haydarojiin ah iyo kuwo koloriin ah. Haddii aynnu u qaadanno in molikiyuułlada haydarojiintu iyo kuwa koloriintu in ay laba'atamleyaah yihin waa in tiroyin isle'eg oo molikiyuułlo haydarojiina iyo kuwo koloriin ay isla falgalaan. Waxaanu la arkay in mugag isle'eg oo haydarojiin iyo koloriin ihi ay isla falgalaan, taasina waxa ay waafaqsan tahay xeerka Afogoardo.

\[ \text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl} \]

1 molikiyuułl

\[ \text{Cl}_2 \sim \text{H}_2 \]

2 molikiyuułl

1 mug

\[ \text{H}_2 \sim \text{Cl}_2 \]

2 mug

U qaadashada ah in ay molikiyuułlada haydarojiin iyo koloriin ay laba'atamleyaal yihiin ee aanay hal'atamleyaal ahayn, waxa loo caddayn karraa sida soo socota: Haddii ay haydarojiin hal'atamle ahaan layhad, waxa dhici layhady in hal litir oo haydarojiina (n atam) uu ku darsami laahaa hal litir oo koloriin ah (n atam) si ay u dhabliyaan hal litir oo HCl ah (n Molikiyuułl). Taasi waxa ay lid ku tahay wixii la arkay, oo ahaa mugga HCl ee soo baxay oo laba jeer ka badan ka haydarojiinta ama ka koloriinta. Halkaa waxa aynnu ka garan kannaa in haydarojiinta iyo koloriintu ay ka kakan yihiin hal'atamleyaal. Haddii haydarojiin iyo koloriin ay laba'atamleyaal yihiin, hal litir oo haydarojiina (n molikiyuułl) ayaa ku darsamayaa hal litir oo koloriin ah (n molikiyuułl) si ay u soo saaraan laba litir oo haydarojiin koloraydh ah (2n molikiyuułl). Taasina waxa ay waafaqsan tahay tijaabootinkii la sameeyay.

\[ \text{H}_2 \sim \text{Cl}_2 \rightarrow 2\text{HCl} \]

n molikiyuułl

1 molikiyuułl

n molikiyuułl

1 mug

2 molikiyuułl

2 mug

80
Falgalka dhaxmara haydarjojiin iyo koloriina waxa lagu tusi karaa, sawir, waana sida jaantuska 8.12 ku taalla.

Waxa kale oo la arkay markii tijaaboyinka lagu sameeyey, in neef badan oo kale oo aya ka mid yihiin ogsiijin iyo naytaroojiin ay iyana laba 'atamleyaal yihiin. Neefaha curiyeyaalka ah ee dunida jira, marka laga reebo kuwa ururka siddeedaad oo hal 'atamleyaal ah mooyee, waa wada laba 'atamleyaal.

\[
\begin{align*}
1 \text{ mug} & \quad + \quad 1 \text{ mug} \\
6 \text{ Cl}_2 & \quad + \quad 6\text{H}_2 & \quad \rightarrow & \quad 12\text{HCl} \\
\text{ama} & \quad \text{Cl}_2 & \quad + \quad \text{H}_2 & \quad \rightarrow & \quad 2\text{HCl}
\end{align*}
\]

JT. 12;

Cuf-molikiyuullada neefaha:

Kaanisaaro ayaa markii ugu horraysay tusay in la sugi karo cuf-molikiyuullada neefaha, haddii la isticmaalo xeerka Afogaarwo. Tusaalaaha soo socda ayaana inna tusi kara: Tijaabo ahaan ayaa waxa la arkay in halkii litir ee haydaroojiin ah u u kulayskiisu yahay 0.09 garaam, halkii litir ee ogsiijin ahna uu kulayskiisu yahay 1.43 garaam, marka heerkulka iyo cadaadiskuba ay beegan yihiin (H.C.B.). Sida xeerka Afogaardoo odhanaya tirada molikiyuullada ee ku jirta laba mug oo isle 'egi waaw isku mid. Sidaa awgeed waa in kulayska molikiyuulkii wale ee haydaroojiin ihiba uu noqdaa 0.09 / 1.43, ama 0.063 oo jeer kulayska molikiyuul ogsiijin ah. Mar haddii cuf-molikiyuulka ogsiijinta, oo laba 'atamle ihi, uu yahay 32, cuf-molikiyuulka haydaroojiintuna waxa uu noqonayaa (0.063 × 32 = 2.016).

Markii tijaaboodin badan la sameeyay waxa la arkay in mugga ay 32 garaam oo ogisijin ihi (1 mool) ay buuxinayaan uu noqonayo 22.4 litir H.C.B. Muggaasi 22.4 litir ahna waxa la yidhaa mugga moolka ee neefta. Neef kasta oo aad soos qaaddo, waxa la arkay in halkii mool ee neeftaa ihi uu buuxinayo mug 22.4 litir ah H.C.B.

Tusaha hoos ku yaalla ayaa tusaya mugga moolka ee dhawr neefood:

<table>
<thead>
<tr>
<th>Neef</th>
<th>Cuf-molikiyuul</th>
<th>Mugga moolka</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂</td>
<td>2</td>
<td>22.432</td>
</tr>
<tr>
<td>N₂</td>
<td>28</td>
<td>22.4</td>
</tr>
<tr>
<td>O₂</td>
<td>23</td>
<td>22.392</td>
</tr>
<tr>
<td>CO₂</td>
<td>44</td>
<td>22.263</td>
</tr>
</tbody>
</table>

Marka aad tusaha u fiirsato waxa aad arkaysaa in mugga moolka ee neef waliba aanu ahayn 22.4 kaa oo go'än, laakiin ay ugu dhowaan neef waliba buuxinayso 22.4 litir H.C.B.

Tirada molikiyuul ee ku jirta halkii mool (22.4 litir) ee neef ahi waa 6.02 × 10²³. Tiradaasi ayaana la yidhaa tirada Afogaardoo.
Waxyaalaha aynnu kor ku soo sheegnay waxa ka muuqata in haddii la rabo in la saaro cuuf-molikiyuulka neefta, ay ku filan tahay in la soo saaraa cuufka neefta ee buuxin kara mugga 22.4 litir ah, marka H.C.B.

Tusaale:
1) Waxa la arkaa in cuufka 350 sm$^3$ oo neef ihi uu yahay 1 garaam H.C.B. Waa imisa cuuf-molikiyuulka neestaasi?

Cufnaan = Cuf / Mug = \(\frac{1 \text{ garaam}}{350 \text{ sm}^3}\) H.C.B.

Cufka 22.4 litir (22400 sm$^3$) H.C.B. = cuufnaan × mug.

\[
\frac{1 \text{ g}}{350 \text{ sm}^3} \times 22400 \text{ sm}^3 = 64 \text{ g}
\]

2) Soo saar mugga ogsiijin ee gubayo 20 sm$^3$ oo (b) kaarboon hal-ogsaydh (t) asitaliina (C$_2$H$_2$) ?

b) \[2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2\]
2 moool : 1 moool.

Adoo isticmaalya xeerka Afogoardo:

\[2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2\]
2 mug : 1 mug
20 sm$^3$ : x

\[x = \frac{20 \text{ sm}^3}{2} = \frac{10 \text{ sm}^3}{1} \text{ ogsiijina}\]

t) \[2\text{C}_2\text{H}_2 + 5\text{O}_2 \rightarrow 4\text{CO}_2 + 2\text{H}_2\text{O}\]
2 mug : 5 mug
20 sm$^3$ : x

\[x = \frac{20 \text{ sm}^3}{2} \times 5 = \frac{50 \text{ sm}^3}{1} \text{ ogsiijina}\]

3) b) Xisaabi mugga ogsiijin ee laga heli karo 5 garaam oo kaaliyam koloreyt ah marka heerkulka iyo cadaadisku ay yihiin 12°C iyo 745 mm sida ay u kala horreeyaan. (K = 39, Cl = 35.5, O = 16, mugga moolka ee neeftu waa 22.4 1. H.C.B.).

Marka ugu horreysa qor isle'egta:

\[2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2\]

Looma baahna in la raadiyo cuufka ogsiijinta mar haddii la yaqaanno mugga hal mool oo ogsiijin H.C.B. Mugga hal mool oo ogsiijin ihi waa 22.4 litir H.C.B Sidaa awgeed 30_2 waxa ay u taagan tahay 3 × 22.4 litir H.C.B.

Haddii la isticmaalo culayska KClO$_3$ iyo mugga O$_2$, waxa aynnu heleynaa:

\[2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2\]

Isle'egta waxa aynnu ka arkaynaa in 245 garaam oo KClO$_3$; ihi ay soo saarayso 3 × 22.4 litir oo O$_2$ ah H.C.B Sidaa awgeed 5 g oo KClO$_3$ waxa ay soo saarayaan 3 × 22.4 × 5; 245 litir oo ogsiijin H.C.B Taasina waxa ay u mid tahay 1.37 litir oo ogsiijinta marka H.C.B.
t) Hadda waa in aynnu soo saarnaa mugga ogsijintaa marka heerkulku yahay 12\degree C, cadaadiskuna 745 mm.

\[
\begin{align*}
P_1 &= 760 \text{ mm} \\
V_1 &= 1.37 \text{ litir} \\
T_1 &= 273^\circ \text{K} \\
P_2 &= 745 \text{ mm} \\
T_2 &= 285^\circ \text{K} \\
V_2 &= ?
\end{align*}
\]

\[
\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}
\]

\[
\therefore \frac{760 \text{ mm} \times 1.37 \text{ litir}}{273^\circ \text{K}} = \frac{745 \text{ mm} \times V_2}{285^\circ \text{K}}
\]

\[
V_2 = \frac{760 \times 1.37 \times 1 \times 285}{273 \times 745} = 1.458 \text{ litir}
\]

4) Imisa molikiyuul oo CO\textsubscript{2} ah ayaa ku jiru kara namuunad neeftaasi ah oo muggiedu yahay 11.2 litir H.C.B. H.C.B. 1 mool oo CO\textsubscript{2} waxay buuxisaa 22.4 litir. 11.2 litirna waxa buuxinaya, 11.2 litir × \frac{1 \text{ mool}}{22.4 \text{ litir}} = 0.5 mool. Mar haddii 6.02 × 10\textsuperscript{23} molikiyuul ay ku jiraan halkii mool, tirada molikiyuullada CO\textsubscript{2} ah ee ku jira 0.5 mool.

\[
= 0.5 \text{ mool} \times \frac{6.02 \times 10^{23} \text{ molikiyuul}}{1 \text{ mool}} = 3.01 \times 10^{23} \text{ molikiyuul}
\]

1) Xisaabi cufnaanta neefta ah haydaroojiin koloraydh marka H.C.B.
2) Waa imisa cufka 1.0 litir oo nefta mitayn ihi (CH\textsubscript{4}) H.C.B ?
3) H.C.B cufka 1.00 litir oo N\textsubscript{2} ah waa 2.5 soo saar :
   b) Cuf-molikiyuulka N\textsubscript{2};
   t) Tirada atammada ee hal molikiyuul oo nayтарoojiin ah ku jirtana soo saar adiga oo isticmaalaya jawaabta b.

4) Haddii mugga 182 g oo neef ihi uu yahay 28.0 litir H.C.B waa imisa cuf-molikiyuulka neeftu ?
5) Dhalo 350 sm\textsuperscript{3} aha ayaa waxa ku jira 0.70 g oo neef ah marka heerkulku yahay 0\degree C, cadaadiskuna 760 mm. Waa imisa cuf-molikiyuulka neeftu ?
6) Waa imisa litir mugga ay 2 mool oo neefta argon ihi ay buuxinaysaa, H.C.B. ?
7) Imisa litir oo haydaroojiin koloraydh ah ayaa laga helayaa 100 g oo naatriyam koloraydh haddii lagu daro salfiyuurik asiidh rib ah ?
8) Imisa molikiyuul ayaa ku jira 0.112 litir oo neefta nayтарoojiin ah H.C.B ?
9) Meeqa litir oo haydaroojiin ah ayaa ka soo baxaya marka 48 g oo magnsiisiyam ah lagu daro haydarokolorik asiidh badhaxon ?
Haddii heerkulka iyo cadaadisku kala yihin 15°C iyo 740 mm, raadi mugga haydarjiinta ee samaysmay. (Culayska hal litir oo haydarjiini H.C.B. waa 0.09 g.)

11) b) 0.2 gm oo bir ah ayaa lagu daray asidh badhxaan. Waxaana soo baxay 306 sm³ oo H₂ qalalan ah markii ay ahaa yeen heerkulka iyo cadaadisku 20°C iyo 730 mm. Raadi isudhiganka birta.

t) Haddii kaftoonkeedu yahay 3, soo saar culays-atamka birta.

(Cufnaanta haydarjiini waa 0.09 g/1 H.C.B.).

Isle'egta neefta dhalliiltiran:

Markii aynnu dhiganayn ay isle'egta guud ee neefaha, waxa aynnu aragnay sida mugga, heerkulka iyo cadaadisku ay isugu xidhan yihin, marka xerka Boo'il iyo ka Jaarlas la isugu geeyo. Xerka Afogaardo ayaa isna innaqo soo kordhiyey xidhiidhka ka dhexeeya mugga neefta iyo tirada moolada marka heerkulka iyo cadaadisku aanay doorsoomin. Halkaa waxa ka muuqata in xidhiidh guud ka dhexayn karo saddexda xeer. Xidhiidkaasina waxa uu isku xidhayaa afarta xaddi ee ah mugga, cadaadiska, heerkulka iyo tirada moolada ee neefaha. Sababta loo yidhi neefta dhalliiltiran waxa aynnu ku arki doonnay casharrada dambe: Isle'egta neefta dhalliiltiran waxa loo heli karaa sida soo socota:

\[ \frac{P_0V_0}{T_0} = \frac{PV}{T} \] (Xerka Boo'il iyo ka Jaarlas)

Waxa aad ka soo qaaddaa in \( V_0 \) ay tahay mugga u hal mool oo neef ihi uu buuxinayo marka cadaadiska, \( P_0 \), iyo heerkulka \( T_0 \) ay beeggalka yihin, (\( P_0 = 76 \text{ sm} = 1 \text{ atm}, T_0 = 273°C \)). Markaa dabadeed \( V \) waxa ay noqonaysaa mugga uu hal mool oo neefta ihi uu buuxinayo marka cadaadisku yahay \( P \), heerkulkuna \( T \). Laakiin xerka Afogaardo waxa aynnu ka baranay in H.C.B. halkii mool ee neef ihi uu buuxinayo mug 22.4 litir ah. Taas macnaheedu waxa uu yahay, neefaha dhalliiltiran oo dhan, qiimaha \( \frac{P_0V_0}{T_0} \) waa isku mid, waana madoorsomme. Qiimaha madoorsoomaha ah oo la yidhaa madoorsoomaha neefta dhalliiltiran, waxa had iyo jeer loo taaga xarafka R. markaa dabadeed:

\[ R = \frac{P_0 \times V_0}{1 \text{ mool} \times T_0} \]

Tiro ahaan qiimaha madoorsoomaha R waa la xisaabin karaa, haddii \( V_0, P_0 \) iyo \( T_0 \) lagu beddelo 22.4 litir, 1 atm, iyo 273°C sida ay u kala horreeyaan.

\[ R = \frac{1 \text{ atm} \times 22.4 \text{ litir}}{1 \text{ mool} \times 273°C} = 0.082 \frac{\text{litir atm.}}{\text{mool-darajo}} \]

Mar haddii \( R = \frac{P_0V_0}{T_0}, \frac{P_0V_0}{T_0} = \frac{PV}{T} \)

Dabadeed \( R = \frac{PV}{T} \) ama \( PV = RT \)

Halkii mool ee neef ah \( \frac{PV}{T} = R,labadii moolna \frac{PV}{T} = 2R \)

Sidaa awgeed n dii mool ee neef ah \( \frac{PV}{T} = nR \).
Isle'egta guud ee neefta dhalliiltiranina waxa ay noqonaysaa :

\[ PV = nRT \]

\[ R = \text{Madoorsoomaha neefta dhalliitiran.} \]
\[ V = \text{Mugga neefta} \]
\[ n = \text{Tirada moollada ee neefta} \]
\[ P = \text{cadaadiska neefta oo lagu tibaaxay atm.} \]
\[ T = \text{Heerkulka kelfin ee neefta.} \]

Afartaa xadda hadba kii maqan waa la soo saari karra, haddii saddexda kale la yaqaan.

**Tusaale:**

1) Waa imisa mugga ay 100 g oo neef NH₃ qallalan ihi ay buuxinaysaa marka heerkulka iyo cadaadisklu yihii 27°C iyo 750 mm sida ay u kala horreeyaan?

**Furfurid:**

Cufka halkii mool ee NH₃ waa 17 g

\[ n = \frac{100 \text{ g oo NH}_3}{17 \text{ g oo NH}_3/\text{mool}}. \]

\[ n = \frac{100}{17} \text{ mool.} \]

\[ P = 730 \text{ mm ama } \frac{730}{760} \text{ atm.} \]

\[ T = (273 + 27) = 300^\circ \text{K} \]
\[ R = 0.082 \]

\[ PV = nRT \quad V = \frac{nRT}{P} \]

\[ V = \frac{100 \text{ mool}}{17} \times 0.082 \frac{\text{litir} \times \text{atm}}{\text{mool} \times 0^\circ \text{K}} \times \frac{300^\circ \text{K}}{730 \text{ atm}} \]

\[ V = 151 \text{ litir} \]

(U fiirso sida ay halbeegyadu isugu go'ayaan ee ay jawaabtana litirro ugo soo hadhayaan).

2) Xisaabi cufka 100 litir oo SO₂ ah marka heerkulka iyo cadaadisku ay 40°C iyo 740 mm kala yihii.

**Furfurid:**

Marka aynnu xisaabtan ka shaqaynayno waa in marka hore aynnu soo saarna tirada moollada ee SO₂.

\[ n = \frac{PV}{RT} \text{ mool} \]
Halkii mool ee SO\(_2\) ahna cufkeedu waa:

\[
32 + (16 \times 2) \text{ g} = 64 \text{ g}.
\]

\[
n \text{ dii moolna} = \frac{PV}{RT} \times \frac{64 \text{ g} \text{ SO}_2}{1 \text{ mool} \text{ SO}_2}
\]

\[
= \frac{740}{760} \text{ atm} \times 100 \text{ liter} \times \frac{649}{0.082} \text{ atm} \times \frac{\text{ liter} \times \text{ liter}}{1 \text{ mool} \times 313K^0} \times \frac{1 \text{ mool}}{1 \text{ mool}}
\]

\[
= 240 \text{ g} \text{ SO}_2.
\]

3) Marka uu cadaadisku ahaa 70 sm oo Hg heerkulkuna 27\(^\circ\)C, 1.85 g oo iskudhis neef ihi, waxa uu buuxinayay mug 500 ml ah. Waa imisa cuf-molikiyulka neeftu?

**Furfurid:**

B) Istitmaalka jidka PV = nRT

\[
P = \frac{70 \text{ sm}}{76 \text{ sm}} = 0.921 \text{ atm.}
\]

\[
V = 500 \text{ ml} = 0.500 \text{ liter}
\]

\[
R = 0.0821 \text{ liter atm \ mool}^0K
\]

\[
T = 27\(^\circ\)C = (273 + 27)K = 300K
\]

\[
n = \text{Tirada mooillada ee neefta.}
\]

\[
PV = nRT.
\]

\[
n = \frac{PV}{RT} = \frac{0.92 \text{ atm}}{0.0821 \text{ liter atm \ mool}^0K} \times \frac{0.50 \text{ liter}}{300K}
\]

\[
n = 0.0187 \text{ mool}
\]

0.0187 mool cufkoodu waa 1.85 g. Mar haddii cufka halkii mool uu lamid yahay cuf-molikiyulka, cufka 0.0187 mool oo neeftan ihina uu 1.85 g yahay, cufmolikiyulka neeftu = 1.85 g/0.0187 mool = 99 g/mool.

**Layli 8.7:**

1) Xisaabi mugga ay 7.00 g oo CO ihi buuxinayaan marka heerkulku yahay — 20\(^\circ\)C, cadaadiskuna 2.00 atm.

2) b) Imisa mool oo neef ah ayaa ku jira 5.6 liter oo neef ah H.C.B?

i) Haddii neeftaa hore cufkeedu yahay 24 g waa imisa cuf-molikiyulkeedu?

3) Ilaa heerkulke ayaa loo baahan yahay in la kulayliyo 0.180 g oo uumi biyo ah oo ku jira dhalo 0.500 liter ah si cadaadisku u noqdo 1.00 atm?

4) Marka uu cadaadisku ahaa 78.0 sm oo Hg ah, heerkulkuna 100\(^\circ\)C, 0.36 g oo iskudhis neef ihi waxa uu buuxinayaa mug 250 ml ah. Waa imisa cuf-molikiyulka neeftu?

5) Haan xadiid ah oo muggeedu yahay 10.0 liter ayaa waxa ku jira neef N\(_2\) ah. Cadaadiska neeftu waa 1.00 \times 10^2 atm, heerkulkuna waa 0\(^\circ\)C. Waa imisa cufka N\(_2\) haanta ku jiraa?
Socodka barown

Markii uu sannadku ahaa 1827kii, Robert Barown oo ahaa dhiryaqaan Iskotij ah. ayaa waxa uu arkay, markii uu fuxalsidyo biyo ku dhex riday, in aanay degayn fuxalsidyo ad ee ay biyaha dhex soconayaan. Markii uu weynayso ku eegay, waxa uu Barown arkay in socodkiisi uu yahay mid hablaawe ah oo ay fuxalsidyo gees kastaba u soconayaan. Markii tijaa-booyin lagu sameeyey waxa kale, lo aarkay in saxarrada aad u yaryar ee biyaha ama neefaha dhex heehaabaab ay iyanna socodkaasi oo kale leeyihiin. Socodka noocaas ah ee ay leeyihiin saxarrada biyaha ama neefaha dhex heehaabaab waxa loo yaqaan socodka Barown. Socodka Barown waxa aad arki kartaa, haddii qiiq sigaar oo ilays ku dhacayo aad weyneyso ku eegtid. Waxa aad arakaysaa in aanay saxarrada qiiq degayn ee ay heehaabaaban iyaga oo gees kastaba u soconaya. Waxa kale oo la aarkay in saxarba saxarka uu ka yar yahay uu ka socod badan yahay. Isla markaana heerkuulba kuu ka sarreyey ay saxarraduna ku kala socod badan yiihiin.

Aragtida socodka molikiyuullassada:

Jiritanka socodka Barown waxa uu inna dareensiiyayaa in molikiyuullassa maatarku ay had iyo jeer socod ku jiraa oo aanay ahayn waxa aab dhaqdhaqaaq lahayn. Saxarrada sigaarka ee aynuu hore u soo aragnayna, waxa aad mudddaan in ay dhinas walba ka soo riixayaan molikiyuullassa kale ee ay deriska yihiin oo uu dabeedeta socodkaisu noqonayo mid hablaawe ah, sida qof doonaya in uu dhex maro meel dadku ku badan yahay. Taasi waxa ay inna dareensiiyayaa in molikiyuullassa maatarka ee ili-ma-aragtayda ihi ay iyana had iyo jeer soconayaan. Aragtidaasina waxa ay saynysahannadu ku magacaabeyn aragtida socodka molikiyuullassa ee maatarka. Labada dhardhaar ee salka u ihinna waa molikiyuullassa maatarka oo had iyo jeer socod ku jira iyo socodkaasi oo ku xidhan kulka. Wejiga keli ah ee aynnu casharkan kaga hadlaynaana waa wejiga maatarka ee neefah ah.

Sida aragtiyada kaleba ay dhacdooyin u sharxaan ayaa aragtida socodka molikiyuullassa ee neefahana loo doortay in ay sharaxdo astaamaaha neefaha. Wanaagisuna waxa uu ku xidhan yahay hadba sida uu u sharxi karo astaamaaha neefaha. Si loogu shaqaysan karana waa in la qaata dhow uqaadasho. Uqaadashooyinka aragtida socodka molikiyuullassa ee neefuhuna waa:

1) Neefuho waxa ay ka kooban yihiin molikiyuullo had iyo jeer socod ku jira.
2) Molikiyuullassadaasi socodkoodu waa mid hablaawe ah. Jiho kastana way u socdaan.
3) Molikiyuullassadaa soconayaay wax is-hirdiyaaan, weelka ay ku jiraa dawooyin waa hirdiyaan, is-hirdigaana wax tamar ihi kagama lumayso.
4) Jimidka molikiyuullassa neefu aad buu u yar yahay, wax ka soo qaadna ma laga marka loo eego dulalaatin addhan ee u dhexaysa molikiyuullassa.
5) Neefta dhaaliiltiran, xoog-isijid kama dhaxeeyo molikiyuullassa.

Inta aynan falanqaynin uqaadashooyinka bal hadda aynnu u fiirranno xidhiidhka ka dhexeeya aragtida socodka molikiyuullassa ee neefaha iyo xaddiyada la xidhiidha neefaha oo ah mugga, cadaadiska iyo heerkuulka. Aragtida socodka molikiyuullassado waxay ay odhanaysaa neefuhu waxa ay ka kooban yihiin bilyanno molikiyuul oo jiho kasta u sooconaya, sidaa awgeedna buuxinaya mugga weelka ay ku jiraan. Molikiyuullassadaa soconayaay waxa ay hirdiyaan darbiyada weelka ay ku jiraan. Hirdidii kastaana waxa ay dhalinaysaa xoog. Wadarta xogaggaasi ee ku aadan halkii sm² ee bedka weelka ah halki sekenba aayaan loo yaaqan cadaadiska neefta. Mar haddii ay molikiyuullassa sooconayaan, waxa ay leeyihiin tamar socod. tamartaasi oo ah tamar kulna waxa cabbira heerkulka neefta.
Bal haddaba aynnu ku noqonno xidhiidhka ka dheexaeya uqaadashooyinka aragtida socodka molikiyuuладa iyo astaamaha neefaha. Uqaadashada kowaad in ay run tahay waxa u daliil ah is-dhexgalka neefaha. Waxa aynnu aragnay in haddii furka laga qaado dhalo cadar ku jiro, ama neefta haydarojiin salfaydh lagu siidaayo qolka, in meel fog laga urinayo. Tassi ma ay dhici kareen haddii aanay molikiyuuладa neeftu soconayn.

Sidii aynnu horeba u soo aragnay, socodka Barown ayaa inna tusaya in molikiyuuладa neeftu ay soconayaan. Taasina waxa ay waaфаqsan tahay uqaadashada labaad. Sida walax kastaba oo socota, molikiyuuладa neefaha ee socodaa waxa ay leeyihiin tamar socod oo la mid ah ½ mv², marka m ay u taagan tahay cuufka molikiyuuладa V na xawaaraha molikiyuuлka. Namuunad kasta oo neef ahna waxa ku jira tiro fara badan oo molikiyuuлlo ah. Molikiyuuладaасina aad u soconayaan, sidaa awgeedna waxa dhacaysa in ay molikiyuuладu is-hirdiyan. Waxase lagama maarmaan ah in wax tamar ihi aanay ku luminum is-hirdigaa. Haddii is-hirdigaa wax tamar ihi ku lunto waxa dhacaysa in tamar socodka molikiyuuладu ay yaraato. Taasina waxa ay keenaysaa molikiyuuлада oo aakhirka wada joogsada, markaa dabadeedna cadaadisku baabaa o, weelkuna uu isku dumo. Noloshaa runta ah, waxa la arkaay in aanay taasi dhicin, sidaa awgeed wax tamar ihi kuma lunto is-hirdigaa. Taasina waxa ay waaфаqsan tahay uqaadashada saddexdaa.

Uqaadashada afaraad waxa u daliil ah diisidda neefaha. Waxa aynnu aragnay in neef so mugeeda la yarayn karo, haddii la isku diiso. Taasi waxa ay tusaysaa in dulalaatidaan oo madhani ay u dhexayso molikiyuuлада, molikiyuuладуну аy geli karaan dulalaатa madhan marka la isku diiso.

Uqaadashada shanaadna waxa u daliil ah fididda ay neefuhu markiiba ku fidaan hadba mugga ay heli karaan. Waxa aynnu aragnay haddii cadaadiska laga dhimo neef koonbo ku jirta, ama furka laga deebiiyo neef haan ku cabbaysan, in ay markiba neeftu fidayso. Taasina waxa ugu wacan iyadoo aanu jirin xoog-isjiid sidaa u sii ridoo oo molikiyuuлада neefta isu hayaa.


Aragtida socodka molikiyuuлада ee aynnu kor kaga soo hadalnay ayaa sharxi karta astaamaha neefaha.

1. **Xeerka Boo’il**:

Cadaadiska neefuhu waxa uu ku xidhan yahay inta jeer ee ay molikiyuuлада neeftu ku dhacaan halkii sm² ee bedka weelka ah, halkii sekena, marka uu heerkulku madoorsoome yahay. Sababta heerkulku madoorsoome looga dhigayaana waxa weeye si molikiyuuлада neefta ee darbiga hirdiyyayaa, ay isku wada xawaarii u ahaadaan. Sidaa aad jaantsuska 8.13 ku aragtid, marka mugga la yareeyo, molikiyuuлада ma ay haystaan mug sidaa u weyn oo ay socsocon karaan. Sidaa awgeed waa in ay intii hore in ka badan hirdiyyaan darbiyada weelka. Xoogga ku dhacaya halkii sm² halkii sekena wuussa ka badanayaa intii hore. Sidaa awgeed cadaadisku wuu kordhaa marka uu muggu yaraado, marka uu heerkulku madoorsoome yahay.
2. **Xeerka Jaarlas**:

Heerkulka neefaha oo kor loo dhigaa waxa ay la imaanaysaa celceliska tamar socodka molikiyuullada neefta oo kordha. Mar haddii tamar socodka molikiyuulladu ay badatana, inta jeer ee ay molikiyuulladu ku dhacayaan darbiga weelka iyo xogga ay ugu dhacayaanba wuu badanayaan, sidaa awgeed cadaadiska ayaa kordhaya. Sidaa aad jaantuska 8.14 ku aragtid, haddii cadaadiska dibaddu aanu doorsoomin, laakiin heerkulka la kordhiyo, neefta buufinta ku jirtaa waxa ay buufinta u fidinaysaa mug kii hore ka badan, taasi oo daryeelaya xogga batay ee molikiyuullada.

3. **Xeerka Daalton**:

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**JT. 8.13**

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**JT. 8.14**

Heerkul hoose

Heerkul sare

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**JT. 8.15**

*Heerka Daalton*
Jaantsuska 8.15 waxa uu tusayaa koonbo uu muggeedu madoorsome yahay. (b) Waxa ay u taagan tahay xaalad ay koonbadu madhan tahay, (t) na iyadood hal molikiyuul oo haydarojiiin ah lagu riday. Taasina waxa ay la imanaysaa cadaadis. Kudaridda molikiyuul labaadna (j) waxa ay laban laabaysaa cadaadiska. Kudaridda laba molikiyuul oo ogsijii in hina (x) mar labaad ayay sii laba laabaysaa cadaadiska. (Ogow in heerkukulku uu madoorsoome yahay si tamar socodka molikiyuulladu aanu isu beddelin, oo molikiyuulkii wal ee lagu kordhiyaana, cadaadiska uu soo kordhinaya u u la mid noqonayo cadaadiskii uu kordhiyey kii ka horreeyey). Waxa ay nuu arkaanu in cadaadisku uu qummaati ula kordhoye tirada molikiyuullada, haddii ay haydarojiiin yihiin iyo haddii ay naytarojiiin yihiin, molikiyuulladaasi neefta ay doonaanha ha ahaadeen. Sidaa awged kudaridda molikiyuulku kaarboon laba-ogsaydh ihi (d) iyo (r) waxa ay kordhinayaan cadaadisk, sidii ay molikiyuulladii horeba u kordhinayeen. Mar haddii tirada molikiyuulladu ay saamigal qumman u tahay tirada mooadda ee neefta, waxa cad in wadarta cadaadiska ee iskujirka neefana ihi uu la mid yahay isugeynta cadaadisyada neefaha.

\[ P_s = P_1 + P_2 + P_3 \ldots \ldots \] Xeerka Daalton

Xeerka Garahaam:

Aragtidida socodka molikiyuulladu waxa ay oranaysaa, celceliska tamar socodka molikiyuulladu neeftu waa isku mid haddii heerkulkoodu isku mid yahay. Sidaa awged marka la isu eego laba neefood (neef 1 iyo neef 2):

\[
\begin{align*}
\text{celceliska tamar socodka} & = \text{molikiyuullada neef (1)} \\
\text{celceliska tamar socodka} & = \text{molikiyuullada neef (2)} \\
\text{ama} & \frac{\frac{1}{2} m_1 s_1^2}{\frac{1}{2} m_2 s_2^2} = \frac{m_2}{m_1}
\end{align*}
\]

Marka \( m_1 \) iyo \( m_2 \) ay kala yihiin cufafka molikiyuullada ee labada neefood (1 iyo 2), \( s_1 \) iyo \( s_2 \) na ay kala yihiin labada celcelis-xawaare ee molikiyuullada neefaha. Haddii labada tamar socod ay isku mid yihiin, cufafka molikiyuulladuna ay kala badan yihiin, waa in labada xawaare ay kala bataan. Halkaasna waxa aynnu ka garan karnaa in labada molikiyuul, ka culusi uu ka xawaare yar yahay ka fudud. Taasina waxa ay ka muuqataa isle'egta.

\[
\begin{align*}
\frac{s_1^2}{s_2^2} & = \frac{\frac{1}{2} m_2}{\frac{1}{2} m_1} = \frac{m_2}{m_1} \\
\text{ama} & \frac{s_1}{s_2} = \frac{m_2}{m_1}
\end{align*}
\]

Cufka molikiyuulku waxa uu saamigal qumman u yahay culays-molikiyuulka. Sidaa awgedna \( m_1 \) iyo \( m_2 \) waxa ay u taagnaan karaan culays molikiyuullada labada neefood. Dhakhshaha iskudhexgalka ee molikiyuullada labada neefood, \( r_1 \) iyo \( r_2 \) waxa ay saamigal qumman u yihiin xawaaraha molikiyuullada. Sidaa awged \( s_1 \) iyo \( s_2 \) waxa lagu beddeli karaa \( r_1 \) iyo \( r_2 \).

\[
\frac{\text{Dhakhshaha dhexgalka ee neef 1}}{\text{Dhakhshaha dhexgalka ee neef 2}} = \frac{r_1}{r_2} = \frac{m_1}{m_2}
\]

Xidhiidhkaa kor ku yaallaa waa tibaaxda xisaabead ee xeerka Garahaam ee isdhexgalka neefaha. Dhakhshaha dhexgalka ee neeftu waxa uu saamigal qumman u yahay rogaalka xidid-labajibaarka culays-molikiyuulkeeda.
Marka xaalado isku mid ah lagu tijaabiyo, haydarojiin oo culays-molikiyuulkeedu ugu yar yahay culays-molikiyuullada neefaha, ayaa dhakhsaha dhexgalkeedu ugu badan tahay.

**Tusaalaha 1aad:**

Muxuu noqonayaa dhakhsaha dhexgalka ee neefta ogsijiin marka loo eego ka haydarojiin, haddii xaaladahoodu isku mid yahay.

**Furfurid:**

\[
m_1 = \text{Culays molikiyuulka haydarojiin} = 2 \\
m_2 = \text{ogsijiin} = 32 \\
r_1 = \text{Dhakhsaha dhexgalka ee haydarojiin} \\
r_2 = \text{ogsijiin}
\]

Hadda isticmaal xeerka Garahaam ee isdhexgalka neefaha

\[
\frac{r_2}{r_1} = \frac{m_1}{m_2} = \frac{2}{32} = \frac{1}{16} = \frac{1}{4}
\]

\[\therefore r_2 = \frac{1}{4} \cdot r_1\]

Dhakhsashada dhexgalka ee ogsijiin waxa weeye \(\frac{1}{4}\) marka loo eego ka haydarojiin.

**Tusaale 2aad:**

Mug neef ah oo heerkulkeeda iyo cadaadiskeedaba la ogyahay ayay 90 seken ku qaadayay in ay meel ku faafto. Isla xaaladaha, mug ogsijiin ah oo ka hore la mid ah, waxa ay ku qaadayay 120 seken in ay ku faafto meeshii oo kale. Waa imisa culays-molikiyuulka neeftu?

\[
\text{waqtiga ay neeftu ku faaftay} = \sqrt{\frac{\text{culays-molikiyuulka neefta}}{\text{culays-molikiyuulka ogsijiin}}}
\]

**Furfurid:**

\[
\sqrt{\frac{\text{culays-molikiyuulka neefta}}{\text{culays-molikiyuulka ogsijiin}}} = \frac{\text{waqtiga ay neeftu ku faaftay}}{\text{waqtiga ay ogsijiintu ku faaftay}}
\]

\[
\sqrt{\frac{\text{culays-molikiyuulka neefta}}{32}} = \frac{90 \text{ s}}{120 \text{ s}} = \frac{3}{4}
\]

\[
\text{culays-molikiyuulka neefta} = \left(\frac{3}{4}\right)^2 \times 32 = \frac{9}{16} \times 32 = 18
\]

Culays-molikiyuulka neeftu waa 18

**Layli 8.8:**

Xisaabaha soo socda oo dhan waxa aad u qaadataa in xaaladaha neefuhu ay isku mid yiihin.

1) Xisaabi saamiga ay isu yiihin dhakhsaha dhexgalka ee kaarboon hal-ogsaydh, CO, iyo ka naytarojiin, N₂.
2) Saamiga ayay isu yihii dhakhsaha dhexgalka ee mitayn, CH₄, iyo ka salfar laba-ogsaydh, SO₂.

3) Shan litir oo SO₂ waxa ay ku qaaday 1 saac in ay dalool ku dhaaafan. Neef kalena waxa ay isla daloolka kaga baxday 10 litir/saacaddiiba.

Waa imisa culays-molikiyuulka neefta dambe?

**Neefta dhalliiiltiran:**

![Diagram](image)

**JT 8.16**

Wax badan ayaynu maqallay neefta dhalliiiltiran, hase yeeshee run ahaantii neef cayn-kaasi ihi ma jirto. Marka aynnu leenahaya neefta dhalliiitrannaa waxa aynnu iska indhatiray-naa oo ayaan waxba ka soo qaaday laba astaamood oo ay neefaha dhabta ihi leeyihiin; labadaa astaamoodna waa jimidhka molikiyuullada neefta iyo xoog-isjiidadka ka dhexeeya molikiyuullad. Jaantsuska 8.14, haddii aad u fiirsato waxa aad arkaysaa in labadaar arrimoode wax ka jiraaan:

b) Waxa aad ku arakaysaa mugga neefta oo aad u weyn oo ay molikiyuullada neeftuna aad u kala fogfog yiihiin.

t) Waxa aad ku arakaysaa isla xaddigii neefta ahaa oo mug yar la isugu diisay, dabadeedna ay yaraatay fogaanshihii u dhexeyeyey molikiyuullada. Taasina laba arrimooy la ayay la imanaysaa:

1) Jimidhka molikiyuullada oo aan la iska indhatirin karin marka loo eego mugga neefta oo intii hore aad ugu yaraaday iyo;

2) Xoog-isjiidadkooda oo intii hore ka badan, waayo fogaanshihii u dhexeyeyey molikiyuul-ayaa yaraaday.

Markii aynnu dhiganaynay mugga moolka ee neefahaa waxa aynnu aragnay in, heerkulka iyo cadaadiska beegan, aanu mugga moolka ee neefuhu ahayn 22.4 litir oo go'aan, laakiin mugga moolka ee neefta dhalliiitrani uu yahay 22.4 litir. Sababta aanu mugga moolka ee neefaha dhabta ihi u ahayn 22.4 litir oo go'anna waa labada arrimooy ee aynnu kor ku soo sheegnay. Hase yeeshee marka aynnu ka shaqaynayno xisaabta la xidhiidha xeerarka neefahaa waxa aynnu u qaadan doonaa in neefaha oo dhammi ay dhaalliiitrin yiihiin, waxana aynnu isticmaali doonaa isle'egta neefta dhalliiirtan, waayo waxa sida u sii ridani iska beddelimaayo jawaabaha xisaabaha.

**Layli 89:**

1) Muxuu yahay socodka Barown.

2) Sheeg u qaadashooyinka aragtida socodka molikiyuullada ee neefahaa.

92
3) Maxay oranayaan xeerarka soo socda:
   b) ka Boo'il, t) ka Jaarlas, j) ka Daalton, x) ka Garahaam.

II) Aragtida socodka molikiyuullada ee neefaha ku sharax mid walba oo xeerarka ka mid ah.

III) Qor tibaaxda xisaabeed ee xee walba.

4) Tus sida ay aragtida socodka molikiyuullada ee neefuhu u sharxayso waxyaalaha soo socda:
   b) Neefaha si dhib yar ayaa loo diisi karaa.
   t) Neefuhu way isdhaxgeli karaan.
   j) Neefuhu cadaadis ayay leeyihiin.
   x) Xawaaraha molikiyuullada neefuhu waxa uu ku xidhan yahay heerkulka.
   d) Neefuhu way isdhaxgalaan.

5) Soo dhirindhiri, qiimihiisaan oo saar madoorsoomaha neefta dhalliiltiran.

6) Waa maxay labada astaamood ee ay neefuhu leeyihiin, ee aan waxba laga soo qaadin marka laga hadlayo neefta dhalriiltiran.

<table>
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<td>Faraansiyam</td>
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</tbody>
</table>
Faneidiym  V  23  50.94
Kaalsiyam  Ca  20  40.08
Kaaliyam  K  19  39.10
Kaarboon  C  6  12.0
Koloriin  Cl  17  35.45
Koroomiyam  Cr  24  52
Kaadmiyam  Cd  48  112.40
Kiribon  Kr  36  83.80
Kobalt  Co  27  58.93
Kubram  Cu  29  63.54
Litiyam  Li  3  6.94
Manganiis  Mn  25  54.94
Magniisiyam  Mg  12  24.31
Meerkuri  Hg  80  200.59
Naytarojiin  N  7  14.01
Nikal  Ni  28  58.71
Niyoon  Ne  10  20.18
Haydarojiin  H  1  1.008
Heliyam  He  2  4
Yuraaniyam  U  92  238.03
Istaanas  Sn  50  118.69
Ogsijiin  O  8  16
Ooram  Au  79  196.96

JAWAABAHA

Layli 1.1:

1. i) 32, ii) 180, iii) 310, iv) 249.54,
v) 150, vi) 40, vii) 63, viii) 164,
ix) 158  x) 975.5

2. b) O = 50%,  S = 50%,
t) Ca = 54.05%,  H = 2.70%, O = 43.25%
j) Mg = 9.76%,  S = 13.01%,
O = 26.01%,  H,O = 51.22%
x) H = 2.04%,  S = 32.65%,
kh) Na = 27.38%,  H = 1.19%, C = 14.29%
O = 57.14%

3. N₂O

4. b) i) O = 11.18%,  Cu = 88.82%,
ii) O = 20.25%,  Cu = 79.75%
iii) Cu = 20.95%,
t) H₂O = 36.06%

5. H = 2.04%,  S = 32.65%,
O = 65.31%,

6. Cu = 78.44%,  O = 21.56%

7. Na = 32.39%,  S = 22.54%,
L a y l i  4.1 :
3)  2,    4)  1.25 g,  5)  8, iyo 5.3,
6)  4.99 g,  8)  207,  9)  55.8, 2, 3,
10) 12,  12)  7.95,  13)  213,208.
L a y l i  5.1 :
5.  b)  4.2 g,  t)  0.032 g,
6.  0.1 garaam-atam,
7.  b)  6.02 \times 10^{23} \text{ atam},  t)  13.244 \times 10^{23} \text{ atam},
   j)  1.505 \times 10^{23} \text{ atam},  x)  14.448 \times 10^{23} \text{ atam},
   kh)  1.505 \times 10^{23} \text{ atam},  d)  12.04 \times 10^{23} \text{ atam},
8.  H = 6.00 \text{ garaam-atam},  P = 2.00 \text{ garaam-atam},
   0 = 8.00 \text{ garaam-atam},
L a y l i  5.2 :
2.  b)  6.02 \times 10^{23} \text{ moli},  t)  1.204 \times 10^{23} \text{ moli},
   j)  12.04 \times 10^{23} \text{ moli},
3.  0.02 mool,
4.  2 mool
5.b) 2.94 mool,  t)  1.52 mool,
   j)  1.12 mool,  x)  1.00 mool,
   kh)  0.546 mool,  d)  1.71 mool,
6.  b)  17.6 g,  t)  34.8 g,
   j)  87.38 g,
7.  H = 1.20 \times 10^{25} \text{ atam},  P = 6.02 \times 10^{24} \text{ atam},
   O = 2.11 \times 10^{25} \text{ atam},
8.  183.8
9.  H = 6.0 \times 10^{23} \text{ atam},  N = 6.0 \times 10^{22} \text{ atam},
   O = 1.81 \times 10^{23} \text{ atam},
10. b) 26,  t)  26 g,  j)  0.5 garaam-atam
L a y l i  6.1 :
1.  CrCl_3
2.  AlCl_3,  Al_2Cl_6
3.  Mg_2P_2O_7
4.  MgCl_2 \cdot 6H_2O
5.  b)  C_2H_6O,  t)  HNO_2
   j)  C_3H_6O_2,
   x)  C_6H_6O_2N_2,
   kh)  C_3H_7O
L a y l i  6.2 :
3.  235 g  4.  80 g  5.  b)  = 118 g.
   t)  = 20.1 g  6.  b)  96 g,
   t)  149 g  7.  b)  0.115 mool,
   t)  0.0575 mool,  j)  1.84 g,
8.  1.37 mool,  9.  40.0 g,
10. b) 217 g,  t)  179 g,  j)  112g.
11. 136 g  12.  3.88 g
L a y l i  8.1 :
1.  b)  400 ml,  t)  67.3 atm,
   j)  9.9 l,  x)  82.98 g,
2.  V_2 = 74 \text{ sm}^3
3.  V_2 = 400 \text{ ft}^3,
4.  10 atm,
5.  1 atm.
Layli 8.2:
1. \( b) \ 319^\circ K, \)
    \( j) \ 341.8^\circ K \)
2. \( V_2 = 236.3 \text{ sm}^3 \)
    \( t) \ 51.2 \text{ sm}^3, \)
5. \( 200^\circ K \)

Layli 8.3:
1. \( b) \ 155.8 \text{ ml}, \)
    \( j) \ 16.12 \text{ l}, \)
2. \( V_2 = 133 \text{ sm}^3 \)
4. \( T_2 = 344^\circ K, \)
6. \( P_2 = 76.12 \text{ sm}. \)

Layli 8.4:
1. \( V_2 = 78 \text{ sm}^3, \)

Layli 8.5:
1. \( 60 \text{ sm}^3 \text{ H}_2, 20 \text{ sm}^3 \text{ N}_2 \)
2. \( 11 \text{ sm}^3 \text{ O}_2, 79 \text{ sm}^3 \text{ N}_2 \)

Layli 8.6:
1. \( 1.63 \text{ g/l} \)
3. \( 28 \text{iyo 2 atm}, \)
5. \( 45, \)
7. \( 3.01 \times 10^{21} \)
9. \( 44.8 \text{ l} \)
    \( t) \ 1011 \text{ ml}, \)
    \( t) \ 48.9 \)
2. \( 0.715, \text{ g}, \)
4. \( 145.6, \)
6. \( 44.8 \text{ l}, \)
8. \( 38.3 \text{ l}, \)
10. \( b) \ 933 \text{ ml}, \)
11. \( b) \ 16.3, \)