LESSON 1: Use of Adverbs

Learning Outcomes

By the end of this lesson, you should be able to:

i) identify ways of doing things.

ii) use of adverbs in your daily life activities.

You will need:

• a pen
• a book

Introduction

An adverb is a word that tells more about a verb, an adjective and another adverb. Adverbs tell us how an action is done: when? why? how? and where?

Examples

i) The cyclist is riding slowly.

ii) Children should cross the road carefully.

Activity 1

Use the correct form of the word in the brackets to complete the sentences below. Examples have been given to guide you.

1. Tino cleverly avoided the punishment. (clever)

2. Uganda's population is steadily rising. (steady)

3. St Thomas choir sang the second compulsory song beautifully. (beauty)

4. The host welcomed us cheerfully. (cheer)

5. We patiently waited for his return from Ojipaku market. (patience)

6. Italians have seen the worsening coronavirus attacked. (worse)

7. They answered the question wisely. (wise)

8. A machete is usually bigger than a knife. (usual)

9. The hungry boy ate the mango greedily. (greed)

10. The hunter bravely attacked the lion in its den. (brave)

Activity 2

Order of Adverbs

When more than one adverb is used in a sentence, they usually follow in this order: manner (how?), place (where?) and time (when?).

Example

The pedestrian crossed the road carefully (how?) at the zebra crossing (where?) yesterday (when?).

From the sentences below, underline the adverbs of manner, place and time.

1. The traffic officer called the driver loudly at the junction in the morning.

2. Many cyclists ride carelessly at the traffic lights every day.

3. The bus driver spoke politely to the passenger on the bus on Tuesday.

4. My mother nicely made cakes from the kitchen last weekend.

5. It rained heavily in our area last year.
1. **ELECTRONIC PRESENTATION**

You are a social worker and you have the following information on the coronavirus pandemic that you would wish to pass on to the community.

The COVID-19 pandemic has spread all over the world. It is now time for the people to prevent its continuous spread. The virus spreads through hand contact with infected persons and with contaminated surfaces. It gets into the body through the eyes, mouth and nose.

The disease can be prevented through regular washing of hands with soap and water, use of sanitisers, masks, continuous disinfecting of publicly-used surfaces and ensuring social distancing.

The symptoms of the virus are dry cough, dry sneezing, shortness of breath, soar throats and high body temperature.

Ugandans are encouraged to report any suspected cases to the health workers and to stay home and stay safe.

**REQUIRED**

(i) Using a presentation software, prepare a six-slide presentation that reflects the given information.

(ii) Apply action buttons that link the slides to each other.

(iii) Insert well-formatted and relevant pictures on at least one of the slides.

(iv) Apply an appropriate background for the slides.

(v) The slide should be set to move at the click of the mouse.

(vi) Set the headings in the slide to have a different font size and colour from the rest of the content.

(vii) Make use of bullets and numbers where necessary.

(viii) Insert a blank slide to appear as the last.

(ix) On the blank slide, insert a SmartArt that shows the transfer of coronavirus from one person to another.

(x) Set appropriate animation for your work.

(xi) Insert your name as a footer.

(xii) Save your work.

(xiii) Print your work as handouts.

2. **DATABASE MANAGEMENT**

The following information is extracted from XYZ employment records

**Employee data**

<table>
<thead>
<tr>
<th>Employee number</th>
<th>Department</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>XYZ001</td>
<td>Accounts</td>
<td>560,000</td>
</tr>
<tr>
<td>XYZ002</td>
<td>Accounts</td>
<td>400,000</td>
</tr>
<tr>
<td>XYZ003</td>
<td>Administration</td>
<td>650,000</td>
</tr>
<tr>
<td>XYZ004</td>
<td>Administration</td>
<td>420,000</td>
</tr>
<tr>
<td>XYZ005</td>
<td>Accounts</td>
<td>720,000</td>
</tr>
<tr>
<td>XYZ006</td>
<td>Security</td>
<td>400,000</td>
</tr>
<tr>
<td>XYZ007</td>
<td>Security</td>
<td>500,000</td>
</tr>
<tr>
<td>XYZ008</td>
<td>Administration</td>
<td>400,000</td>
</tr>
<tr>
<td>XYZ009</td>
<td>Accounts</td>
<td>410,000</td>
</tr>
<tr>
<td>XYZ100</td>
<td>Administration</td>
<td>700,000</td>
</tr>
</tbody>
</table>

**REQUIRED**

(i) Open a database management software and save it as your name.

(ii) Create the two tables — employee data and employee salary — with relevant fields.

(iii) Set the relevant field as a primary key.

(iv) Set the relevant field types with lookup wizard for each of the tables.

(v) Create a relationship between the two tables.

(vi) Create a form “entry” that will be used to enter data into the two tables.

(vii) Use the “entry” form to enter the above data.

(viii) Create a report that returns the workers in the accounts department, showing their names, department, date of birth and salaries.

(ix) All workers have been given a 20% salary increase, create a query that returns the new salary.

(x) Create one report that shows all the information above with the names presented in ascending order.

(xi) Print the database objects.

3. **WEB DESIGNING**

As a class monitor for your class, you wish to keep in touch with your classmates during the COVID-19 lockdown.

(i) Design a four-page collaborative website which you will use to continuously discuss with your classmates.

- Page 1 — Home page
  a. Banner of your choice, a header and motto.
  b. A marquee “STAY HOME STAY SAFE”.
  c. Provision of active links to other pages.
  d. A short introduction to the website.
  e. Relevant graphics.

- Page 2 — Updates
  a. Add a table and list the various things happening in the country like COVID-19 testing, closure of schools, ban on public transport, etc.
  b. Include relevant pictures.
  c. Use an appropriate background.

- Page 3 — Discussion
  Make a collaborative page, where the learners will always have a topic of discussion updated daily.
  i. Show the topic of discussion.
  j. Space for discussion.
  k. A short paragraph, explaining the page.

- Page 4 — Conclusion
  a. A brief conclusion.
  b. Contact, where the learners can get in touch with you by phone or email.
  c. Appropriate background and photographs.

(ii) Save your work as a website.

(iii) Print your work.
1. Let \( x = 2.4233 \ldots \)
\[ 100x = 242.33 \ldots \] (i)
\[ 1000x = 2423.33 \ldots \] (ii)
\[ (ii) - (i) \]
\[ 1000x - 100x = 2423.33 \ldots - 242.33 \ldots \]
\[ 900x = 2181 \]
\[ x = \frac{2181}{900} \]
\[ x = 2.4233 \ldots \] as required.

2. \( \log(7x + 3) - \log(x - 1) = \frac{2}{3} \log 8 \)
\[ \log \left( \frac{7x + 3}{x - 1} \right) = \log 8^{\frac{2}{3}} \]
\[ \log \left( \frac{7x + 3}{x - 1} \right) = \log 4 \]
\[ 7x + 3 = 4x - 4 \]
\[ 7x - 4x = -4 - 3 \]
\[ 3x = -7 \]
\[ x = -\frac{7}{3} \]
\[ x = -2 \frac{1}{3} \]

3. \( \text{Gradient of } AB = \frac{0 - 1}{4 - 2} = -\frac{1}{2} \)
\( \text{Gradient of } AB \times \text{Gradient of a perpendicular bisector} = -1 \)
\( -\frac{1}{2} \times \text{Gradient of a perpendicular bisector} = -1 \)
\( \text{Gradient of a perpendicular bisector} = 6 \)

Midpoint of \( AB = \left( \frac{2 + 4}{2}, \frac{0 + 1}{2} \right) = (3, \frac{1}{2}) \)
\( \text{Equation of the perpendicular bisector is } \)
\[ y - \frac{1}{2} = 6 \left( x - 3 \right) \]
\[ y = 6x - 12 + \frac{1}{2} \]
\[ y = 6x - 11.5 \]

4. \( \text{Volume scale factor} = \frac{67510.8}{2500.4} = 27 \)
\( \text{Linear scale factor} = \sqrt[3]{27} = 3 \)
\( \text{Height of a small kettle} = \frac{113.5}{3} \text{ cm} \)

5. \( n^2 + 3n + 5 = 54 \)
\( n^2 + 3n + 5 = 3n + 3n + 5 \)
\( n^2 - 49 = 0 \)
\( n = \sqrt{49} \)
\( n = 7 \)

6. \( \sqrt{108} - \sqrt{18} = 6\sqrt{3} - 3\sqrt{2} \)
\[ \left( \sqrt{2} - \sqrt{3} \right) \]
\[ \sqrt{2} \left( \sqrt{3} + \sqrt{2} \right) \]
\[ = 2\sqrt{6} - 3\sqrt{2} \]
\[ = \sqrt{12} - \sqrt{6} \]

7. \( P = \{1, 3, 6, 10, 15\} \)
\( \text{As required.} \)

8. \( \left( \frac{3}{2} \right) - 3 \left( -\frac{3}{2} \right) = 3m \)
\[ \left( \frac{3}{2} \right) - \left( -\frac{3}{2} \right) = 3m \]
\[ \frac{3}{2} + \frac{3}{2} = 3m \]
\[ 3 = 3m \]
\[ m = 1 \]
\[ \text{Length of } AB = \sqrt{6^2 + 9} = \sqrt{9\sqrt{2} = 5 \text{ units}} \)

9. \( \text{Area of grassed part} = \text{Area of the whole Alena} - \text{Area of the throwing part} \)
\[ = \frac{40 \times 100^2 \times \pi \times 5^2}{3600} - \frac{40 \times 360 \times \pi}{3600} \]
\[ = \frac{1}{9} \times (100^2 - 5^2) \]
\[ = \frac{1}{9} \times (10000 - 25) \]
\[ = 9975\pi \]
\[ = 3481.931858 \]
\( \text{The area} = 3481.932 \text{ (3 dps)} \)

10. \( P = \{1, 3, 6, 10, 15\} \)

11. \( a) \ \text{"is a factor of"} \)
\( b) \ \text{"is less than"} \)

12. \( f(x) = \frac{3x}{x + 2} \)
\( f'(x) = \frac{3x^2 - 18}{x^4 - 4} \)
\( \text{(i) Let } h(x) = m \)
\[ \frac{3m}{m^2 + 2} = \frac{3x^2 - 18}{x^4 - 4} \]
\[ \frac{3m}{m^2 + 2} = \frac{x^2 - 6}{x^2 - 2} \]
\[ = \frac{m^2 - 4m}{m^2} = \frac{x^2 - 6}{x^2 - 2} \]
\[ m = 2 \]
\[ m = x^2 - 6 \]
\[ h(x) = x^2 - 6 \]
(ii) \( f^{-1}(x) \)
\[
\begin{align*}
\frac{y}{x} &= \frac{3x}{x+2} \\
nx + 2y &= 3x \\
2y &= 3x - nx \\
x(3 - ny) &= 2 \\
x &= \frac{2}{3} - \frac{ny}{x}
\end{align*}
\]
\( \frac{y}{x} \rightarrow f^{-1}(x) \) and \( y \rightarrow x \)

\( f^{-1}(-3) = \frac{2}{3} - \frac{ny}{x} = \frac{2}{3} - \frac{3}{x} \)

(c) \( f(x) = \frac{3x^2 - 18}{x - 4} \)
Equate the denominator to zero:
\( x^2 - 4 = 0 \)
\( x = \pm 2 \) and \( x = 2 \)

13. Okello

<table>
<thead>
<tr>
<th>Time (hrs)</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00</td>
<td>0</td>
</tr>
<tr>
<td>11:00</td>
<td>20</td>
</tr>
<tr>
<td>11:15</td>
<td>25</td>
</tr>
<tr>
<td>11:45</td>
<td>25</td>
</tr>
<tr>
<td>12:45</td>
<td>55</td>
</tr>
</tbody>
</table>

Distance–Time graph for Okello and Apio’s Journey

b) (i) 11:40 am
(ii) 1:15 pm

51 minutes

Okello arrived 51 minutes later than Apio.

14 (a) Let the size of the land be \( p \) and the time they will take be \( t \).

Sharon: 50 hours \( \Rightarrow p \)
1 hour \( = \frac{p}{50} \)
\( t \) hours \( = \frac{p}{50}t \)

Peter: 10 hours \( = p \)
1 hour \( = \frac{p}{10} \)
\( t \) hours \( = \frac{p}{10}t \)

Sharon’s portion in \( t \) hours + Peter’s portion in \( t \) hours
\( = \frac{p}{50}t + \frac{p}{10}t = p \)

They will take \( \frac{4}{7} \) hours or 8 hrs 20 minutes

b) \( Y \) or \( X \) let \( a \) = constant of proportionality.
\( Y = ax^2 \) also
\( Y = bx^2 \)
\( Y = ax^2 + bx^2 \)
When \( X = 40, Y = 3264 \)
\( 3264 = a(40)^2 + b(40)^2 \)
\( 3264 = 1600a + 6400b \)
Reduce by 64
\( 51 = 25a + 1000 \) …… (i)
When \( X = 20, Y = 416 \)
\( 416 = a(20)^2 + b(20)^2 \)
\( 416 = 400a + 8000b \)
\( 26 = 25a + 500b \) …… (ii)

Evaluating a in (i) and (ii)
\( 51 = 25a + 1000 \)
\( 26 = 25a + 500b \)
\( 25 = 500b \)
Substituting \( b = \frac{1}{20}b \) in (i)
\( 25a = 51 - 1000 = \frac{1}{20} \)
\( 25a = 51 - 50 \)
\( a = \frac{1}{25} \)
\( Y = ax^2 + bx^2 \)
\( Y = \frac{1}{25}x^2 + \frac{1}{20}x^2 \)

(ii) Given that \( X = 30 \)
\( Y = \frac{1}{25} \times 30^2 + \frac{1}{20} \times 30^2 \)
\( Y = \frac{900}{25} + \frac{900}{20} \)
\( Y = 36 + 1350 \)
\( Y = 1386 \)

15. (i) Cash price
\( \frac{100 - 15}{100} \times 750,000 \)
\( \frac{85}{100} \times 750,000 \)
\( = 637500 \)

Customer pays UGX 637500 if he/she pays cash.
Weekly hire purchase price = 100,000 + (8 × 100,000)
= UGX 900,000

Saving the customer makes by buying cash rather than weekly hire purchase
\( = 900,000 - 637500 \)
\( = UGX 262500 \)

Sharon saves UGX 262500

(ii) Monthly hire purchase = 210,000 + (4 × 150,000)
\( = 210,000 + 600,000 \)
\( = UGX 810,000 \)
Saving = 810,000 - 637,500
\( = UGX 172,500 \)

Customer saves UGX 172,500

b) A = \( 15000000(1 - \frac{1}{a}) \)
\( = 9211875 \)

The car’s value will be UGX 9,211,875 after 3 years.

SECTION A

1. Solve the simultaneous equations.
\( \sqrt{4+y} = 2 \)
\( 5 + y = 2\sqrt{2} \)

2. Given that \( m = \frac{3m^2 - 10m}{m^2} \), evaluate
(a) \( 2m - 3 \)
(b) \( 7 \times (2m - 3) \)

In the figure above two chords AB and CD intersect at E. AB = 10 cm, CD = 4 cm. If EB is 2 cm shorter than ED, find the length of EB and ED.
Continued from page III

3. a) Copy and complete the table of values below for $y = (2x + 5)(x - 3)$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$2x + 5$</th>
<th>$x$</th>
<th>$x - 3$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>7</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>17</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>

(b) Use your complete table to draw the graph of $y = (2x + 5)(x - 3)$. Use a scale of 1cm to represent 5 units on the $x$-axis.

(c) Draw on the same graph the line $y = 3x + 15$ hence solve the equation $x^2 - 2x = 15$.

11. (a) Find the model weight from the histogram.

(b) Draw a frequency distribution table and hence calculate the;

(i) Mean weight

(ii) Median weight

12. (a) If \[
\begin{pmatrix}
1 & 3 \\
4 & 2
\end{pmatrix}
\begin{pmatrix}
x \\
y
\end{pmatrix} =
\begin{pmatrix}
8 \\
-2
\end{pmatrix},
\]

find the value of $x$, $y$ and $z$.

(b) Find the inverse of \[
\begin{pmatrix}
1 & 3 \\
4 & 2
\end{pmatrix}
\]

and hence solve the simultaneous equations \[
x + 3y = 7 \\
x + y = 1
\]

13. In a trading Centre, there are four wholesale shops A, B, C and D. A is 750m on a bearing of $038^\circ$ from B. C is 600m on a bearing of $170^\circ$ from B. D is 950m on a bearing of $50^\circ$ from C.

(a) Use a scale of km to represent 100m to construct a scale drawing showing the positions of the four wholesale shops.

(b) Find the distance and bearing of D from A.

14. The histogram below shows the heights of students in a given class.

(a) Find the model weight from the histogram.

(b) Draw a frequency distribution table and hence calculate the;

(i) Mean weight

(ii) Median weight

15. (a) Draw the graph of $y = \sin x$ for the domain $0^\circ \leq x \leq 720^\circ$ using an interval of $60^\circ$.

(b) From the graph, if, (i) $\sin x = 0$ (ii) $\sin x = \frac{1}{2}$

(iii) $\sin x = \frac{1}{2}$ and $\sin x = 1$, what are the positive possible values of $x$?

(c) Obtain the graph the values of:

(i) $\sin 170^\circ$

(ii) $\sin 270^\circ$

16. A triangle PQR with vertices P(2, -2), Q(4, -4) and R(-3, -5) is mapped onto triangle P’Q’R’ by a transformation matrix \[
M = \begin{pmatrix}
-1 & 0 \\
0 & 1
\end{pmatrix}
\]

The triangle P’Q’R’ is mapped onto triangle P”Q”R” by another transformation matrix \[
N = \begin{pmatrix}
-0.5 & 0 \\
0 & -0.5
\end{pmatrix}
\]

(a) Determine the coordinates of the vertices

(i) P”, Q” and R”

(ii) P”, Q” and R”

(iii) P”, Q” and R”

(b) On the same axes draw the triangle PQR, P’Q’R’ and P”Q”R”.

(c) Describe fully the transformation represented by

(i) M

(ii) N.

17. A farmer plans to plant a 20 hectares field with maize and beans. The farmer’s estimates for the projects are shown in the table.

<table>
<thead>
<tr>
<th></th>
<th>Maize</th>
<th>Beans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of working hours per hectare</td>
<td>15 days</td>
<td>6 days</td>
</tr>
<tr>
<td>Planting and harvesting costs per hectare</td>
<td>UGX 900,000</td>
<td>UGX 600,000</td>
</tr>
<tr>
<td>Expected profit per hectare</td>
<td>UGX 2,000,000</td>
<td>UGX 1,500,000</td>
</tr>
</tbody>
</table>

The farmer has only UGX 12,600,000 to invest in the project. The total number of working days is 150.

(a) Let x and y represent number of hectares to be planted with maize and beans respectively.

Write down all the inequalities for the above information.

(b) Write down an expression for the profit P in terms of x and y.

(c) (i) On the same axes plot graphs of the inequalities by shading out the unwanted regions.

(ii) Use your graphs to determine how the farmer should use the field to maximise the profit. Hence find the farmer’s maximum profit.

SECTION A

1. a) Chromatography is a technique for the separation of a mixture by passing it in a solution or suspension through a medium in which the components move at different rates on an adsorbent medium.

b) Athlete Y

c) Paper chromatography works by passing the dissolved material, liquid or gas through a filter/adsorbent medium.

The molecules separate into layers as the molecules pass through the filter. Chemical components in liquid mixture spread out and travel at different speeds over a stationary solid. The component that is more soluble in the solvent, rises faster and this way, component colours get separated and spread out. Coloured patches on adsorbent medium for PED and samples are matched. Patterns in a sample similar to those in PED confirm presence of PED in the sample.

d) Large quantity of sample cannot be applied on paper chromatography.

Does not give quantities of components in the sample.

2. a) i) W

ii) X and Z

b) X, W, Z

c) WX

d) i) Noble gases or inert gases

ii) Its outermost shell/valance shell has eight electrons

Stable and does not combine with other atoms

3. a) Mg(s) + Cu2+(aq) → Mg2+(aq) + Cu(s)

b) Redox combines the terms reduction and oxidation. Mg(s) loses two (2) electrons to form magnesium ions (Mg2+), this is an oxidation, Cu2+ gains the electrons lost by Mg2+ to become Cu(s) this a reduction reaction.

The equation involves both oxidation and reduction.

c) 

4. a) (i) C

H

85.7

14.3

14.3

7.142

7.142

2

1

CH3

(ii) (CH3)x = 42

12x + 2x = 42

14x = 42

ANSWERS FOR CHEMISTRY PAPER TWO (MAY 11 ISSUE)
\[ \text{Cu}(s) + \text{2KOH}(aq) \rightarrow \text{Cu}(OH)_2(s) + \text{K}_2\text{CO}_3(aq) \]

7. a) i) Arrangement:

- Copper sulphate is an ionic compound. When in solid state, the electrons are held by the strong electrostatic forces created by the electrostatic forces of attraction of opposite charges. Atoms in copper II sulphate are held together by ionic bonds, have a regular, repeating arrangement called an ionic lattice. Copper II sulphate is an ionic compound. The ions in a solid solution, the negative cathode electrode attracts Cu\(^{2+}\) ions depleting the concentration of blue copper ion Cu\(^{2+}\) in solution. The positive anode electrode loses 2 electrons to form a gas: 

\[ \text{Zn}(s) \rightarrow \text{Zn}^{2+}(aq) + 2e^- \]

b) Potassium sulphate is a soluble salt; the solution is gently stirred to dissolve it. The solution is now a mixture of ions: 

\[ \text{K}^+ + \text{SO}_4^{2-} \]

- The blue colour fades as more and more copper is deposited, indicating the reduction reaction: 

\[ \text{Cu}_{\text{II}}^2+(aq) + 2e^- \rightarrow \text{Cu}(s) \]

ii) Excess carbon dioxide reacts with CaCO\(_3\) (ppt) to form calcium carbonate: 

\[ \text{CaCO}_3(s) + \text{H}_2\text{O}(l) + \text{CO}_2(g) \rightarrow \text{CaCO}_3(s) + 2\text{H}_2\text{O}(l) \]

b) Increasing the temperature increases the solubility of some ionic compounds in water: 

\[ \text{Zn}^{2+}(aq) + 2\text{OH}^- \rightarrow \text{Zn(OH)}_2(s) \]

- Ethene (\(\text{C}_2\text{H}_4\)) is a hydrocarbon, a compound containing only carbon and hydrogen atoms. It is a monomer, a molecule consisting of one type of atom. Ethene is a gas at room temperature:

\[ \text{CaCO}_3(s) + \text{CO}_2(g) + \text{H}_2\text{O}(l) \rightarrow \text{CaCO}_3(s) + \text{H}_2\text{O}(l) \]

- Ethene is used in the manufacture of polyethylene, a plastic:

\[ \text{CH}_2=\text{CH}_2 + \text{H}_2 \rightarrow \text{CH}_2\text{CH}_2\text{H}_2 \]

Use a catalyst to speed up the reaction:

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

- The reaction is exothermic and the temperature in the furnace reaches 2000°C. This reaction is exothermic and the temperature in the furnace reaches 2000°C. The oxide should be in powder form. Sprouted sorghum is roasted and crushed then added to the banana juice, sorghum provides an enzyme zymase.

\[ \text{C}(s) + \text{O}_2(g) \rightarrow \text{CO}_2(g) \]

- Oxygen in the blast furnace with coke to form carbon monoxide.

\[ \text{Fe}_2\text{O}_3(s) + \text{3CO}(g) \rightarrow 2\text{Fe}(l) + 3\text{CO}_2(g) \]

- Hematite Fe\(_2\)O\(_3\) is added to iron ore at the top of the furnace. The oxide should be in powder form. Molten iron is used to make steel or poured into moulds to solidify. The large chunks of iron formed are called pig iron. The iron is then purified by blowing pure oxygen through it in a converter:

\[ \text{Fe}_2\text{O}_3(s) + \text{3CO}(g) + \text{O}_2(g) \rightarrow 2\text{Fe}(l) + 3\text{CO}_2(g) \]

- Magnesium is more reactive than carbon. It is able to displace the carbon dioxide. 

\[ \text{Mg}(s) + \text{CO}_2(g) \rightarrow \text{MgO}(s) + \text{C}(s) \]

- Magnesium continues to form with a dazzling white flame. 

\[ \text{MgO}(s) + \text{C}(s) \rightarrow 2\text{Mg}(s) + \text{CO}(g) \]

- Magnesium is more reactive than carbon. It is able to displace the carbon dioxide. 

\[ \text{Mg}(s) + \text{CO}_2(g) \rightarrow \text{MgO}(s) + \text{C}(s) \]

- Magnesium continues to form with a dazzling white flame.

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\[ \text{Mg}(s) + \text{CO}_2(g) \rightarrow \text{MgO}(s) + \text{C}(s) \]

- Magnesium continues to form with a dazzling white flame.
1. The figure below shows a set-up to separate mixtures in the laboratory.

![Fractionating column with beads](image)

a) Identify;
   i) the method of separation of mixtures shown.
   ii) Liquid X.
b) During the process, what is the role of;
   i) water in the trough.
   ii) beads in the fractionating column.
c) Explain the principle behind this method of separation of mixtures.

2. The atomic number and mass numbers of hydrogen and nitrogen are shown in the table below.

<table>
<thead>
<tr>
<th>Element</th>
<th>Atomic number</th>
<th>Mass number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>7</td>
<td>14</td>
</tr>
</tbody>
</table>

Write the standard representation of the atoms of each element.
(a) i) Name the type of bond formed when the two atoms combine.
(ii) State two characteristics of the compound formed resulting from the type of bond.
(b) Using valence shells, show how the atoms of the two elements bond.

3. Ammonia is manufactured by the reaction between hydrogen and nitrogen in the Haber process.
a) State the conditions used in the Haber process.
   i) Temperature.
   ii) Pressure.
   iii) Catalyst.
b) Describe and explain the effect of increasing the pressure on the rate of this reaction.
c) Ammonia is used to make fertilisers. The table gives some information about two fertilisers made from ammonia.

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Formula</th>
<th>Relative formula mass (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium nitrate</td>
<td>NH₄NO₃</td>
<td>80</td>
</tr>
<tr>
<td>Urea</td>
<td>(NH₄)₂CO</td>
<td>60</td>
</tr>
</tbody>
</table>

Use the data in the table to find which fertiliser contains a greater percentage by mass of nitrogen than ammonium nitrate.

4. The statements below give some of the chemical properties of metal X and its compounds.
   • X does not react with cold water.
   • X does not form a precipitate with potassium iodide.
   • X reacts with cold hydrochloric acid to form an aqueous solution.
   • X reacts with magnesium oxide.
   a) Suggest a possible identity for X.
   b) Write the equation for the reaction between X and the oxide of magnesium.
c) Write an ionic equation for the reaction between X and sodium hydroxide solution.
d) Metal X is a good electrical conductor explain why X conducts electricity.

5. The atmosphere contains a large number of gases, including oxygen, nitrogen, carbon dioxide, sulphur dioxide, oxides of nitrogen, methane and chlorofluorocarbons (CFCs).
a) Carbon dioxide, methane and CFCs are greenhouse gases.

6. Iron metal was reacted with dilute sulphuric acid.
   a) i) State what was observed.
      ii) Write a chemical equation for this reaction.
   b) Zinc granules were added to the resultant solution.
      i) State what was observed.
      ii) Write an equation of reaction.

7. The flow chart shows some reactions of copper(II) nitrate, Cu(NO₃)₂.
   a) i) When two moles of Cu(NO₃)₂ is heated strongly, a black residue; gases A and B are formed. Identify;
      ii) The black residue.
      iii) Gases A and B.
   b) i) Identify reagent X
      ii) Write an equation that leads to formation of the green precipitate.

8. The figure below shows processes involved in the treatment of water.

9. Concentrated sulphuric acid was reacted with sugar crystals in a boiling tube.
   a) i) State what was observed.
      ii) Write a chemical equation for the reaction.
   b) State one domestic use of the solid product in the above reaction.
   c) i) Which property of sulphuric acid is demonstrated by this reaction?
      ii) How is the step important for good water quality?
   d) Explain how chlorination ensures that water is colourless before being released to the community.

10. Nitrogen and hydrogen gases were reacted to form ammonia gas.
    a) i) State the conditions for this reaction.
        ii) Write an equation of reaction.
    b) 25cm³ of nitrogen were reacted with 15cm³ of hydrogen gas. Calculate;
        i) The volume of ammonia formed.
        ii) The volume of excess gas.

11. a) What is meant by the term heat of neutralisation?
    b) An experiment was carried out where different volumes of dilute hydrochloric acid and aqueous sodium hydroxide both at 25°C were mixed and stirred with a thermometer. The highest temperature reached by each mixture was recorded in the table below:

<table>
<thead>
<tr>
<th>Volume of hydrochloric acid (cm³)</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of sodium hydroxide (cm³)</td>
<td>45</td>
<td>40</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Highest temperature of mixture (°C)</td>
<td>27.2</td>
<td>29.4</td>
<td>31.6</td>
<td>33.8</td>
<td>33.6</td>
<td>31.8</td>
<td>30.0</td>
<td>28.4</td>
</tr>
</tbody>
</table>

Plot a graph to represent the above information.
   i) Using your graph, determine the highest temperature reached, the volume of acid and base reacting when highest temperature is reached.
   c) i) Write a balanced equation for this reaction.
      ii) Calculate the amount of heat liberated during the neutralisation process at this temperature. (Specific heat capacity is 4.1 g⁻¹ K⁻¹ and the density of solutions is 1.0 g/cm³).
   d) State any factor which can affect the results of this experiment.
   e) The molar enthalpy of neutralisation between hydrochloric acid and ammonia solution was found to be -52.2 kJ mol⁻¹, while that of hydrochloric acid and sodium hydroxide was -571 kJ mol⁻¹. Explain the difference in these values.

12. Sulphur can be extracted by Frasch process. In the process, superheated water is used.
   a) i) Why is it necessary to use superheated water in this process?
      ii) State two physical properties of sulphur that makes it possible for it to be extracted by this method.
   b) The diagram below shows part of the processes in the manufacture of sulphuric acid.

13. (a)(i) What is the chemical name of soap?
    (ii) Briefly describe how soap can be prepared in the laboratory.
    (iii) Explain the cleansing action of soap.
    (b) Detergents are sometimes called soapless soaps.
        i) What are soapless soaps?
        ii) How are detergents different from soap?
    (iii) Explain why detergents don’t form scum with hard water.

14. (a) With help of a diagram, describe how a dry sample of chlorine gas can be prepared in the laboratory.
    (b) Dry chlorine gas was reacted with hydrogen.
        i) State what was observed.
        ii) Write an equation of reaction.
    (c) The product in (b) above was dissolved in water and the resultant solution.
        i) Treated with a red litmus paper. State what was observed.
        ii) Reacted with a solution of lead II nitrate. State what was observed and write an equation of reaction.
    (d) State any two uses of chlorine gas.