PRIMARY SIX
SELF STUDY MATERIALS
ENGLISH LANGUAGE
PRIMARY SIX
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 worse coronavirus attacked. (worse)

7. They answered the question wisely. (wise)

8. A machete is unusually 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.

LESSON 2: Informal Letter Writing

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

i) express your views on safety on the road.

ii) write a letter about safety on the road.

Introduction
Letter writing is one way of sending a message between or among people. You can write a letter to a friend, parents, relatives and many others.

Activity 1
1. (a) Write a letter to your father appreciating him for his effort to keep everybody well in this period of COVID-19 pandemic. Wish him a longer stay in this life. Use your school address.

   (b) The letter below has some words missing. Using the words in the box, complete it by filling in the gaps correctly.

   reap advise purpose academic not arua discussions hear dear examinations
1. Which component is responsible for converting the data received from the user into computer understandable format?
   A. Memory Unit
   B. Arithmetic & Logic Unit
   C. Input device
   D. Output device

2. The only language which the computer understands is ……
   A. assembly language
   B. binary language
   C. basic
   D. C language

3. Which of the following is used to hold running program instructions?
   A. Flash disk
   B. Compact disc
   C. RAM
   D. Hard disk

4. Which of the following programs would enable users to perform specific tasks on a smartphone?
   A. Android
   B. Disk cleaner
   C. Antivirus
   D. WhatsApp®

5. What is the main difference between a mainframe and a super computer?
   A. Super computer is much larger than mainframe computers
   B. Supercomputers handle complex computations while mainframe host a large amount of data
   C. Super computers are much smaller than mainframe computers.
   D. Supercomputers are focused to execute as many programs as possible while mainframe uses its power to execute few programs as fast as possible.

6. The fifth generation of computers focuses much of the use of …………..
7. Which of the following is used to hold running program instructions?
   A. Transitors
   B. Microprocessor
   C. Integrated Circuits
   D. Artificial intelligence

8. Presentation, spreadsheet and photo-editing are examples of………
   A. system software.
   B. operating system.
   C. application software.
   D. programming languages.

9. After a picture has been taken with a camera on your smartphone and processed appropriately, the actual print of the picture is considered…………………..
   A. data.
   B. input
   C. output
   D. process

10. Choose the correct combination of the effects of a computer virus
    i. Disk Crash
    ii. Mother Board Crash
    iii. Corruption of program
    iv. Deletion of files
    v. System unit crash
    A. (i), (ii), (iii)
    B. (i), (iii), (iv)
    C. (ii), (iv), (v)
    D. (ii), (iii), (iv)

11. In a spreadsheet program, =MAX (A2:A5) is an example of
    A. value
    B. formula
    C. cell address
    D. function

12. In order to send an e-mail to another class on the school's local area network, a student must first know the class'…
    A. classroom teacher
    B. e-mail password
    C. computer type
    D. e-mail address

13. When a file comprises of instructions that can be carried out by the computer, it is often called a(n) …….. file.
    A. Data
    B. information
    C. executable
    D. memory

14. To move a picture within a word document, which procedure should a computer user follow?
    A. Select, Paste, Print
    B. Select, Copy, Paste
    C. Select, Paste, Copy
    D. Select, cut, Paste

15. Which of the following is designed to control the operations of a tablet?
    A. Application Software
    B. System Software
    C. Off shell Software
    D. User

16. Which advantage is offered to someone researching using an online database instead of a printed set of similar information?
    A. Easier to access information
    B. Better charts
    C. Easier to understand tables
    D. More legible diagrams

17. A computer user found a picture in a printed newspaper that he wanted to use as a full-size cover for a report. Using the computer, how might she do this?
    A. Print the report and glue the picture
    B. Scan the picture and edit it in a photo-editing software.
    C. Copy the picture and paste it into the report.
    D. Print the report and then insert the photo.
1. \[3^4 = \frac{3(3) + 3(3)}{2}\]
   \[= \frac{15 + 12}{2}\]
   \[= \frac{27}{2}\]
   \[= 13.5\]

2. \[\frac{1}{5}(2x - 5) \leq (2x + 1)\]
   Multiplying both sides by 15 gives
   \[2x - 5 \leq 15(2x + 1)\]
   \[2x - 5 \leq 30x + 15\]
   \[2x - 30x < 15 + 5\]
   \[-28x < 20\]
   \[x > \frac{20}{28}\]
   \[x > \frac{5}{7}\]

3. \[M = \begin{bmatrix} 4 & -5 \\ 6 & 1 \end{bmatrix}\]
   \[\text{Det } M = (4 \times 1) - (6 \times 3)\]

4. \[\text{Let the age of the Seventh boy be } x\]
   \[17 + 13 + 15 + 12 + 15 + 8 + x = 13\]
   \[80 + x = 13\]
   \[80 + x = 13(7)\]
   \[x = 91 - 80\]
   \[x = 11\]
   \[\therefore \text{The Seventh boy is 11 years.}\]

5. \[(x+2) \text{ and } (x - 1)\]
   \[x^2 - 1 + 2x - 1\]
   \[x^2 + 2x - 2 = 0\]

6. \[5x^6 - 80y^6\]
   \[= 5(x^2)^3 - (2y^2)^3\]
   \[= 5(x^2)^3 - (2y^2)^3\]
   \[= 5(x^2 - 2y^2)(x^2 + 2y^2)(x^2 + 4y^2)\]

7. \[3 \begin{bmatrix} 5 \\ 4 \end{bmatrix} = \begin{bmatrix} 15 - 4 \\ 4 \end{bmatrix}\]
   \[= \begin{bmatrix} 11 \\ 5 \end{bmatrix}\]
   \[\therefore \text{Therefore image of } (5, -4) \underbrace{\text{under the transformation matrix}}_{\begin{bmatrix} 1 & 3 \\ 1 & 0 \end{bmatrix}} \text{ is } (11, 5).\]
8. From the diagram AE = ED and angle AED = 90°

Using \( \Delta ABE \)

\( (AB)^2 = (BE)^2 + (AB)^2 \)

\( AE = \sqrt{89} \).

Using \( \Delta EDA \)

\( \sin 45° = \frac{ED}{AD} \). But \( \sin 45° = \frac{1}{\sqrt{2}} \)

\( \frac{\sqrt{2}}{2} = \frac{AD}{\sqrt{2}} \)

Multiplying both sides by \( \sqrt{2} \)

\( AD = \sqrt{89} \times \sqrt{2} \)

\( AD = \sqrt{13.3417} \)

\( \therefore AD = 13.3 \) (1 decimal place)

9. \( \sqrt{2} \tan \theta = 1 \)

\( \tan \theta = \frac{1}{\sqrt{2}} \)

\( \theta = \tan^{-1}\left(\frac{1}{\sqrt{2}}\right) \)

\( = 35.2644°, 215.2644° \)

\( \therefore \theta = 55.3° \) and \( 215.3° \) (1 decimal place)

10. a) 

\[
\begin{array}{cccc}
+ & 2 & 3 & 4 \\
5 & 6 & 7 & 8 \\
9 & 10 & 11 & 12
\end{array}
\]

b) \( \frac{5}{12} \)

11. a) \( P = \sqrt{3 + 2R} \)

Squaring both sides

\( \frac{P^2}{1} = \frac{3 + 2R}{3R - 3} \)

\( P^2(3R - 3) = 3 + 2R \)

\( 3RP^2 - 3P^2 = 3 + 2R \)

\( 3RP^2 = \frac{3 + 2R}{3R - 3} \)

\( R = \frac{3 + 3P^2}{3P^2 - 2} \)

For \( P = 2 \)

\( R = \frac{3 + 6}{20 - 2} \)

\( R = \frac{15}{18} \)

\( \therefore R = \frac{5}{6} \)

b) Let \( x \) represent the price for a book and \( y \) represent the price for a pen.

\( 5x + y = 2700 \)  \( (i) \)

\( 12x + 2y = 6400 \)  \( (ii) \)

Solving (i) and (ii) simultaneously

\( 2(5x + y) = 2700 \)

\( 12x + 2y = 6400 \)

\( 10x + 2y = 5400 \)

\( 12x + 2y = 6400 \)

Equation (ii) - Equation (i) gives

\( 12x - 10x + (2y - 2y) = (6400 - 5400) \)

\( 2x = 1000 \)

\( x = \frac{1000}{2} \)

12a) 

\( x = 500 \)

Substituting \( x = 500 \) in equation (i) gives

\( 5(500) + y = 2700 \)

\( 2500 + y = 2700 \)

\( y = 200 \)

The cost of a book was UGX 500.

The cost of a pen was UGX 200.

13a) 

\( P(QQ) = 10.8 \text{cm} \)

\( QR = 11.9 \text{cm} \)

\( c) R = 6.2 \text{cm} \)

\( A = \pi r^2 \)

\( = (5.142)(6.2)^2 \)

\( = 120.77848 \)

\( = 120.7785\text{cm}^2 \) (4 decimal places)

14a) 

\[
\begin{array}{ccc}
1 & 0 & 0 \\
0 & 4 & 0 \\
0 & 0 & 6
\end{array}
\]

\( R \)

\[
\begin{array}{ccc}
1 & 0 & 0 \\
0 & 4 & 0 \\
0 & 0 & 6
\end{array}
\]

\( R' \)

Vertices of \( R' \) are \((0, 0), (4, 0)\) and \((0, 6)\)

15. 

(i) \( P(\text{RR}) + P(\text{GG}) + P(\text{BB}) \)

\( P(\text{RR}) = 5 \times 4 = 20 \)

\( P(\text{GG}) = 3 \times 2 = 6 \)

\( P(\text{BB}) = 4 \times 3 = 12 \)

\( = 30 + 6 + 12 \)

\( = 48 \)

\( = 16 \)

(ii) \( 4 \times 5 \times 5 = 100 \)

\( \frac{11}{11} \frac{13}{13} \frac{15}{15} \)

(iii) \( 15 + 20 + 15 + 12 + 20 + 12 \)

\( = 94 \)

\( 132 \)

16a) Re-arrange the equations

\( 4x - 6y = 5 \)
1. Find the next two values in the sequences below
   a) 1, 2, 3, 5, 8, 13, \ldots
   b) 11, 22, 110, 201, 220, \ldots in base three

2. Y varies inversely as the square of x. The difference between the value of y when x = 6 and x = 3 is 16. Find the law connecting x and y.

3. The coordinates of A and B are (a -1) and (5, b) respectively. Given that (5, 2) is the midpoint of line segment AB, find:
   (a) column vector \overrightarrow{AB}
   (b) the length of vector \overrightarrow{AB} correct to 2 decimal places.

4. Use logarithm tables to evaluate \sqrt{3841.325}. correct to 3 significant figures.

5. Express \frac{a + \sqrt{c}}{b} in the form \frac{a}{b} + \sqrt{c}. Hence state the values of a, b and c.

6. Given that \frac{(1+y)}{c - 1/2} = \frac{3}{4}. Determine the values of x for which \frac{1+y}{c} is undefined.

   a) Find the percentage increase in the price of the book.
   b) If the old price of the book is UGX 3000, find the new price of the book.

8. In the figure below, \overrightarrow{AB} is parallel to \overrightarrow{PQ} - 4\overrightarrow{QR} + 2\overrightarrow{PR}
   a) Find \overrightarrow{AB}.
   b) Find \overrightarrow{AB} - 10cm, depth of the cone \overrightarrow{AP} = 3cm and \overrightarrow{AP} = 2cm.
   c) Find the maximum volume of water the cone contain.
   (i) taxi
   (ii) Volume of the remaining solid wood.
   (iii) Surface area of the remaining solid wood.

9. A chord of length 16cm is 6cm away from the centre of a circle; calculate the circumference of the circle.

10. A chord of length 16cm is 6cm away from the centre of a circle. Calculate the circumference of the circle.


SECTION B

11. A survey was conducted on 30 participants to establish the transport means they preferred. It revealed that 7 preferred taxi (T) and Boda (B), but not Private cars (P), 5 preferred Taxi and private cars, but not Boda, 2 preferred Boda and private cars, but not Taxi, while 3 preferred neither of the transport means. Those who preferred private cars only were twice those who preferred all the 3 means of transport and a third of those who preferred Taxi only, 4 preferred Boda only. (a) Represent this information on a Venn diagram.
   (b) From the Venn diagram, determine the how many people preferred:
   (i) All the 3 means.
   (ii) Private cars.
   (iii) Taxi only.
   (iv) Neither of the transport means.
   (v) A chord of a circle.

12. a) Given that \theta = \frac{2}{3} \pi, find:
   (i) \sin \theta
   (ii) The values of \sin \theta.
   (b) If \sin \theta = \frac{2}{\sqrt{3}} \sin \theta - 2x, find the value of x
   for which \log_{a} (x) = \log_{a} (x) - 2.

13. (a) Without using a table or calculator, simplify the following:
   i) \left( \frac{16}{0.625} \right)^{2} \times \left( \frac{0.16}{5} \right)^{2}
   ii) \frac{1}{2} \log_{a} b + 2 \log_{a} (\frac{a}{b}) + \log_{a} a^{2}
   b) Henry takes a train for two thirds of his journey, a bus for seven-eights of the remainder and walks the rest of the journey. If his bus journey is 3km longer than what he walks. How long is the complete journey?

14. A conical hole is drilled in a solid wooden pyramid as shown in the figure below.

Given that \overrightarrow{OQ} = 6cm, \overrightarrow{OR} = 10cm, depth of the cone \overrightarrow{AP} = 4cm and \overrightarrow{PR} = 2cm.

Find (i) the maximum volume of water the cone contain.
(ii) Volume of the remaining solid wood.
(iii) Surface area of the remaining solid wood.

15. Two cyclist A and B moved off from rest in the same direction. The speed of car A increases at a uniform rate of 20km/h, while the speed of B is as given in the table below.

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed (km/h)</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) Using a suitable scale, draw on the same axes the velocity-time graph of cars A and B.
   (i) Time when the cars have equal speeds and the magnitude of the speed.
   (ii) Difference in speeds after 5 hours.

16. In the diagram below, E is the midpoint of AB and F is the point of intersection of EF and AD.

Given that \overrightarrow{EF} = a \overrightarrow{AB} and \overrightarrow{EF} = b \overrightarrow{AD}.
Express the following vectors in terms of \overrightarrow{a} and \overrightarrow{b}.
(i) \overrightarrow{EF}
(ii) \overrightarrow{EF} (iii) \overrightarrow{AD}.

Given further that \overrightarrow{EF} = k \overrightarrow{AD} and \overrightarrow{EF} = \alpha \overrightarrow{AB}.
Find the two different expressions of \overrightarrow{EF} in terms of \overrightarrow{h}, \overrightarrow{b}, \overrightarrow{a}.
Hence find the scalars h and k.

Show that points O, F and E are collinear.
1. The table below shows a tax structure of some country.

<table>
<thead>
<tr>
<th>Income</th>
<th>Tax rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-50,000</td>
<td>Tax free</td>
</tr>
<tr>
<td>50,001-200,000</td>
<td>12</td>
</tr>
<tr>
<td>200,001-300,000</td>
<td>20</td>
</tr>
<tr>
<td>300,001-400,000</td>
<td>32</td>
</tr>
<tr>
<td>Above 400,000</td>
<td>44</td>
</tr>
</tbody>
</table>

Tax is levied on monthly income after the following allowances have been deducted:
Shs.45,000 for transport, Shs.64,000 for insurance, Shs.630,000 annually for feeding, Shs.11,800 for water and electricity, Shs.40,000 for airtime and communication. Family allowances are also offered at the following rates:
Shs.5,000 for each child below 10 years old and Shs.15,000 for each child aged between 10 and 19 years.
Mr. Made has a gross monthly salary of Shs.645,000 and has 5 children aged 7, 12, 18, 22 and 30 years. Family allowance is paid only for 3 children.
Calculate:
(a) His total monthly allowance.
(b) His income tax as a percentage of his gross monthly income.
(c) His net income.
1. a) Density of gases as compared to air.
b) Balloon A is displaced upwards because the gas therein is less dense than air. Balloon B contains a gas which is denser than air so it is displaced downwards.
c) Gas X – upward delivery/downward displacement of air.
Gas Y – downward delivery/upward displacement of air.
d) Used in advertisement balloons.

2. a) i) The two miscible liquid mixtures have different boiling points at which when they are heated, the liquids can be separated.
ii) Paper chromatography is based on the principle where molecules in mixture are applied onto the surface, the components have different speed along a stationary phase (stable phase) carried by a mobile phase. The more soluble solutes will move more rapidly and further up the paper than the other less soluble component(s).
b) Air contains substance (gases and suspended matter) not chemically combined together and can be separated by physical means.

3. a) i) A white ring is formed closer to the end with hydrochloric acid (at point x)
ii) NH₃(g) + HCl(g) → NH₄Cl(s)
b) Gases or matter is made up of particles/molecules that are constantly moving. Lighter molecules move faster than heavier ones. The molecules of ammonia are lighter than the molecules in hydrogen chloride. The molecules in ammonia diffuse faster than those of hydrogen chloride, hence forming ammonium chloride (product) closer to the side with hydrogen chloride.

4. a) An isotope is a variant of a particular chemical element which differs in neutron number and consequently in nucleon number.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>n⁺</td>
<td>Neutron</td>
<td>0</td>
</tr>
<tr>
<td>p⁺</td>
<td>Proton</td>
<td>+1</td>
</tr>
<tr>
<td>e⁻</td>
<td>Electron</td>
<td>−1</td>
</tr>
</tbody>
</table>

b) Using the symbol T to represent tritium, give the formulae of (i) T (ii) NaH

5. a) and b)

![Energy Diagram](image)

- When a catalyst is added, the activation energy is lowered. This lowers the energy required to form products hence the reaction is faster.

6. a) A redox reaction is a reaction in which one species is reduced and another is oxidised.
b) Haematite contain iron (III) oxide, Fe₂O₃. The oxygen is removed from the iron (III) oxide to form iron. This is a reduction reaction. The oxygen removed from haematite is added to carbon monoxide, forming carbon dioxide, which is an oxidation reaction. Since the process of extracting iron involves both reduction and oxidation reactions, it is a redox reaction.
c) Fe₂O₃(s) + 3CO(g) → 2Fe(l) + 3CO₂(g)

7. a) i) In the first set up, a pale green solution gradually turned colourless. In the second setup, a colourless gas that burns with a blue flame and a pop-sound is evolved.
ii) Zn(s) + Fe₂O₃(aq) → ZnO₂(aq) + Fe(s)
b) Used to fill weather station balloons. Used to harden margarine.

8. a) Polypropene, • It can be used at temperatures beyond 100°C • It is insoluble in organic solvents like oil. b) It has low usability temperature. With hot food, polychloroethene bags melts and dissolves in organic food and this may cause ill health.

i) High density polythene • Food packaging • Shopping bags • Dustbins crates • Water pipes

ii) Low density polythene • Squeezeable bottles • Cling film milk carton lining • Flexible water pipes cable jacketing

b) Polythene material is non-biodegradable. Poor disposal of polythene leads to pollution of soil and blockage of drainage systems.

9. a) i) Graphite has a very high melting and boiling point because the strong covalent bonds that hold the carbon atoms together in the layers require a lot of heat energy to break.
ii) The layers in graphite can slide over each other because the forces between them are weak. This makes graphite slippery.
b) - Making lead pencils. - Used as lubricant in electric devices.

10. a) the empirical formula of X

<table>
<thead>
<tr>
<th>Element</th>
<th>Formula</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.16</td>
<td>0.06</td>
</tr>
<tr>
<td>H</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>0.06</td>
<td></td>
</tr>
</tbody>
</table>

The empirical formula is CH₂O

b) This is also called the hydration of ethene. Steam is reacted with ethene in presence of phosphoric acid as a catalyst at a temperature of about 300°C and pressure of 60 atmospheres.
c) The orange solution of potassium dichromate turns green.

SECTION B

11. a) i) The reaction generates heat. Increasing or applying heat will lower the rate at which the products are formed.
ii) The reaction proceeds with increase in volume, since pressure and volume are inverse proportions. Increasing pressure will lower the rate of formation of products.
(b) During the reaction, ammonia and oxygen are passed through a powdered catalyst.
(i) Platinum
(ii) To increase the surface area upon which the reaction takes place
(ii) The catalyst lowers the activation energy required to form products. When applied, the reaction goes faster.

12. a) Carbon burns in limited air to form carbon monoxide gas 2C(s) + O₂(g) → 2CO(g)

b) Manganese(VII) oxide catalyses the decomposition of aqueous hydrogen peroxide. In an experiment 50.0 cm³ of aqueous hydrogen peroxide was mixed with 0.50 g of manganese(VII) oxide. The total volume of oxygen formed was measured every 10 seconds. The results of the experiment are shown in the graph.

![Graph](image)

- At the start, the graph shows an exponential increase in the volume of oxygen formed with time, due to a high concentration of reactants. However, later, as the concentration of reactants decrease, the volume of oxygen formed lowers until there is no more increase in volume of oxygen formed when the reactants are used up.

13. a) A colourless gas that turns lime water milky is given out.
b) Calcium oxide is manufactured by the decomposition of calcium carbonate.

- CaCO₃(s) → CaO(s) + CO₂(g)
- A drying agent in preparation of dry ammonia gas.
- i) Metal carbonate
- [Table]

<table>
<thead>
<tr>
<th>Metal carbonate</th>
<th>Identity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be</td>
<td></td>
</tr>
<tr>
<td>Mg</td>
<td></td>
</tr>
<tr>
<td>Na</td>
<td></td>
</tr>
<tr>
<td>Ca</td>
<td></td>
</tr>
<tr>
<td>Ba</td>
<td></td>
</tr>
<tr>
<td>Any group I metal carbonate e.g. Na₂CO₃</td>
<td></td>
</tr>
</tbody>
</table>
ii) Generally group 1 metal carbonates do not decompose when heated to give carbon dioxide, a basis for identifying Y. For other group II metals, reactivity increases down the group, so barium carbonate is more stable than magnesium carbonate since as you go down the group, the carbonate are more stable and therefore requires more time and heat to decompose them.

d) i) \( \text{Ca(NO}_3\text{)}_2(s) \rightarrow \text{CaO}(s) + \text{NO}_2(g) + \text{O}_2(g) \)

ii) Moles of calcium nitrate

\[
\text{Moles of calcium nitrate} = \frac{0.10}{164} = 0.00061 \text{ moles of calcium nitrate}
\]

From equation, 1 mole of calcium nitrate liberates 1 mole of gas

Moles of gas produced = 0.00061 moles (for either nitrogen dioxide or oxygen)


b) i) Iron

\( \text{N}_2(g) + \text{H}_2(g) \rightarrow \text{NH}_3(g) \)

Pressure: 200 atmospheres

temperature: 450ºC

c. After spreading a fertiliser containing ammonium nitrate onto his land, a farmer then spreads calcium hydroxide on his land. However the nitrogen content in soil remains low.

\[
2\text{NH}_4\text{NO}_3(s) + \text{Ca(OH)}_2 \rightarrow \text{Ca(NO}_3\text{)}_2(aq) + 2\text{NH}_3(g) + 2\text{H}_2\text{O(l)}
\]

Calculate the percentage of nitrogen in both the fertiliser and the nitrogen containing product in c(i) above

**Percentage of nitrogen in NH\(_4\)NO\(_3\)**

\[
\begin{align*}
N &= 2 \times 14 = 28 \\
O &= 3 \times 16 = 48 \\
H &= 3 \times 1 = 3
\end{align*}
\]

\[= 79\]

% of nitrogen in NH\(_4\)NO\(_3\) = \(\frac{28}{79} \times 100 = 35.44\%\)

**Percentage of nitrogen in Ca(NO\(_3\))\(_2\)**

\[
\begin{align*}
\text{Ca} &= 1 \times 40 = 40 \\
N &= 2 \times 14 = 28 \\
O &= 6 \times 16 = 96
\end{align*}
\]

\[= 164\]

% of nitrogen in Ca(NO\(_3\))\(_2\) = \(\frac{28}{164} \times 100 = 17.1\%\)

i) Because calcium hydroxide reacted with ammonium nitrate, forming calcium nitrate, which has a low nitrogen content as compared to ammonium nitrate.

d) i) Blue precipitate soluble in excess forms a deep blue solution

ii) With Fe\(^{2+}\) ions – white precipitate insoluble in excess with Zn\(^{2+}\) ions – white precipitate soluble in excess forms colourless solution

**CHEMISTRY QUESTIONS (OCHM006)**

1. Study the set-up below and answer the questions that follow.

   a) i) Name the substance that was collected in tube P.

   ii) Describe how hydrogen chloride gas can be tested in the laboratory.

   b) i) State what is observed in the combustion tube.

   ii) Write an equation for the reaction.

   c) Give a suitable condition for the experiment in the set-up.

2. Figure 5 shows an apparatus used to separate a mixture of water and hexene.

   a) Name the apparatus.

   b) State the principle by which the mixture of the two liquids is separated.

   c) i) Write an equation of reaction for preparation of chlorine gas

   ii) Explain how the melting points of their oxides compare.

   d) i) Give reasons why excess hydrogen chloride gas is dissolved using the funnel arrangement.

   ii) Write an equation for the reaction in c(i) above.

3. a) Distinguish between:

   i) Empirical and molecular formula of a compound

   ii) Atomic number and atomic mass

   b) Element U has atomic number 12, while element V has atomic number 16.

   i) Write the electron configuration of the elements

   ii) Explain how the melting points of their oxides compare.

4. The flow chart below represents some stages in the extraction of copper metal. Study it and answer the questions that follow.

   a) Identify two mistakes in the set-up, give a reason for each.

   b) i) Write an equation of reaction for preparation of chlorine gas

   ii) State any two uses of chlorine gas.

   c) Explain why a dry litmus paper dipped in a jar containing chlorine gas will not be bleached, whereas a moist litmus paper is bleached.

8. Study the flow chart below and answer the questions that follow.

   a) Name the anion present in the potassium salt.

   b) Write an ionic equation for the formation of solid M.

   c) Give one use of gas N.

9. 30.0 cm\(^3\) of aqueous sodium hydroxide containing 8.0 g per litre of sodium hydroxide were completely neutralised by 0.294 g of a dibasic acid. Determine the relative formula mass of the dibasic acid. (Na = 23.0, O = 16.0, H 1.0)

10. One of the allotropes of sulphur is rhomubic sulphur.

   a) Name the other allotrope of sulphur.

   b) Draw a diagram to show the shape of the allotrope named in (a) above.

   c) i) State what is observed when concentrated sulphuric acid is reacted with sulphur.

   ii) Write an equation for the reaction in c(i) above.

**SECTION B:**

11. a) Alkanes are said to be saturated hydrocarbons.

   i) What is meant by saturated hydrocarbons?

   ii) Draw the structure of the second member of the alkane homologous series and name it.

   b) When the alkane, hexane, is heated to high temperature, one of the products is ethene.

   i) Write the equation for the reaction.

   ii) Name the process described in (b).

   c) Study the flow chart below and answer the questions that follow.

12. The diagram below was used to prepare hydrogen chloride gas which was passed over heated iron powder.