P525/2 Inst. Sch.
CHEMISTRY
PRACTICAL
INSTRUCTIONS
2026

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY PRACTICAL INSTRUCTIONS

P525/2 Inst. Sch.

2026

CONFIDENTIAL

Great care should be taken that the information given below does not reach the candidates either directly or indirectly.

INSTRUCTIONS FOR PREPARING CHEMICALS AND APPARATUS

The head teacher **must** ensure that the teacher responsible for preparing the chemicals and apparatus hands in his/her procedures together with the trial results properly sealed in a separate envelope and **firmly** fastened (attached) on to the candidates' scripts envelop(s).

1. The description of the reagents and chemicals specified below does **not** necessarily correspond with the description in the examination paper. Candidates must **not** be informed of the differences.

2. Candidates are **not** allowed to use reference books (i.e. text books, booklets on qualitative and quantitative analysis etc.) during the examination.

3. In addition to the fittings and substances ordinarily contained in a chemistry laboratory, each candidate will require:

1 burette (50 ml)
1 pipette (25 ml or 20 ml)
2 volumetric flasks (250 ml)
2 conical flasks
2 plastic beakers
1 measuring cylinder (50 ml or 100 ml)
1 thermometer
1 stop clock/ stop watch
Labels
8 test tubes
200 cm^3 of distilled water
10 cm^3 of **Q**
1.2 g of **X**
2.0 g of **Y**
200 cm^3 of **FA1**

Easy access to:

- Heat source.
- Common reagents for identifying gases, cations, anions and organic compounds.
- Weighing balance reading to atleast one decimal point.
- Phenolphthalein indicator and methyl orange indicator

FA1 is prepared by diluting 166 cm^3 of concentrated hydrochloric acid with distilled water to make one litre of solution.

Q is propan-2-oɩ .
X is magnesium powder.
Y is solid magnesium oxide.

This form MUST be completed and returned in a separate envelope firmly attached to the script envelope(s).

UGANDA ADVANCED CERTIFICATE OF EDUCATION

2026

REPORT ON CHEMISTRY PRACTICAL P525/2

Section I:

Any information which the teacher responsible for preparing the apparatus and chemicals thinks may be useful to the examiners should be given on this sheet. The teacher must try all the items and submit his/her results together with the procedure in the space provided below to guide the scorers about the procedure used, apparatus and concentrations of the chemicals used.

NB: Teachers who **DO NOT** submit their procedures together with trial results will be held responsible for their candidates' performance.

Procedure and results:

Section II:

The Invigilator in consultation with the teacher responsible for preparing the apparatus and chemicals should give details below of any difficulties experienced by particular candidates, giving their names and personal numbers. This should include reference to:

(a) difficulties due to faulty apparatus,

_____

_____

_____

(b) accidents to apparatus or materials,

_____

_____

_____

(c) physical handicaps of candidates,

_____

_____

_____

(d) any other information.

_____

_____

_____

Other cases of hardship e.g. illness, disability, should be reported directly to **UNEB** in the normal way.

A plan of work benches, giving details by personal numbers of the places occupied by the candidates for each experiment, for each session, must be enclosed with the scripts.

Invigilator's Name_____Signature_____

Signature of the teacher responsible for preparing chemicals _____

Signature of the head teacher _____

Centre Number _____

END

P525/2
CHEMISTRY
Paper 2
(Practical)
2026
3¼ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 2
(Practical)

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

This examination paper consists of two **compulsory** *examination items.*

Responses to these items **must** *be written in the answer booklet provided.*

Begin each item on a fresh page.

All working must be clearly shown. Graph papers will be provided.

Mathematical tables and silent non-programmable scientific calculators may be used.

You are **not** *allowed to use reference books* (*i.e, text books, booklets on qualitative and quantitative analysis, etc.*)

 Turn Over

1. Organic compounds have many applications such as being used as solvents in industries, preservation of food stuffs and biological tissues. A secondary school is organising a science exhibition where students will showcase various chemical products made using organic compounds among other substances.

When the organisers of the exibition requested for samples, it was discovered that one of the containers did not bear a label. The organisers asked the students to use the content of the unlabelled container to determine the nature of organic compound as well as its likely application so that a label is printed before the exhibition. The students, however, did not know how this could be done and, hence, needed help.

You have been provided with liquid **Q** which is a sample of the unknown organic compound obtained from the unlabeled container.

Task:

a) Design and carry out systematic qualitative analysis investigation to generate information to be printed on the label.
(*At least* **8** *tests are required*).

b) Make justifiable recommendations on the most likely applications of **Q**.

2. Magnesium oxide has a potential of being used as a binder during construction. The enthalpy of formation is a good measure of stability but it is not easy to determine directly. This however can be done indirectly using Hess's law.

Senior Five learners in a certain secondary school are exploring the use of locally made magnesium oxide as an alternative to Portland cement. They want to begin by determining its stability in the environment, before being used in construction but they do not know how it can be done.
The laboratory technician, when approached by the learners, advised them to react approximately 1.2 g of magnesium metal and 2.0 g of magnesium oxide separately with not less than 60 cm^3 of dilute hydrochloric acid, measuring temperature after specific time intervals. However, with all this information, the learners could not determine the stability of magnesium oxide in the enviroment and therefore need your help.

The laboratory technician also gave them the following information.
Both magnesium metal and magnesium oxide react with hydrochloric acid separately according to the following equations;

$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$

$MgO_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_2O_{(l)}$

The heat of formation of water is represented by the equation.
$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)} \quad -285.8\ kJmol^{-1}$

The technician further provided that;
Specific heat capacity of water is 4.2 $Jg^{-1}mol^{-1}$.
Density of water is 1 gcm^{-3}.
Average heat of formation of portland cement is -3000 $kJmol^{-1}$.
(*Mg =24, O=16*)

You are provided with the following;

I. **Solid X**, which is magnesium metal.
II. **Solid Y**, which is magnesium oxide.
III. **FA1**, which is **2.0 M** hydrochloric acid.

Task:

Design and carry out an investigation then use your findings to help the senior Five learners.(*Your response should be in form of a scientific report. A minimum of* **six** *readings are required*).

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

P525/2 CHEMISTRY

SCORING GUIDE

FOR THE SAMPLE PAPER

Turn Over

Item 1.

To attain the highest level of achievement, a *candidate is expected to;*

- *develop clear logical and well sequenced plan using appropriate preliminary tests, specific tests and confirmatory tests for inorganic or organic substances.*
- *perform tests accurately, and record observations accurately for preliminary tests, specific tests and confirmatory tests.*
- *use observations made to make logical deductions for preliminary test, specific tests and confirmatory tests.*
- *give a recommendation based on conclusion.*

Possible response

TESTS	OBSERVATIONS	DEDUCTIONS
a) A small amount of **Q** was burnt on spatula end.	Colourless liquid burnt with a yellow non-sooty flame	**Q** is an aliphatic organic compound of low carbon content.
b) To 1cm3 of **Q** in a test tube was added 2 cm^3 of distilled water. The mixture was shaken and solution tested with blue and red litmus paper.	**Q** was completely miscible with water. The solution had no effect on both blue and red litmus paper.	Polar organic compound of low molecular mass. Neutral compound like alcohol, carbonyl compound present.
c) To 1 cm^3 of **Q** in a test tube was added Brady's reagent.	No observable change.	Carbonyl compound absent.
d) To 1 cm^3 **Q** in a test tube, 3 drops of acidified potassium dichromate(vi) sodium was added and mixture warmed (heated)	Orange solution turned green.	Primary alcohol or secondary alcohol present.
e) To 1 cm^3 of **Q** in a test tube was added 1cm3 of ethanoic acid and then 3 drops of concentrated sulphuric acid and mixture heated and then poured in water in a beaker.	A sweet fruity smell.	Ester formed so **Q** is a primary alcohol or a secondary alcohol.
f) To 1 cm^3 of **Q** in test tube was added 3 drops of acidified potassium dichromate(vi) solution and the mixture heated. The mixture was cooled and then	Orange solution formed green then. No reddish brown ppt was formed	Secondary alcohol oxidized to ketone.

Fehling's reagent added and heated.	with Fehling's reagent.	
g) To 1 cm^3 of **Q** was added to Lucas reagent.	A cloudy solution formed after 8 minutes.	Secondary alcohol present.
h) To 1 cm^3 of **Q** in a test tube, 3cm^3 of iodine solution was added followed by little sodium hydroxide solution.	Yellow precipitate formed	Secondary alcohol of the form CH_3CHR present.

Conclusion; **Q** is an aliphatic secondary alcohol of the form CH_3CHR.

Recommendations

Q can be used to make perfumes since it is a low molecular mass aliphatic alcohol.

Q can be used to make sanitizers since it is polar and soluble of low molecular mass.

Q can be used to make nail vanish remover since it has a hydro-carbon group that can dissolve non-polar compounds.

ITEM 2

Planning for the experiment

To attain the highest level of achievement, a *candidate is expected to present;*

- *an aim that should have the; nature of the experiment (the relationship between variables), the purpose of the experiment derived from the challenge in the scenario.*
- *all variables (independent, dependent and controlled).*
- *a correct hypothesis (prediction on the interaction of independent and dependent variables of the experiment with a reason for the prediction)*

Possible responses

Aim; An investigation to determine enthalpy of formation of magnesium oxide by measuring temperatures at specific time intervals when a fixed volume of hydrochloric acid separately reacts with a fixed mass of solid **X** and **Y** so as to determine the suitability of magnesium oxide as an alternative binder to Portland cement.

Hypothesis; The enthalpy of formation of magnesium oxide obtained by measuring temperatures at specific time intervals when a fixed volume of hydrochloric acid separately reacts with a fixed mass of solid **X** and **Y** is lower than that of Portland cement.

Variables

Independent variables; Type of solid (**X** or **Y**) and time.

Dependent variables; Temperature of solution for **X** and **Y**.

Controlled variables; Volume of hydrochloric acid used was 60 cm^3.

The mass of solid **X** and **Y** were fixed at 1.2 g and 2.0 g respectively.

Time intervals used was 30 seconds.

Methodology of the experiment.

To attain the highest level of achievement, a *candidate is expected to;have a procedure with; all the relevant steps logical presented and coherent to the scenario, well used apparatus, appropriate quantities of variable used, mitigated risks.*

Procedure;

i) 1.2g of solid **X** (magnesium metal) was weighed using a weighing balance.
ii) 60.0 cm^3 of FA1 (hydrochloric acid) was measured using a measuring cylinder and transferred into a plastic beaker.
iii) The initial temperature of the acid was measured using a thermometer and recorded.
iv) Solid **X** was added to acid in the plastic beaker and a stop clock started immediately.
v) The temperature of the mixture was noted and recorded after every 30 seconds for three minutes.
vi) Procedure (i) to (v) were repeated using 2.0g of **Y** (magnesium oxide) instead of **X**.
vii) The results were tabulated.

Alternative Procedure;

i) 1.2 g of solid **X** (magnesium metal) was weighed using a weighing balance.
ii) 60.0 cm^3 of FA1 (hydrochloric acid) was measured using a measuring cylinder and transferred into a plastic beaker.
iii) The initial temperature of the acid was measured using a thermometer three consecutive times after every 30 seconds for one minute then solid X was added and the recording of the temperature continued for another three minutes.
iv) Procedure (i) to (iii) was repeated by using 2.0 g of solid **Y** (magnesium oxide) instead of **X**.
v) The results were tabulated.

Mitigated risks.

The reaction gives off hydrogen gas which when inhaled can cause respiratory complications. This can be avoided by wearing a face mask to prevent inhalation of the gas.

Injuries and cuts from broken glass equipment. This can be mitigated by wearing closed shoes, gloves to prevent contact of the body with broken glass.

Data presentation

To attain the highest level of achievement, a *candidate is expected to;*
to present complete data sets required, data must be accurate (presented with correct decimal places within accuracy range), data presented in appropriate formats, variables in the table must be with correct units.

Volume of FA1 used = 60.0 cm^3

Mass of solid **X** + container (g)	101.2
Mass of container only (g)	100.0
Mass of **X** weighed (g)	1.2

Mass of solid **Y** + container (g)	102.0
Mass of container only (g)	100.0
Mass of **Y** weighed (g)	2.0

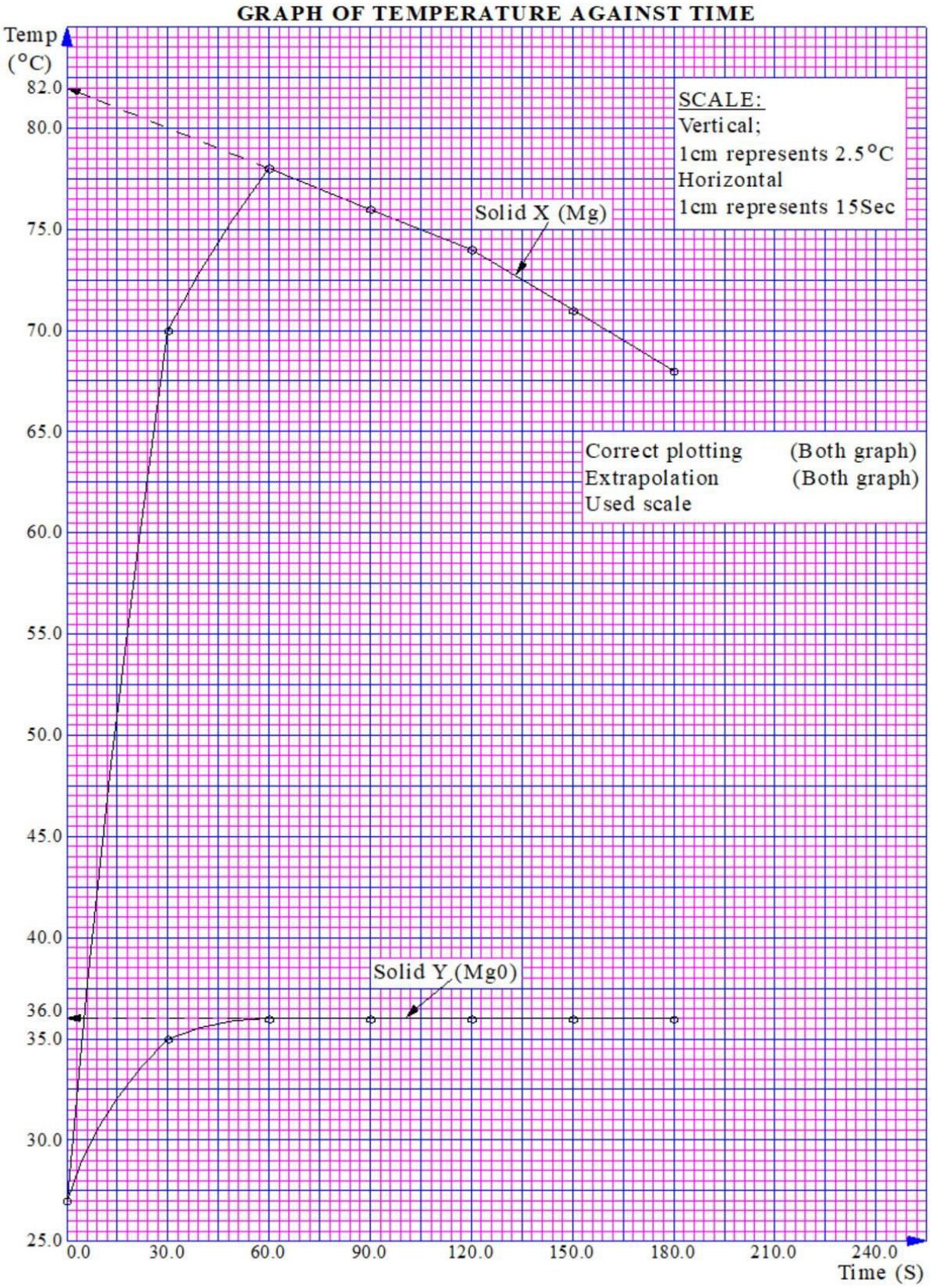
Time (s)	0.0	30.0	60.0	90.0	120.0	150.0	180.0
Temperature of **X** + HCl (^{0}C)	27.0	70.0	78.0	76.0	74.0	71.0	68.0
Temperature of **Y** + HCl (^{0}C)	27.0	35.0	36.0	36.0	36.0	36.0	36.0

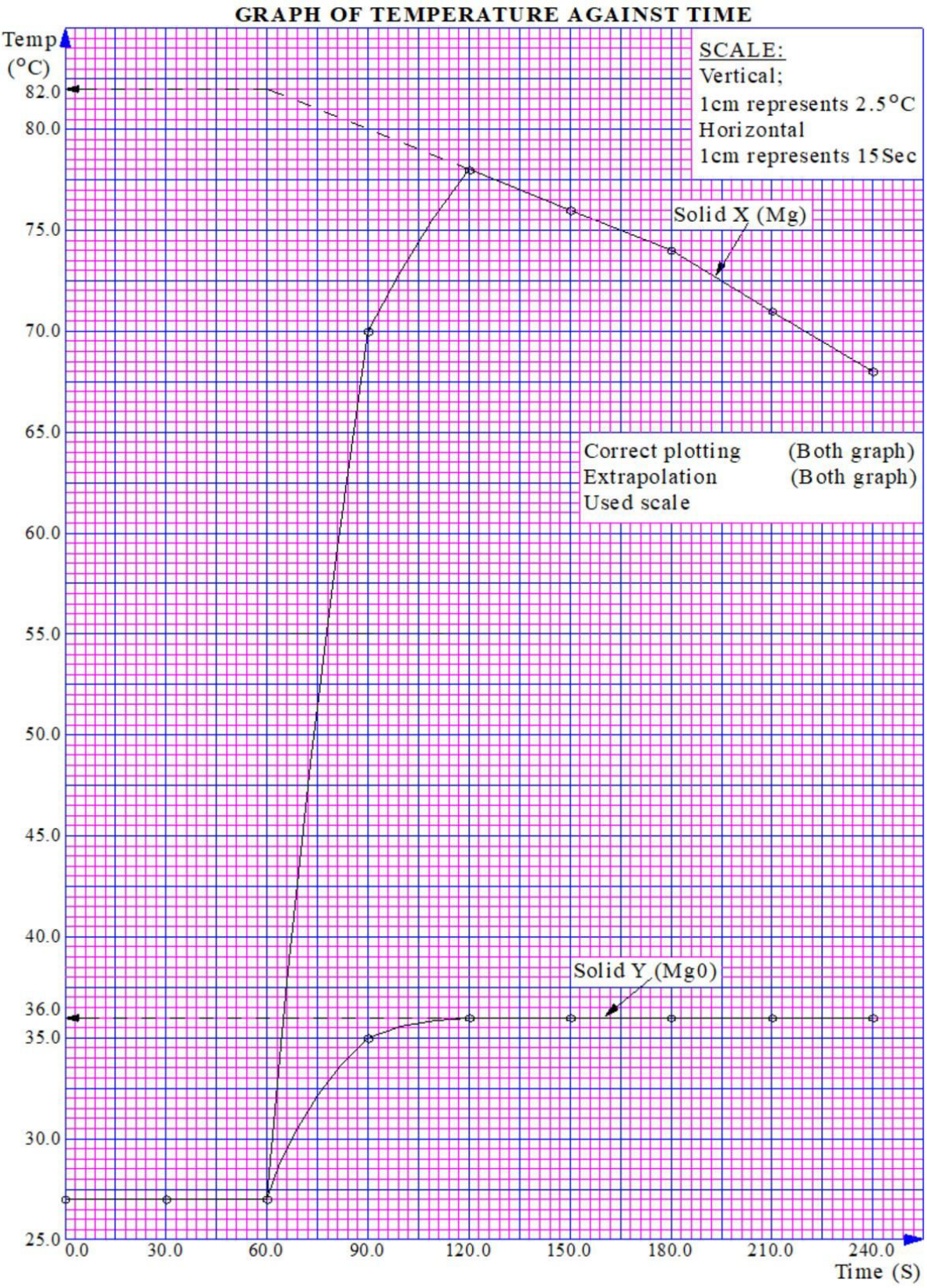
Alternative

Time (s)	0.0	30.0	60.0	90.0	120.0	150.0	180.0	210.0	240.0
Temperature of **X** + HCl (^{0}C)	27.0	27.0	27.0	70.0	78.0	76.0	74.0	71.0	68.0
Temperature of **Y** + HCl (^{0}C)	27.0	27.0	27.0	35.0	36.0	36.0	36.0	36.0	36.0

Data interpretation

To attain the highest level of achievement, a *candidate is expected to;*
identify trends and relationships, apply scientific principles to give logical interpretation of data.





Determination of the enthalpy for the reaction;

$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$

Heat change; MCΔT

ΔT (82.0 – 27.0) = 55.0 ^{0}C

Mass of solution; (density X volume)

(1.0 x 60) = 60.0 g

C = 4.2

Heat change; (60 x 4.2 x 55.0) = 13860 J

Moles of solid **X** used; (1.2/24) = 0.05 moles

0.05 moles of solid **X** liberated 13860 J

1 mole of solid **X** liberated $\frac{(13860 \times 1)}{0.05}$

277200 Jmol^{-1}

277.2 kJmol^{-1}

The enthalpy of the reaction between solid **X** and hydrochloric acid is -277.2kJmol^{-1}.

Determination of enthalpy of reaction for;

$MgO_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_2O_{(l)}$

Heat change; MCΔT

ΔT; (36.0 – 27.0) = 9.0 ^{0}C

Mass of solution; (1 x 60) = 60 g

Heat change = (60 x 4.2 x 9.0); 2263 J

Number of moles of Y; (2.0/40.0) = 0.05 moles

0.05moles of Y liberated 2268J of heat

1 mole of Y liberated $\frac{(2268 \times 1)}{0.05}$ J

= 45360 Jmol^{-1}

= 45.36 kJmol^{-1}

The enthalpy of the reaction between solid Y and hydrochloric acid is -45.36KJmol^{-1}.

Enthalpy of formation of MgO.

$Mg_{(s)} + ½O_{2(g)} \longrightarrow MgO_{(s)}$

$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$ -277.2 kJmol^{-1} ……(i)

$MgO_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_2O_{(g)}$ -45.36 kJmol^{-1} ……...(ii)

$H_{2(g)} + ½O_{(g)} \longrightarrow H_2O_{(l)}$ -285.8 kJmol^{-1} ……(iii)

Applying Hess's law;

Equation (i) + Reversed equation (ii) + Equation (iii)

-277.2 + 45.36 + (-285.8)

= -518 kJmol^{-1}

The enthalpy of formation of magnesium oxide is -518 kJmol^{-1} and exothermic.

Conclusion and recommendation

To attain the highest level of achievement, a *candidate is expected to;*
to give a recommendation (linked to the challenge in the scenario)and based on conclusion (conclusion should be linked to the hypothesis).

Conclusion;
The enthalpy of formation of magnesium oxide is -518 $kJmol^{-1}$ which is less negative than that of Portland cement (-3000 $kJmol^{-1}$). Therefore, magnesium oxide is less stable than Portland cement.
Recommendation;
Magnesium oxide is not a suitable alternative to Portland cement as a binder.