



Rewarding Learning

General Certificate of Secondary Education

Centre Number

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Candidate Number

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GCSE Chemistry

Unit 1

Higher Tier



[GCM12]

GCM12

Assessment

TIME

1 hour 15 minutes.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **2(c)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

12461



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1 Atoms are made up of three types of subatomic particles – protons, neutrons and electrons.

(a) State the approximate size of the radius of an atom.

_____ [1]

(b) The table below gives details of some atoms and ions (A, B, C and D). The letters do not represent the symbols for elements.

Atom/ion	Number of protons	Number of electrons	Electronic configuration
A	11	10	2,8
B	20	20	2,8,8,2
C	7	10	2,8
D	1	1	1

(i) Which one of A, B, C or D is an ion with a charge of 3-?

_____ [1]

(ii) Which one of A, B, C or D is found in Period 4 of the Periodic Table?

_____ [1]

(iii) Identify A.

_____ [2]



(c) (i) The neutron was the last of the three subatomic particles to be discovered. Suggest a reason for this.

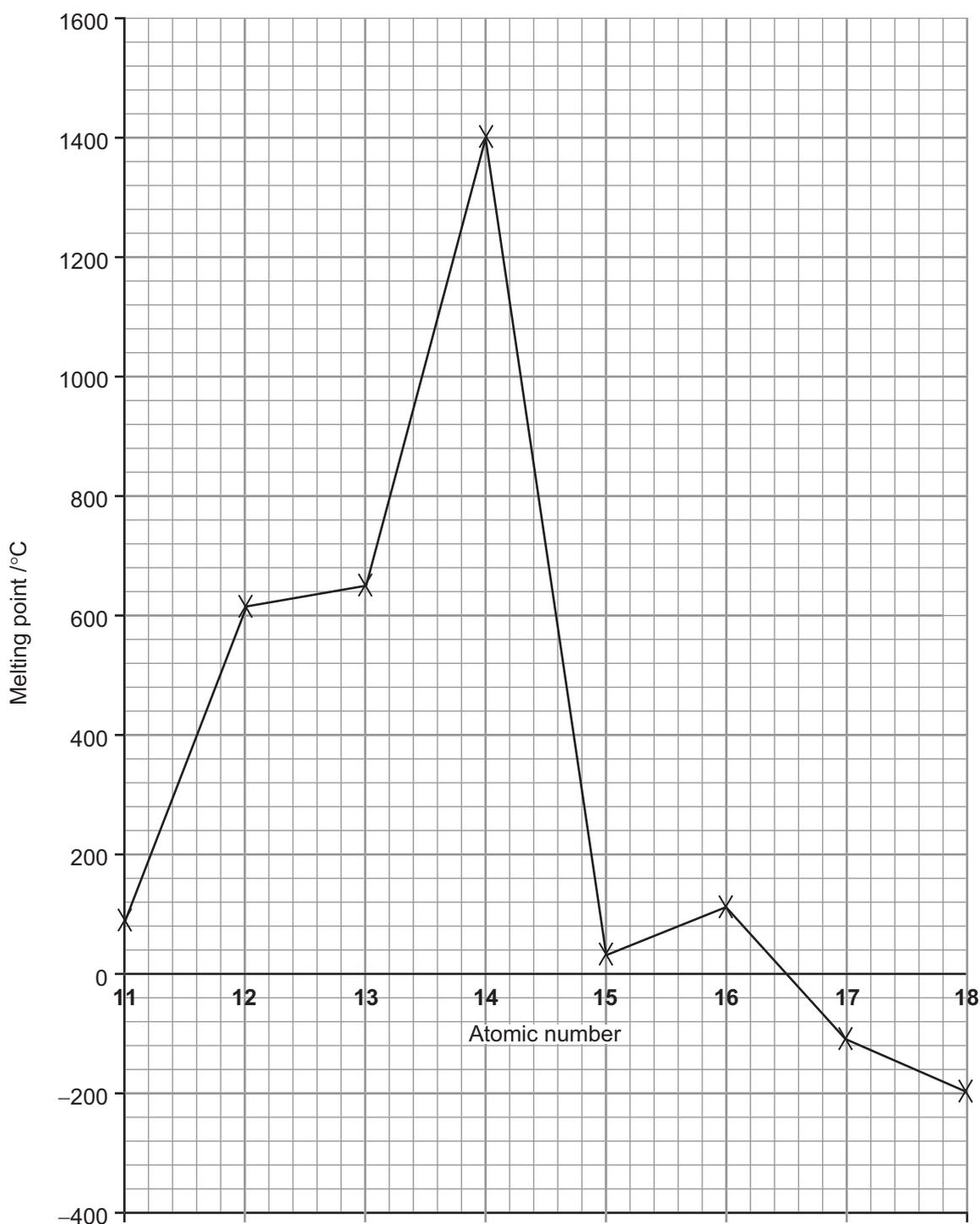
[1]

(ii) Name the scientist who discovered the neutron.

[1]



(d) The elements in Period 3 of the Periodic Table differ in their melting point and their electrical conductivity. The graph below shows the melting points of the Period 3 elements.



12461



24GCM1204

(i) Name the element with a melting point of -200°C .

[1]

(ii) Explain, in terms of bonding and structure, why the element chlorine has a low melting point.

[3]

(iii) Aluminium has the highest electrical conductivity in Period 3. Explain why aluminium conducts electricity.

[2]

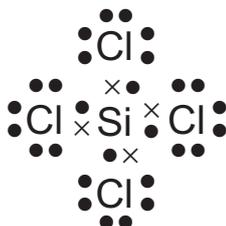
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12461



24GCM1205

- (e) Chlorine gas reacts with silicon to form the compound silicon tetrachloride.
The diagram below shows the bonding in a molecule of silicon tetrachloride.



- (i) Write the formula of silicon tetrachloride.

_____ [1]

- (ii) Name the type of bonding found in a molecule of silicon tetrachloride.

_____ [1]



2 Approximately 80% of the elements in the Periodic Table are metals.

(a) What is meant by the term element?

_____ [1]

(b) Atoms of metal X have 2 electrons in their outer shell. Metal X reacts with chlorine to form a metal chloride.

(i) To which group of the Periodic Table does metal X belong?

_____ [1]

(ii) Write the formula of the metal chloride formed.

_____ [1]

(iii) Write a half equation to show the formation of chloride ions from a chlorine molecule.

_____ [3]

[Turn over





[6]

(d) Group 0 of the Periodic Table contains unreactive gases including neon.

(i) What name is given to Group 0?

[1]

(ii) State the colour of neon.

[1]

(iii) Explain why Group 0 elements are unreactive.

[2]



3 Nitric acid is a strong acid and has many uses in food processing and in the manufacture of fertilisers and explosives.

(a) Complete the table below.

Indicator	Colour in nitric acid
phenolphthalein	
methyl orange	

[2]

(b) Nitric acid is used to remove magnesium deposits in dairy processing factories. The reaction between magnesium and nitric acid releases heat energy.

(i) Write a balanced symbol equation for the reaction between magnesium and nitric acid.

_____ [3]

(ii) State two **other** observations you would make during this reaction.

1. _____

2. _____ [2]

(c) Ammonium nitrate is an important fertiliser which may be produced from the reaction of nitric acid with ammonium carbonate.

(i) Name one **other** substance which would react with nitric acid to form ammonium nitrate.

_____ [1]

(ii) Describe the appearance of ammonium nitrate.

_____ [2]



(iii) When heated rapidly, ammonium nitrate decomposes according to the following equation:



Write a balanced symbol equation for this reaction.

_____ [3]

(d) Sodium nitrate is a salt which is used as a food preservative. It may be produced from the reaction between nitric acid and solid sodium hydrogencarbonate.

(i) What do you understand by the term salt?

_____ [2]

(ii) Write the balanced symbol equation for the reaction between nitric acid and sodium hydrogencarbonate.

_____ [2]

(iii) State two observations you would make during this reaction.

1. _____

2. _____ [2]

[Turn over



(e) Trinitrotoluene (TNT) is an explosive produced using nitric acid. TNT has the formula $C_7H_5N_3O_6$.

Calculate the percentage of nitrogen by mass in TNT.

percentage = _____ % [2]





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12461

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24GCM1213

4 (a) Nicotine is a harmful and highly addictive compound found in tobacco.

A sample of nicotine was analysed and found to contain the following percentage composition by mass.

Element	Percentage by mass/%
Carbon	74.17
Hydrogen	8.61
Nitrogen	17.22

(i) Determine the empirical formula of nicotine.

empirical formula: _____ [4]



(ii) The relative molecular mass (M_r) of nicotine is 162. Determine the molecular formula of nicotine.

molecular formula: _____ [1]



- (b)** Household bleach contains the chemical sodium hypochlorite, NaOCl, which can cause irritation of the eyes, skin and lungs.

Sodium hypochlorite may be produced from the reaction of sodium hydroxide and chlorine. The balanced symbol equation for the reaction is:



200 g of sodium hydroxide were added to 142 g of chlorine and a reaction occurred.

- (i)** Calculate the number of moles of sodium hydroxide in 200 g.

moles of sodium hydroxide = _____ [1]

- (ii)** Calculate the number of moles of chlorine in 142 g.

moles of chlorine = _____ [1]



(iii) Determine which reactant is the limiting reactant.

_____ [1]

(iv) Calculate the mass of sodium hypochlorite produced in this reaction.

mass of sodium hypochlorite = _____ g [2]



5 Potassium iodide is used as a medicine and dietary supplement.

- (a)** A solution of potassium iodide was prepared by weighing out 39 g of potassium iodide and adding it to 25 g of water in a boiling tube.

The boiling tube was placed in a beaker of water and heated using a Bunsen burner. The contents of the boiling tube were stirred using a thermometer. All the potassium iodide dissolved and a saturated solution was obtained at 35°C.

- (i)** Draw a labelled diagram of the assembled apparatus used in this experiment.

[3]



(ii) Explain what is meant by the term saturated solution.

[1]

(iii) Calculate the solubility of potassium iodide at 35°C.

solubility = _____ g/100g water [1]

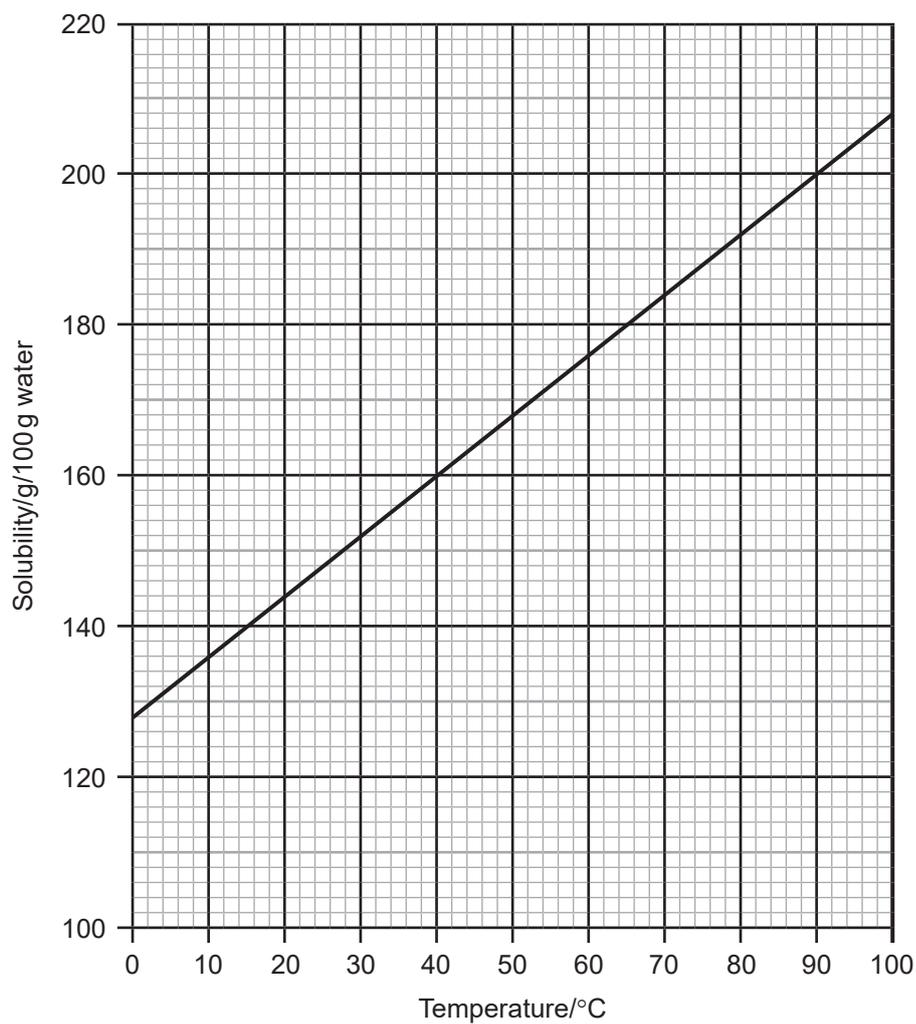
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(b) A solubility curve for potassium iodide is shown below.



Use the solubility curve to answer the questions opposite.



(i) What is the solubility of potassium iodide at 70°C?

solubility = _____ g/100g water [1]

(ii) A hot solution of potassium iodide containing 192 g of potassium iodide in 100 g of water is cooled from 90°C to 30°C. At what temperature will crystals begin to form?

temperature = _____ °C [1]

(iii) A saturated solution of potassium iodide in 250 g of water at 60°C was cooled from 60°C to 30°C. What mass of crystals was deposited?

mass = _____ g [4]

[Turn over

12461



24GCM1221

(c) The table below shows the results of some anion and cation tests which were carried out on three solutions, X, Y and Z.

Test	Solution X	Solution Y	Solution Z
Flame test		yellow flame	
Add sodium hydroxide solution	green precipitate	no reaction	brown precipitate
Add barium chloride solution	white precipitate	no reaction	no reaction
Add silver nitrate solution	no reaction	yellow precipitate	cream precipitate

(i) Based on the results above, write the formulae of the anion and the cation present in each solution, X, Y and Z.

Solution X: _____ and _____

Solution Y: _____ and _____

Solution Z: _____ and _____ [6]

(ii) Name the white precipitate formed when barium chloride solution was added to solution X.

_____ [1]

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24GCM1223

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	

Total Marks	
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Examiner Number

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