New Specification

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2018–2019

Double Award Science: Chemistry

GDW22

Unit C1
Higher Tier

[GDW22]

THURSDAY 8 NOVEMBER 2018, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **5(a)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

Examiner Only	
Marks	Remark

1 A representation of part of the Periodic Table developed by Mendeleev is shown below. Mendeleev's Periodic Table did not contain the noble gases as they had not been discovered at that time.

Li	Be	B	C	N	O	F	Fe
Na	Mg	Al	Si	P	S	Cl	Co
K	Ca		Ti	V	Cr	Mn	Ni
Cu	Zn			As	Se	Br	Ru
Rb	Sr	In	Zr	Nb	Mo	I	Rh

(a) State three differences, other than the absence of the noble gases, between the Periodic Table developed by Mendeleev and the modern Periodic Table.

1. _____

_____

2. _____

_____

3. _____

_____ [3]

(b) **(i)** Why were the noble gases more difficult to discover and identify than the other gaseous elements?

_____

_____

_____ [2]

(ii) What colour is neon gas?

_____ [1]

Examiner Only	
Marks	Remark

2 Many medicines are often referred to as formulations.

(a) Explain fully the meaning of the term “formulation”.

_____

_____

_____

_____ [3]

(b) Milk of magnesia is a common medicine. It contains insoluble magnesium hydroxide suspended in water.

Name the most suitable separation technique to separate the magnesium hydroxide from the water.

_____ [1]

(c) When magnesium hydroxide powder is added to dilute nitric acid, a reaction occurs.
Give two observations that can be made during this reaction.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

3 Atoms and ions are made up of the three subatomic particles: protons, electrons and neutrons.

(a) Information about an atom of indium is shown below.

$$^{115}_{49}\mathrm{In}$$

(i) How many neutrons does this atom of indium contain?

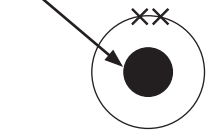
_____ [1]

(ii) Indium forms an indium(III) ion, In^{3+}. How many electrons would this ion contain?

_____ [1]

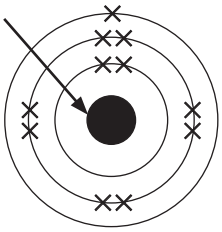
(b) The diagrams below show some atoms and ions of elements in the Periodic Table. They are labelled **Q**, **R**, **S**, **T**, **U** and **V**.

3 protons
4 neutrons



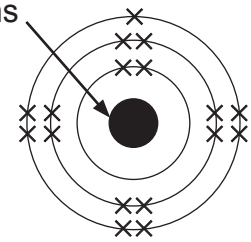
Q

11 protons
12 neutrons



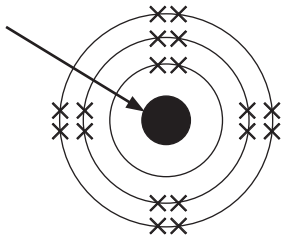
R

17 protons
20 neutrons



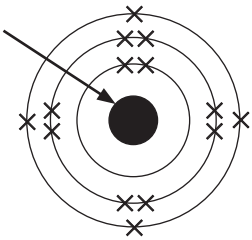
S

19 protons
20 neutrons



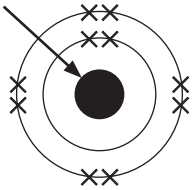
T

14 protons
14 neutrons



U

8 protons
8 neutrons



V

Examiner Only

Marks	Remark

(i) Complete the table below about the atoms and ions **Q** to **V**. Some information has already been filled in.

Atom or Ion	Atomic number	Mass number	Number of electrons	Electronic configuration
Q	3		2	2
R	11	23		2,8,1
S		37		2,8,7
T	19	39	18	
U	14		14	
V		16	10	2,8

[4]

(ii) Which of the diagrams **Q, R, S, T, U** or **V** represent ions?

_____ [2]

(c) The element thallium has two isotopes, thallium-203 (^{203}Tl) and thallium-205 (^{205}Tl). The percentage abundance of the isotopes are given in the table below.

Isotope	Percentage abundance/%
thallium-203 (^{203}Tl)	30
thallium-205 (^{205}Tl)	70

Use the information in the table to calculate the relative atomic mass of thallium.

Show your working out.

relative atomic mass = _____ [2]

Examiner Only	
Marks	Remark

4 When sodium is added to water it moves on the surface of the water, fizzes as a gas is produced and heat is released.

(a) State two other observations which occur when sodium reacts with water.

1. _____

2. _____ [2]

(b) Write a balanced symbol equation for the reaction of sodium with water.

_____ [3]

(c) The reactions of potassium with water and sodium with water are very similar.

(i) State two observations which occur when potassium reacts with water which are not observed when sodium reacts with water.

1. _____

2. _____ [2]

(ii) Explain why sodium and potassium have similar chemical properties.

_____

_____

_____ [2]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

5 **(a)** Iodine is a halogen which has a molecular covalent structure. If some iodine is placed in a boiling tube and gently heated, the iodine sublimes. The experiment should be carried out in a fume cupboard.

Demonstrate your understanding of the above paragraph.

You should:

- Describe what is observed in the boiling tube when iodine sublimes
- Explain why the experiment should be carried out in a fume cupboard
- Explain, in terms of having a molecular covalent structure, why iodine sublimes

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

Describe what is observed in the boiling tube when iodine sublimes.

Explain why the experiment should be carried out in a fume cupboard.

Explain, in terms of having a molecular covalent structure, why iodine sublimes.

[6]

(b) Describe the test for chlorine gas. State the result if the gas is chlorine.

Test: _____

_____

Result: _____

_____

_____ [3]

(c) When chlorine reacts with potassium bromide solution a displacement reaction occurs.
Write a balanced symbol equation for this reaction.

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 Iron forms a variety of compounds.

(a) Calculate the relative formula mass (M_r) of the following compounds which contain iron.
(relative atomic masses: C = 12, O = 16, S = 32, Fe = 56)

(i) $FeCO_3$

_____ [1]

(ii) $Fe_2(SO_4)_3$

_____ [1]

(b) Complete the sentence below.

The mass of one mole of a substance in grams is _____

_____

_____ [1]

(c) Iron(III) hydroxide decomposes when heated according to the equation below.

$$2Fe(OH)_3 \rightarrow Fe_2O_3 + 3H_2O$$

(relative formula masses: $Fe(OH)_3$ = 107; Fe_2O_3 = 160)

(i) How many moles are present in 2.14 g of iron(III) hydroxide?

_____ [1]

(ii) Calculate the theoretical yield (in grams) of iron(III) oxide, Fe_2O_3, formed from 2.14 g of iron(III) hydroxide.

theoretical yield = _____ g [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 Non-metallic elements and compounds contain covalent bonds.

(a) What is meant by the term s**ingle covalent bond**?

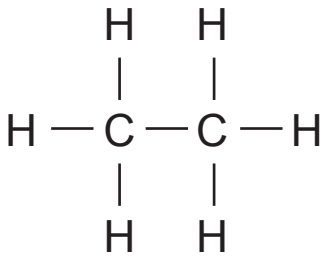
_____

_____ [1]

(b) Use a dot and cross diagram to show **all** the electrons in a molecule of nitrogen, N_2.

[3]

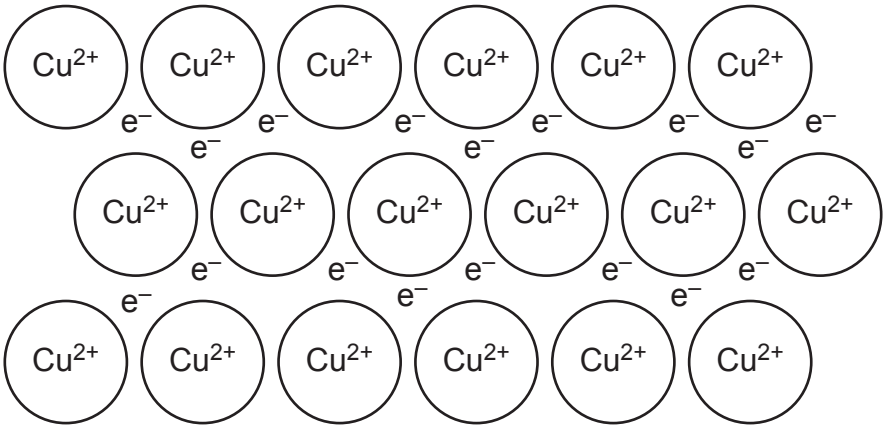
(c) Ethane is a chemical found in natural gas and has the formula C_2H_6. The diagram below represents a molecule of ethane.



How many covalent bonds are shown in the diagram above?

_____ [1]

8 The diagram below shows the structure and bonding in copper metal.



(a) What is represented in the diagram by e^-?

_____ [2]

(b) Explain the bonding in copper metal.

_____

_____

_____

_____ [2]

(c) Explain why copper conducts electricity.

_____

_____

_____ [2]

(d) Explain why copper is ductile.

_____

_____

_____ [3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 Carbonic acid is a weak acid found in carbonated drinks. A solution of carbonic acid has a pH of 4. It can be produced by the reaction below:

carbon dioxide + water → carbonic acid

(a) What is the chemical formula of carbonic acid?

_____ [1]

(b) Explain fully why carbonic acid is described as a weak acid.

_____

_____ [2]

(c) A solution of carbonic acid can be neutralised by adding sodium hydroxide solution.
Write an ionic equation, with state symbols, for the neutralisation reaction.

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

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