

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Learner Registration Number

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**Pearson BTEC Level 3 Nationals Certificate, Extended Certificate,
Foundation Diploma, Diploma, Extended Diploma**

Time 40 minutes

**Paper
reference**

31617H/1C

Applied Science/Forensic and Criminal Investigation

UNIT 1: Principles and Applications of Science I

Chemistry

SECTION B: PERIODICITY AND PROPERTIES OF ELEMENTS

You must have:

A calculator and a ruler.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The exam comprises three papers worth 30 marks each:
 - Section A: Structures and Functions of Cells and Tissues (Biology)
 - Section B: Periodicity and Properties of Elements (Chemistry)
 - Section C: Waves in Communication (Physics).
- The total mark for this exam is 90.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- The periodic table of elements can be found at the back of this paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

1 Figure 1 shows some metals in order of reactivity.

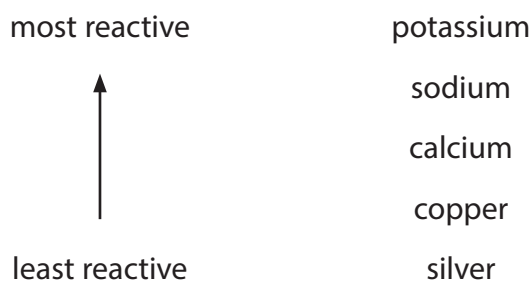


Figure 1

(a) (i) Give **one** use of silver that relies on the low reactivity of the metal.

(1)

(ii) Name **one other** metal, **not** shown in Figure 1, that is more reactive than sodium.

You may use the periodic table to help you answer the question.

(1)

(iii) Explain, in terms of atomic structure, why calcium is less reactive than sodium.

(2)

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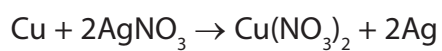
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(b) When copper metal is placed in a solution of silver nitrate, a redox reaction takes place.

The equation for this reaction is:



Explain which element is oxidised and which element is reduced in this reaction.

(4)

oxidised

.....

.....

.....

reduced

.....

.....

.....

(Total for Question 1 = 8 marks)

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2 (a) Manganese is a transition metal.

(i) Give **one** property of transition metals.

(1)

(ii) A manganese atom has five electrons in its 3d subshell.

Identify the correct arrangement of electrons in the 3d subshell of a manganese atom.

(1)

- A

↑↓	↑↓	↑		
----	----	---	--	--
- B

↑↓	↑↓	↓		
----	----	---	--	--
- C

↑↓	↑	↑	↑	
----	---	---	---	--
- D

↑	↑	↑	↑	↑
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(b) Potassium permanganate, KMnO_4 , is a compound of manganese.

0.050 dm³ of a solution of potassium permanganate contains 1.975 g of potassium permanganate.

Calculate the concentration of this solution in g dm⁻³.

(2)

concentration = g dm⁻³

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(c) (i) The solution contains 0.489g of potassium ions.

Calculate the number of moles of potassium ions in the solution.

(1)

relative atomic mass of potassium = 39.1

number of moles =

(ii) Calculate, using your answer to (c) (i), the number of potassium ions in the solution.

If you did not get an answer for (c) (i), use the value 0.016 for the number of moles.

(2)

Use the equation:

number of ions = number of moles \times Avogadro constant

Avogadro constant = $6.02 \times 10^{23} \text{ mol}^{-1}$

Show your working.

number of potassium ions =

(Total for Question 2 = 7 marks)



3 Figure 2 shows four simple molecular, covalent compounds.

$\begin{array}{c} \text{H}-\text{N}-\text{H} \\ \\ \text{H} \end{array}$	$\text{O}=\text{C}=\text{O}$	$\text{H}-\text{Cl}$	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$
ammonia	carbon dioxide	hydrogen chloride	methane

Figure 2

(a) (i) Which molecule in Figure 2 has a relative molecular mass of 17?

(1)

- A ammonia
- B carbon dioxide
- C hydrogen chloride
- D methane

(ii) Which molecule in Figure 2 has the strongest covalent bond?

(1)

- A ammonia
- B carbon dioxide
- C hydrogen chloride
- D methane

(b) Draw the dot and cross diagram for a molecule of carbon dioxide.

(2)

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(c) Figure 3 shows the three-dimensional structure of a molecule of methane.

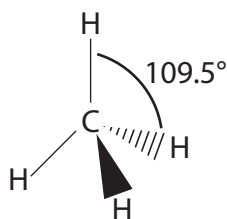


Figure 3

Explain why all the bond angles in methane are 109.5° .

(2)

.....

.....

.....

(d) Simple molecular compounds have weak intermolecular forces between the molecules.

Complete Table 1 with ticks and crosses to show which intermolecular forces exist between the molecules.

Carbon dioxide has been completed for you.

(3)

molecule	structure	intermolecular force		
		hydrogen bonding	permanent dipole – dipole forces	temporary – induced dipole forces
carbon dioxide	O=C=O	x	x	✓
ammonia	$\begin{array}{c} \text{H}-\text{N}-\text{H} \\ \\ \text{H} \end{array}$			
hydrogen chloride	H-Cl			
methane	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$			

Table 1

(Total for Question 3 = 9 marks)



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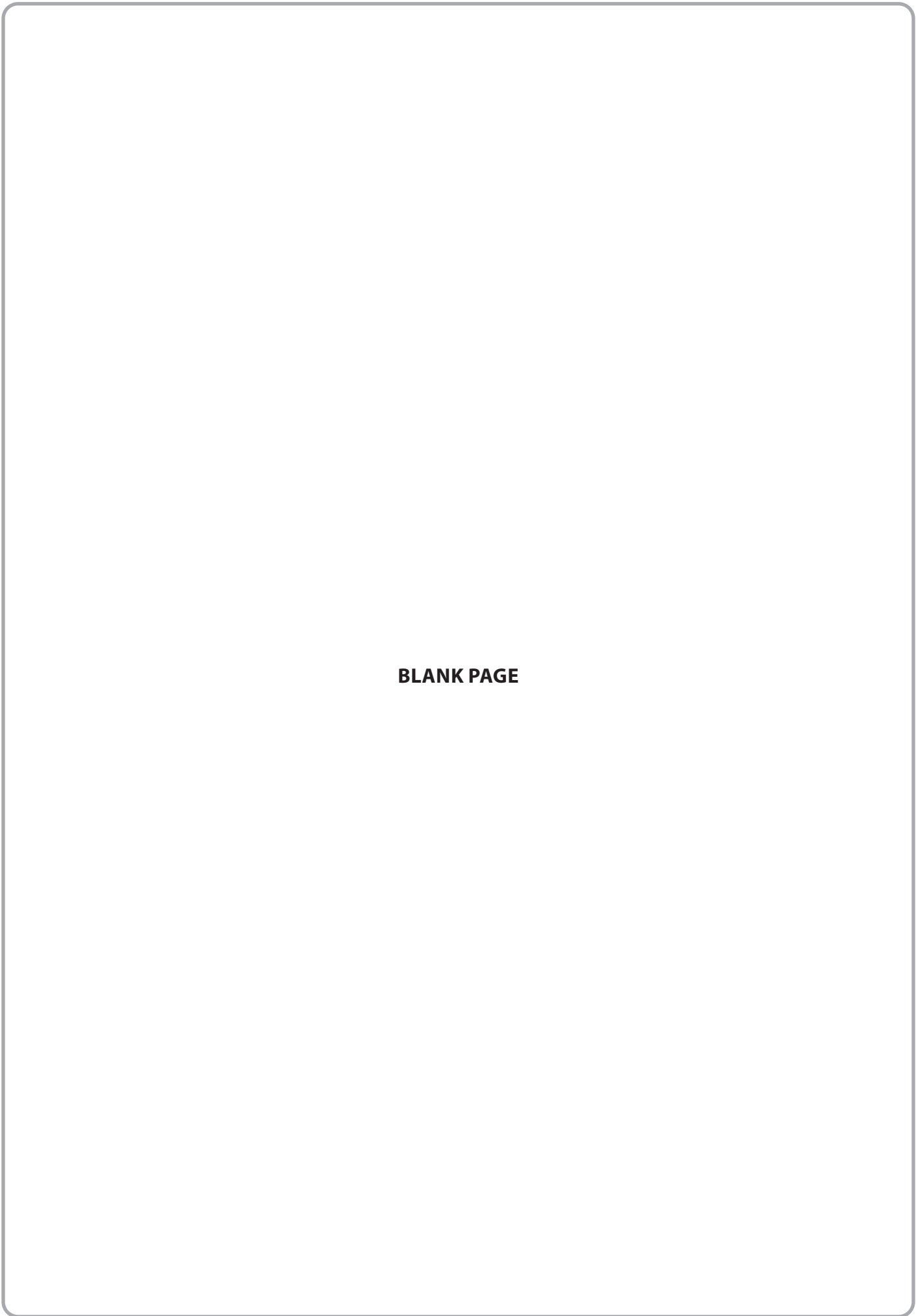
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Handwriting practice area with 15 horizontal dotted lines.

(Total for Question 4 = 6 marks)

TOTAL FOR SECTION B = 30 MARKS





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