

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson BTEC
Level 3
Nationals
Certificate

Centre Number

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Learner Registration Number

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Wednesday 15 January 2020

Morning (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: Structure 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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P 6 3 9 4 2 A 0 1 1 2



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

Some questions must be answered with a cross in a box ☒. 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 a molecule of the covalent compound tetrachloromethane.

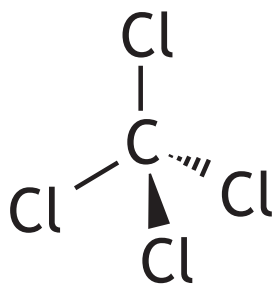


Figure 1

- (a) Identify the reason why the molecule in Figure 1 has a tetrahedral shape.

(1)

- ☐ A Each chlorine atom forms four single bonds.
- ☐ B The carbon atom forms four single bonds.
- ☐ C The carbon atom forms two double bonds.
- ☐ D The molecule has four atoms.

- (b) Complete the dot and cross diagram, in Figure 2, for tetrachloromethane, CCl_4 .

Show outer electrons only.

(2)

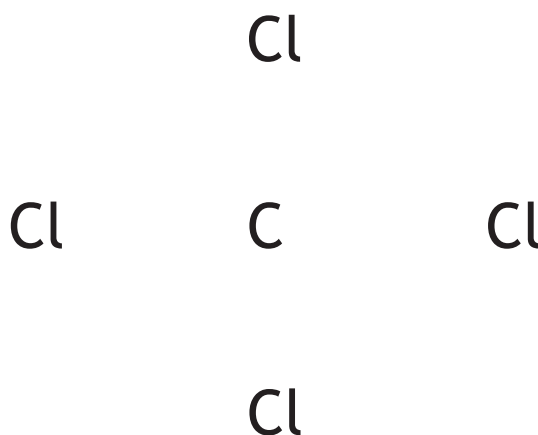


Figure 2



(c) CCl_4 is a liquid at room temperature.

There are intermolecular forces between the molecules.

Name the intermolecular force between the CCl_4 molecules.

(1)

(d) A sample of chlorine contains 80% chlorine-35 and 20% chlorine-37.

Calculate the relative atomic mass of this sample of chlorine.

Show your working.

(2)

relative atomic mass =

(Total for Question 1 = 6 marks)



P 6 3 9 4 2 A 0 3 1 2

2 Magnesium sulfate is an ionic compound.

(a) Describe the structure of an ionic compound.

(2)

.....

.....

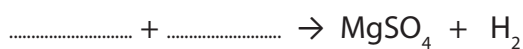
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(b) Magnesium reacts with sulfuric acid to form magnesium sulfate and hydrogen.

Complete the equation for this reaction.

(2)



(c) (i) A learner is given 6.02 g of magnesium sulfate.

Calculate the number of moles of magnesium sulfate.

(relative formula mass of $\text{MgSO}_4 = 120.4$)

(1)

number of moles =

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- (ii) The learner dissolves the magnesium sulfate in distilled water to make 500 cm^3 of solution.

Calculate, using your answer to (c)(i), the molar concentration of this magnesium sulfate solution.

If you did not get an answer for (c)(i), use the value 0.04 for the number of moles.

Show your working.

(3)

molar concentration = mol dm^{-3}

(Total for Question 2 = 8 marks)

- 3** Fluorine, chlorine, bromine and iodine are the first four elements in group 7 (the halogens).

(a) Identify the halogen with the lowest first ionisation energy.

(1)

- ☐ **A** bromine
- ☐ **B** chlorine
- ☐ **C** fluorine
- ☐ **D** iodine

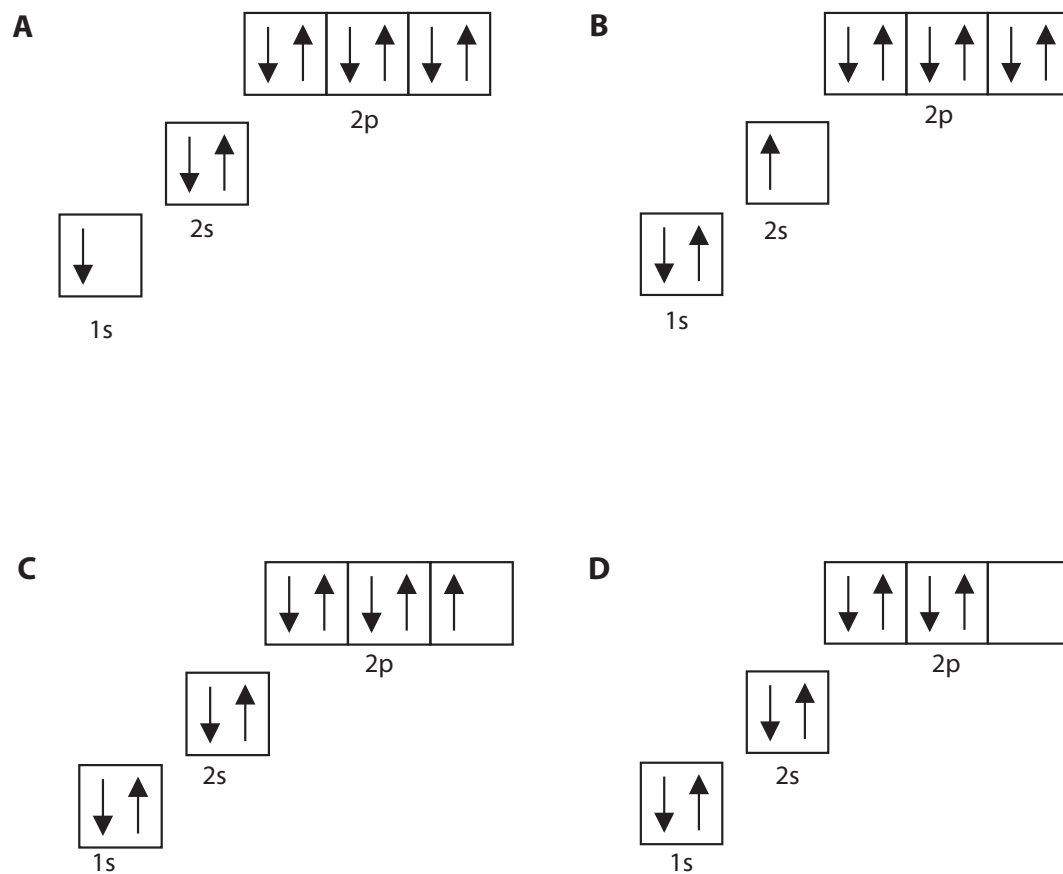


P 6 3 9 4 2 A 0 5 1 2

(b) The halogens all have similar chemical properties because of their electronic configuration.

(i) Identify the correct electronic configuration for an atom of fluorine.

(1)



- ☐ A
- ☐ B
- ☐ C
- ☐ D



- (ii) Fluorine atoms can react to become fluoride ions.

Electron affinity is one way of measuring how easily a fluorine atom becomes a fluoride ion.

Identify the correct word in each sentence to complete Paragraph 1.

Underline the words you have chosen.

(2)

The first electron affinity is the energy released

when one mole of fluorine atoms gains / loses / shares one mole of electrons.

For the electron affinity to happen,

the atoms must be in the gas / liquid / solid state.

Paragraph 1

- (iii) The electronegativity of the halogens changes down group 7.

Explain how electronegativity changes down group 7.

(3)



P 6 3 9 4 2 A 0 7 1 2

- (c) A displacement reaction is when a more reactive element displaces a less reactive element from a compound.

In a displacement experiment, different halogens were added to different sodium halide solutions.

Table 1 shows the results of the displacement experiment.

A tick (✓) shows when a displacement reaction occurred.

A cross (✗) shows when no displacement reaction occurred.

		sodium halide solution		
		sodium bromide	sodium chloride	sodium iodide
halogen	bromine	✗	✗	✓
	chlorine	✓	✗	✓
	iodine	✗	✗	✗

Table 1

Identify and justify, using the results from Table 1, the order of reactivity of the **three** halogens.

(3)

Order of reactivity

Most reactive halogen

.....

Least reactive halogen

Justification.....

.....

.....

.....

(Total for Question 3 = 10 marks)



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(Total for Question 4 = 6 marks)

TOTAL FOR SECTION B = 30 MARKS



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