PARTICULATE NATURE OF MATTER-SET-1-QP-MS

1 (a) Dolphins communicate with each other under water using sound waves.

(i) Sound waves travel through water as a series of compressions and rarefactions.

Describe the difference between a compression and a rarefaction.

.....

..... [1]

(ii) The speed of sound in air is 330 m/s. In water the speed of sound is about 1500 m/s.

Suggest why the speed of sound is greater in water than in air. Use ideas about the distances between molecules and the movement of molecules in your answer.

.....

.....

.....

..... [2]

(b) The water in the sea is heated by the Sun.

Some molecules of the water evaporate. The water does not boil.

State **two** ways in which boiling differs from evaporation.

1 .....

.....

2 .....

.....

[2]

(c) Fig. 9.1 shows three different ways in which particles may be arranged in substances.

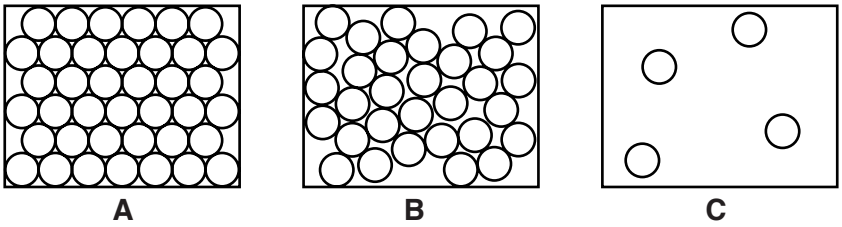

Fig. 9.1

Water in the sea is a liquid and water in the air is a gas.

(i) State which diagram best represents the way particles are arranged in liquid water.

Explain your answer.

diagram .....

explanation .....

..... [1]

(ii) State which diagram best represents the way particles are arranged in gaseous air.

Explain your answer.

diagram .....

explanation .....

..... [1]

MARKING SCHEME

(a) (i) compression – region of high pressure / particles are closer together / particles are more dense ; [1]
OR
rarefaction – region of low pressure / particles more spread out / particles less dense ;

(ii) particles closer together ;
particles, pass on vibrations / collide, more quickly / time between collisions shorter ; [2]

(b) evaporation can occur at any temperature / boiling only happens at the boiling point ; **[max 2]**
evaporation happens only at the surface / boiling happens throughout the liquid ;
boiling takes energy in (endothermic) to occur / evaporation lets only the molecules with the highest kinetic energy out ;
evaporation can occur using the internal energy of the system / while boiling requires an (external) source of heat ;
evaporation produces cooling / boiling does not produce cooling ;
evaporation is a slow process / boiling is a rapid process ;

(c) (i) **B** because most particles are touching / closely packed and randomly arranged ; [1]

(ii) **C** because particles are widely spaced and randomly arranged ; [1]

[Total: 7]

2 Table 1.1 shows some information about three elements **A**, **B** and **C**.

Table 1.1

element	group number in Periodic Table	number of outer electrons in one atom	reactive or unreactive
A	1		
B	7		reactive
C		8	

(a) Add the five missing pieces of information to complete Table 1.1. [3]

(b) The diagrams, **D**, **E** and **F**, in Fig. 1.1 show the structures of three materials.

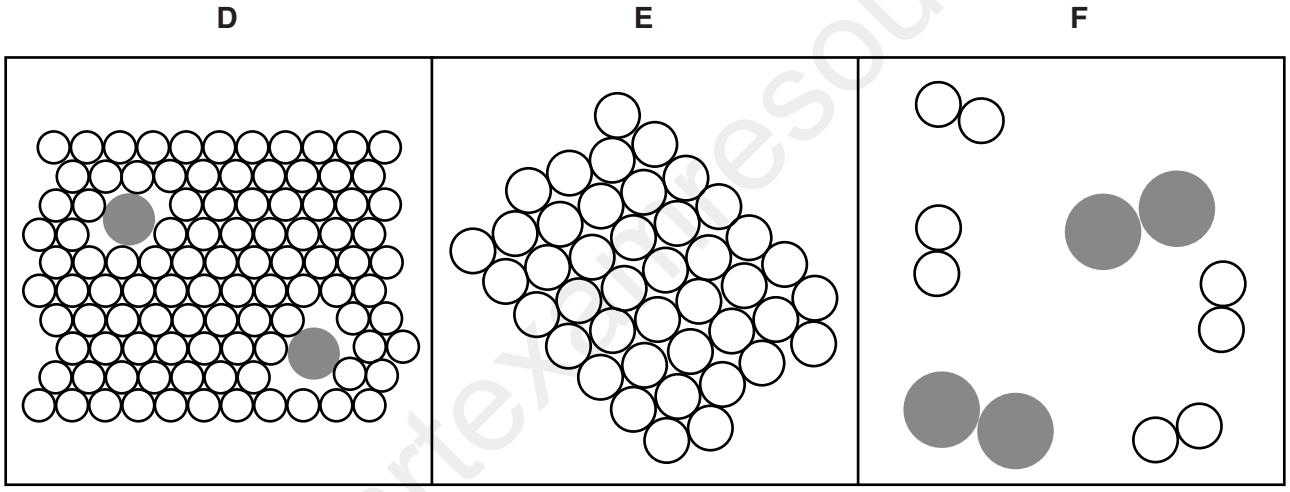

Fig. 1.1

Deduce which diagram shows an alloy and explain why.

diagram showing an alloy .....

explanation .....

.....

.....[2]

(c) Fig. 1.2 shows a small piece of sodium reacting in ethanol at 25 °C. In this reaction hydrogen gas is given off.

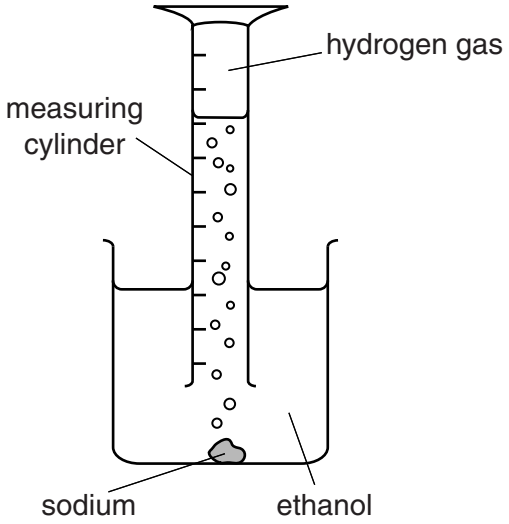

Fig. 1.2

(i) State how the rate of reaction in Fig. 1.2 would be different if the temperature of the ethanol was 10 °C.

Explain your answer in terms of collisions between particles.

.....

.....

.....

.....[3]

(ii) The total volume of hydrogen produced by the reaction shown in Fig. 1.2 is 8.4 cm^3.

Calculate the number of moles of hydrogen in 8.4 cm^3.
The molar volume of gas at 25 °C is 24 dm^3.

Show your working.

number of moles = ...[2]

MARKING SCHEME

(a)

element	Group number in Periodic Table	Number of outer electrons in one atom	reactive/ unreactive
A	(1)	**1**	**reactive**
B	(7)	**7**	(reactive)
C	**0**	(8)	**unreactive**

(1 for each column correct) ; ; ; [3]

(b) (**D**)
an alloy is a mixture of metals ;
E is not a mixture/ is only one substance/ is pure/ single metal ;
F does not show metals/ is a mixture of gases/ is a mixture of compounds ; [max 2]

(c) **(i)** reaction rate is lower ;
(ethanol) molecules have lower average energy/ are moving more slowly ;
so frequency of collision with sodium is lower ;
lower chance of successful collision ;
R: there are fewer collisions [max 3]

(ii) molar volume 24 000 cm^3 ;
8.4 ÷ 24 000 = 0.00035 ;
(allow 1 mark for 8.4 ÷ 24 = 0.35)

OR

volume of hydrogen 0.0084 dm^3 ;
0.0084 ÷ 24 = 0.00035 ; [2]

[Total: 10]

3 **(a)** Below is a list of materials.

aluminium **copper** **glass** **iron** **plastic**

From the list choose **one** material to match each description below.

Each material can be used once, more than once or not at all.

- It can be charged by rubbing with a cloth. .....
- It can be used as the core in a transformer. .....
- It can be used to make a lens. .....
- It is used as the conductor in the windings of a transformer. .....

[2]

(b) One nuclide of iron is represented in nuclide notation as $^{54}_{26}Fe$.

(i) For one neutral atom of $^{54}_{26}Fe$, state its nucleon number.

..... [1]

(ii) Another isotope of iron has two more neutrons in the nucleus.

Use similar notation to that used in **(b)(i)** to represent this nuclide.

..... [1]

(iii) An isotope of iron is radioactive. It has a half-life of 2.73 years.

State what is meant by the term *half-life*.

.....

.....

.....[1]

(c) The boiling point of iron is 2862 °C. Some iron evaporates at a temperature below this.

Describe **one** difference between evaporation and boiling.

.....

.....[1]

(d) Fig. 7.1 shows an iron bar suspended by a string.

A magnet is brought close to the iron bar. The iron bar is attracted to the magnet.

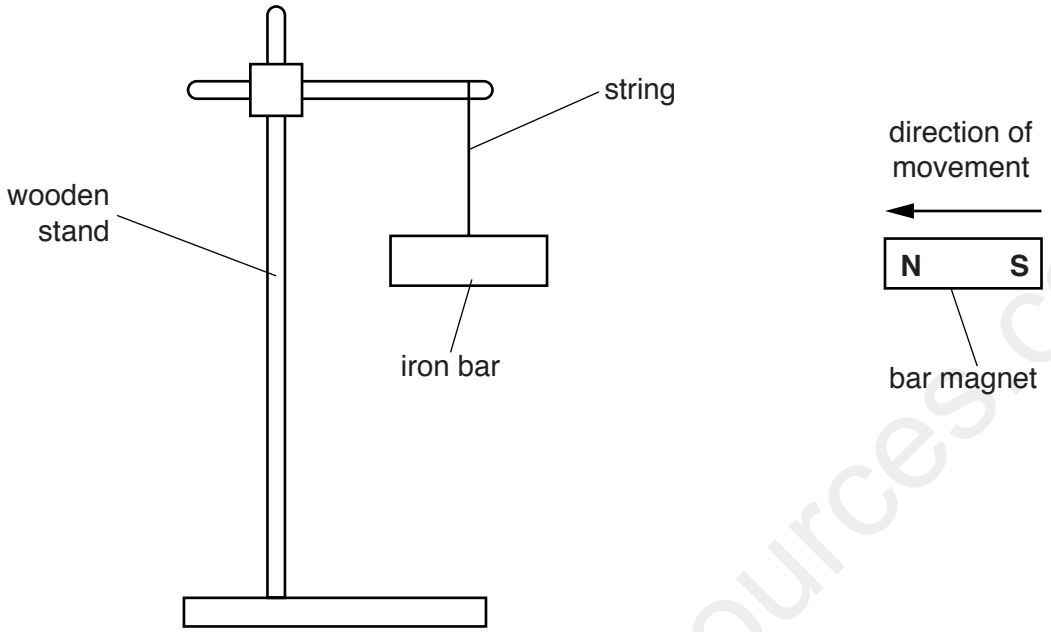

Fig. 7.1

Explain why the iron bar is attracted to the magnet.

.....

.....[1]

(e) Iron is an example of a solid at room temperature.

The three diagrams **A**, **B** and **C** in Fig. 7.2 show the different arrangements of particles in the three states of matter.

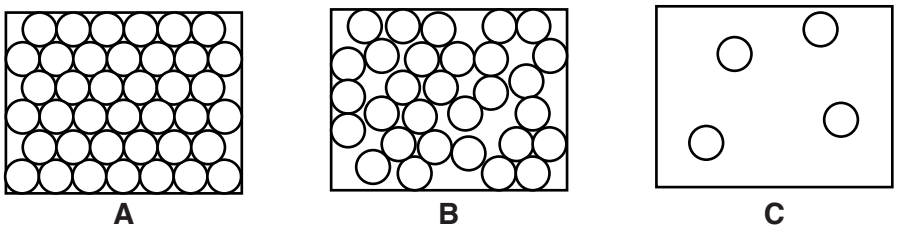

Fig. 7.2

Use the correct letter **A**, **B** or **C** from Fig. 7.2 to fill in the blank and complete the statement to explain your choice.

Diagram ..... shows solid iron because the particles .....

..... [1]

(f) A student is trying to calculate the density of an irregular piece of iron.

To do this he must measure the mass and the volume of the piece of iron.

Describe how the student could measure the **volume** of the piece of iron using a measuring cylinder.

.....

.....

.....

.....

.....[2]

MARKING SCHEME

(a) plastic / glass
iron
glass / plastic
copper
4 correct = 2 marks, 3 or 2 correct = 1 mark ;; [2]

(b) **(i)** 54 ; [1]

(ii) $^{56}_{26}Fe$ [1]

(iii) time taken for a sample of radioactive isotope to decay by half/
time taken for count rate of radioactive isotope to decrease by half ; [1]

(c) evaporation can occur at any temperature/
boiling only happens at the boiling point ;

evaporation happens only at the surface/
boiling happens throughout the liquid ;

evaporation lets only the molecules with the highest kinetic energy out/
boiling taken energy in (endothermic) to occur ;

evaporation can occur using the internal energy of the system/
boiling requires an external source of heat ;

evaporation produces cooling/
boiling does not produce cooling ;

evaporation is a slow process/
boiling is a rapid process ; [max 1]

(d) reference to induced magnetism ; [1]

(e) **A** (no mark)
regular arrangement ; [1]

(f) workable method of measurement of displacement ;
ref to displacement/ subtraction of two volumes ; [2]

[Total: 10]