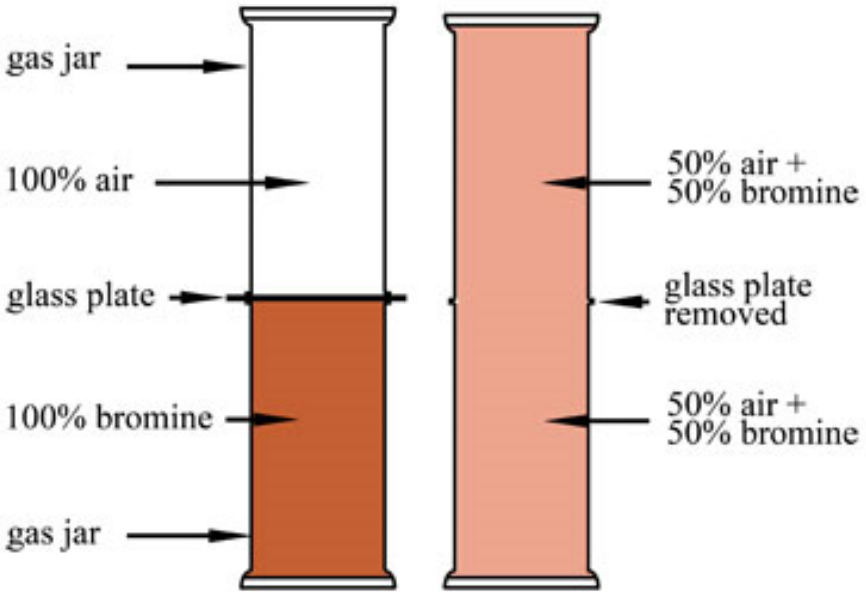
Section A [5 marks]

Answer **all** questions.

Write your answers in the boxes provided at the end of the Section.

1 When the glass plate is removed from the setup on the left, the colour of the gas in the setup becomes same for both jars after several days as shown in the diagram on the right.



Which statement best explains the appearance after a few days?

A Heavier particles sink while lighter particles rise.

B Both the air and bromine particles diffuse at the same rate.

C There are as many air particles as bromine particles in each jar.

D Both the air and bromine particles move randomly.

2 The ions $^{32}_{16}S^{2-}$ and $^{35}_{17}Cl^{-}$ have the same

1: number of electrons
2: number of protons
3: number of neutrons

A 1 only

B 2 and 3 only

C 1 and 2 only

D 1 and 3 only

3 Which of the following groups consists of a metallic element, an ionic compound and a gaseous mixture?

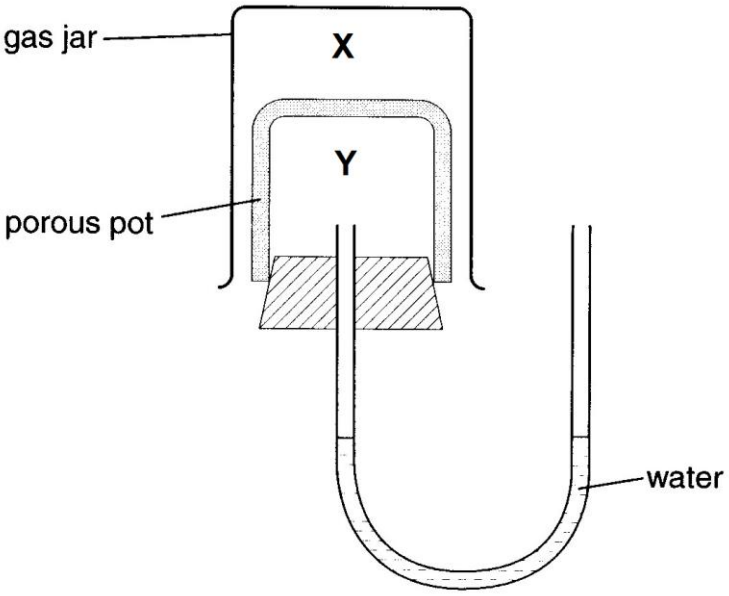
A bronze, sodium chloride, sea water

B air, tungsten, sodium bromide

C sodium, bronze, air

D silicon, aluminium oxide, sea water

4 Which pair of gases will cause the water level in the left side of the tube to fall?



	X	Y
A	N_2	CO
B	Ne	F_2
C	SO_2	NO_2
D	Cl_2	CO_2

5 Which of the following is an ionic substance?

A CO_2

B CI_2O

C K_2O

D SiO_2

Write your answers for Section A in the boxes below.

1.	2.	3.	4.	5.

[Total: 5]

Section B [30 marks]
Answer **all** questions.
Write your answers in the spaces provided.

B1 The table below gives the number of protons, neutrons and electrons in some particles.

Particle	Proton	Neutron	Electron
A	17	18	18
B	17	20	17
C	17	18	17
D	16	16	16
E	16	16	18

(a) **(i)** Which particles are negative ions?

……. [1]

(ii) Which two atoms are isotopes?

……. [1]

(iii) Which particle is able to form a compound with a calcium atom in a 1:1 ratio?

……. [1]

(iv) What is the nucleon number of particle **B**?

……. [1]

(v) What element is particle **D**?

……. [1]

(vi) What is the charge of particle **E**?

……. [1]

(b) **(i)** Magnesium chloride is an ionic salt. Describe the structure and bonding of this ionic compound.

……

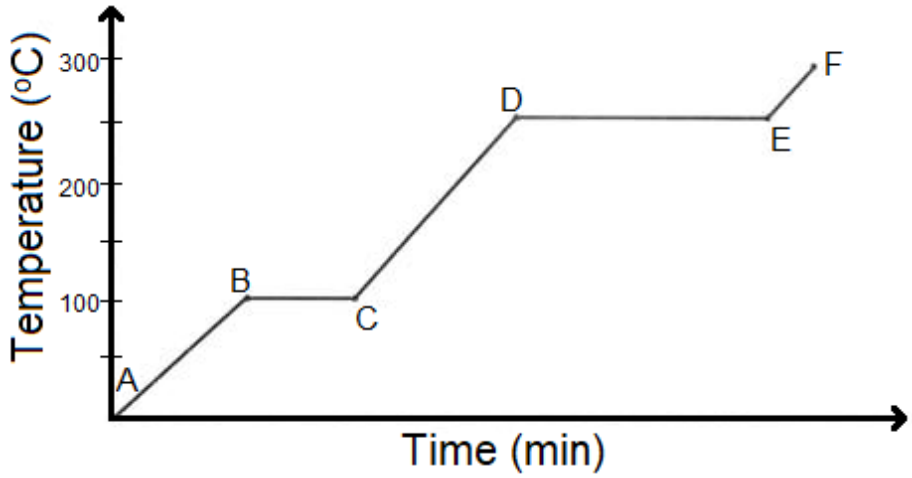
……

……. [3]

(ii) Draw a ‘dot-and-cross’ diagram of magnesium chloride. Show outer electrons only.

[3]
[Total: 12]

B2 The following graph shows a heating curve of an unknown substance.



(a) **(i)** What is the melting point of the unknown substance?

..... [1]

(ii) What is the boiling point of the unknown substance?

..... [1]

(b) Predict the physical state(s) of the unknown substance when it is at the temperature of

(i) 50°C: ..... [1]

(ii) 100°C: ..... [1]

(iii) 300°C: ..... [1]

(c) Using the Kinetic Particle Theory, explain the process that is occurring in the region of **DE**.

.....

.....

.....

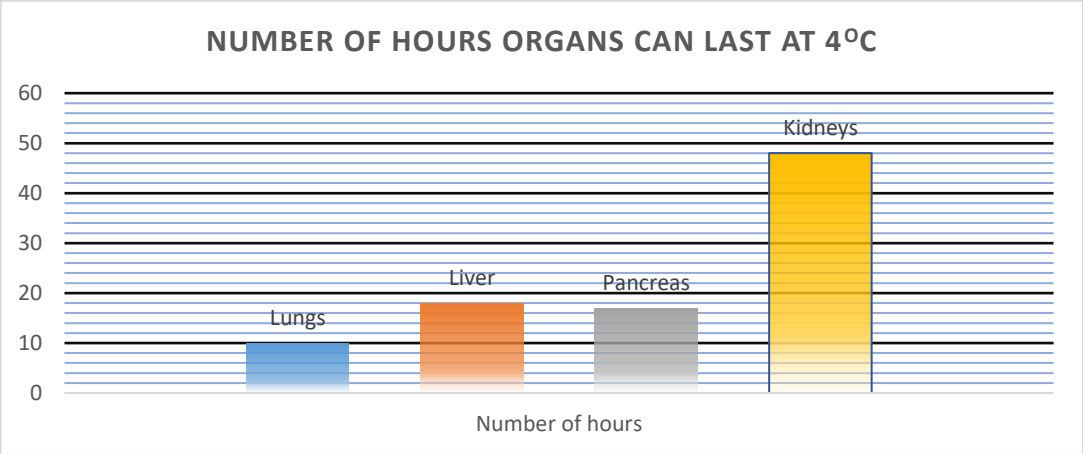
.....

..... [4]

[Total: 9]

B3 Preservation time of organs and tissues

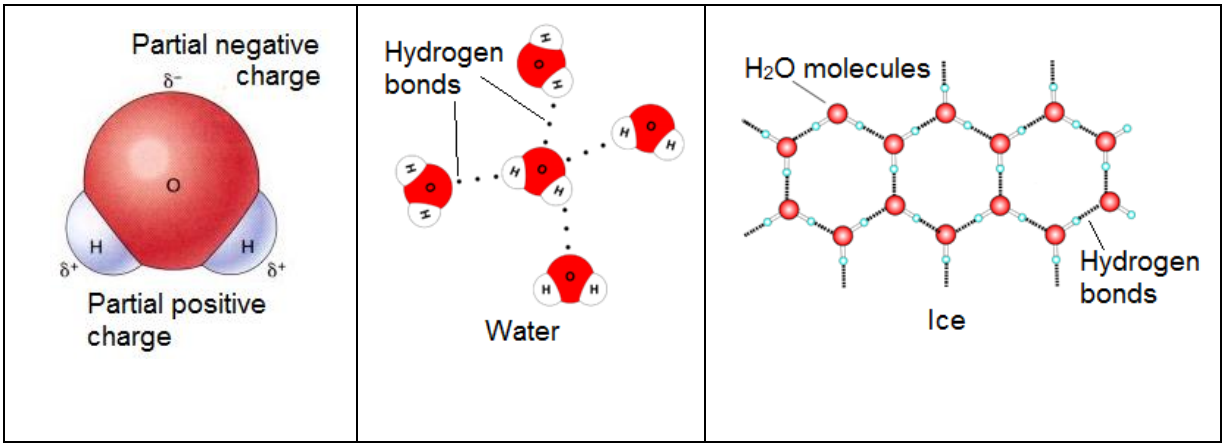
Heart transplantation must be done within four hours. The heart that is removed from the donor is pumped with a solution that has a high concentration of potassium ions. At 4°C, the heart would survive about 20 times as long as it would at body temperature. The solution also helps with the preservation. The time limits for other organs are a little better, which can be seen from the chart below.



Freshly frozen plasma can be kept for a year at -30°C while packed red blood cells can be refrigerated at 6°C for 42 days. Red blood cells that are maintained below freezing temperature can last for 10 years. The reason why packed red blood cells are usually kept at 6°C and not at any lower temperature is because ice crystals will start forming.

Why do ice crystals form?

Due to the shape of a water molecule, there is a slight negative charge (δ-) at the oxygen atom, and slight positive charges (δ+) on the hydrogen atoms. These slight opposite charges causes water molecules to be attracted to each other through hydrogen bonds.



At higher temperatures, hydrogen bonds constantly form and break. But as the temperature approaches 4°C, hydrogen bonds form more often than they break as there is insufficient energy to overcome the forces of attraction. This forces the water molecules to be in an arrangement that would crowd them, as the temperature drops further. To create more space, the cooling water then expands until it reaches freezing point. When it freezes, it forms crystallised ice and then expands further.

In the presence of red blood cells, newly forming ice crystals push on the membranes that surround the red blood cells, causing damage to the cells. When the cells thaw, the damaged membranes allow precious haemoglobin to escape.

(a) **(i)** At what temperature would a heart last 20 times longer than at body temperature?

………………………………………………………………………………………….. [1]

(ii) How long can a kidney and pancreas last at 4°C?

Kidney: …………………………………..

Pancreas: ………………………………….. [2]

(b) **(i)** What are hydrogen bonds?

………………………………………………………………………………………..

……………………………………………………………………………………….. [1]

(ii) In ice, what is the dominant shape formed by the water molecules?

……………………………………………………………………………………….. [1]

(iii) Why is there a need to form this shape as water approaches freezing point?

………………………………………………………………………………………..

……………………………………………………………………………………….. [2]

(c) A hospital where two students are working as interns have a good supply of blood donors.

Student C says, "We should keep donated red blood cells at 6°C."

Student D says, "No, we should cool it to a much lower temperature."

Who do you agree with? Explain your answer.

………………………………………………………………………………………………..

………………………………………………………………………………………………..

………………………………………………………………………………………………..

……………………………………………………………………………………………….. [2]

[Total: 9]

End of Paper****