

Name of the Student: \_\_\_\_\_

Max. Marks : 26 Marks

Time : 26 Minutes

**Q1.**

An electrical heater is placed in an insulated container holding 100 g of ice at a temperature of  $-14^{\circ}\text{C}$ . The heater supplies energy at a rate of 98 joules per second.

- (a) After an interval of 30 s, all the ice has reached a temperature of  $0^{\circ}\text{C}$ . Calculate the specific heat capacity of ice.

answer = \_\_\_\_\_  $\text{J kg}^{-1}\text{K}^{-1}$  (2)

- (b) Show that the final temperature of the water formed when the heater is left on for a further 500 s is about  $40^{\circ}\text{C}$ .

specific heat capacity of water =  $4200 \text{ J kg}^{-1}\text{K}^{-1}$

specific latent heat of fusion of water =  $3.3 \times 10^5 \text{ J kg}^{-1}$  (3)

- (c) The whole procedure is repeated in an uninsulated container in a room at a temperature of  $25^{\circ}\text{C}$ .

State and explain whether the final temperature of the water formed would be higher or lower than that calculated in part (b).

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2)  
(Total 7 marks)

**Q2.**

Molten lead at its melting temperature of 327°C is poured into an iron mould where it solidifies. The temperature of the iron mould rises from 27°C to 84°C, at which the mould is in thermal equilibrium with the now solid lead.

mass of lead = 1.20 kg

specific latent heat of fusion of lead =  $2.5 \times 10^4 \text{ J kg}^{-1}$

mass of iron mould = 3.00 kg

specific heat capacity of iron =  $440 \text{ J kg}^{-1}\text{K}^{-1}$

- (a) Calculate the heat energy absorbed by the iron mould.

answer = \_\_\_\_\_ J

(2)

- (b) Calculate the heat energy given out by the lead while it is changing state.

answer = \_\_\_\_\_ J

(1)

- (c) Calculate the specific heat capacity of lead.

answer = \_\_\_\_\_  $\text{J kg}^{-1} \text{K}^{-1}$

(3)

- (d) State **one** reason why the answer to part (c) is only an approximation.

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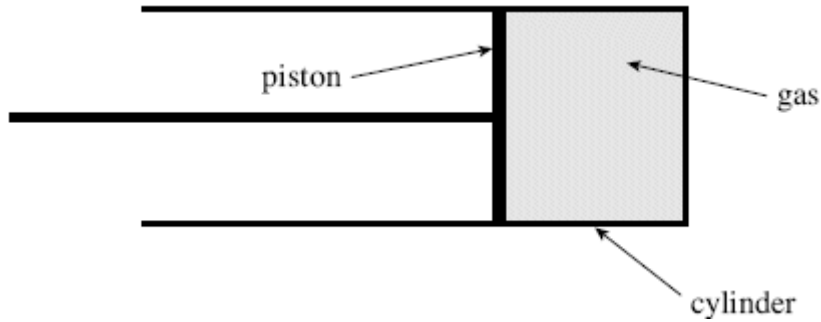
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(1)

(Total 7 marks)

**Q3.**

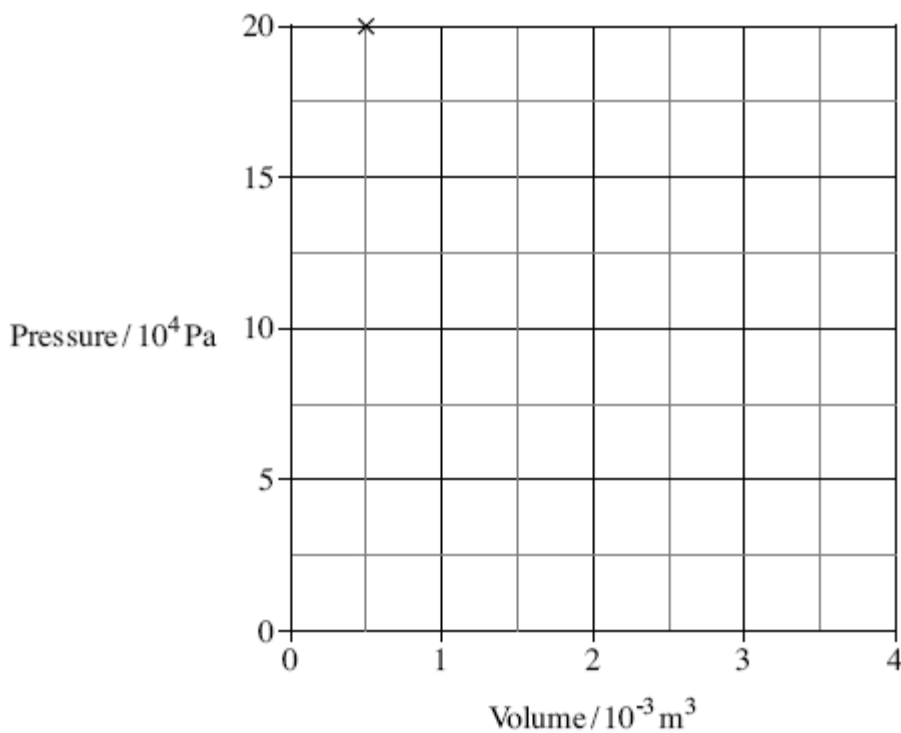
**Figure 1**



**Figure 1** shows a cylinder, fitted with a gas-tight piston, containing an ideal gas at a constant temperature of 290 K. When the pressure,  $p$ , in the cylinder is  $20 \times 10^4$  Pa the volume,  $V$ , is  $0.5 \times 10^{-3} \text{ m}^3$ .

**Figure 2** shows this data plotted.

**Figure 2**



(a) By plotting two or three additional points draw a graph, on the axes given in **Figure 2**, to show the relationship between pressure and volume as the piston is slowly pulled out. The temperature of the gas remains constant.

(3)

(b) (i) Calculate the number of gas molecules in the cylinder.

answer = \_\_\_\_\_ molecules

(2)

(ii) Calculate the total kinetic energy of the gas molecules.

answer = \_\_\_\_\_ J

(3)

(c) State **four** assumptions made in the molecular kinetic theory model of an ideal gas.

(i) \_\_\_\_\_

\_\_\_\_\_

(ii) \_\_\_\_\_

\_\_\_\_\_

(iii) \_\_\_\_\_

\_\_\_\_\_

(iv) \_\_\_\_\_

\_\_\_\_\_

(4)

(Total 12 marks)