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1.Figure (i) shows a tube containing gas and mercury at room temperature. Indicate on Figure (ii) the mercury levels when the water is heated to a higher steady temperature. [2]

Using your knowledge of the kinetic theory, explain the new position of the mercury

surface in contact with the gas.[2]

[JUNE 86/P1/Q3]

Graphic1

2.A bubble of air at the bottom of a lake has a volume of 3.0 cm3 and the pressure on it is equivalent to 4.5 atmospheres. Assuming that the temperature remains constant, calculate the volume of’ the bubble when it reaches the surface, where the pressure is 1.0 atmosphere.[3]

Suggest. in terms of the forces acting on it, why the bubbies rises towards the surface. [1]

[JUNE 86/PI/Q4]

3.State the effect of a rise in temperature on the motion of the molecules of a gas. [1] A gas in an enclosed container is heated uniformly. Assuming the volume of the container does not change. Use the simple kinetic theory to explain the effect of this heating on the pressure which the gas exerts on the container. [3]

[NOV 89/PI/Q4]

4. A mass of gas. initially at room temperature of

20 oC is rapidly heated to 400°C in a vessel of constant volume.

Name a suitable thermometer for measuring the changing gas temperature during the heating. Give reasons for your choice. [31

Calculate the pressure in the vessel when the temperature reached 400°C given that the pressure was 8000 Pa.

in the vessel at room temperature

[4]

If the gas were heated in a cylinder in such a way that the pressure remained constant, draw a sketch graph to show how its volume would change between 20°C and 400°C. [4] With the aid of a labelled diagram, describe an experiment to show how the pressure of a fixed mass of air varies with volume whilst at constant temperature. Draw a labelled sketch graph to illustrate the results you

would expect.[61

[NOV 86/P2/Q8]

5.

Graphic2

The diagram shows a cylinder, containing. fixed mass of gas, connected to a mercury manometer. As indicated by the mercury levels, the gas is at atmospheric pressure. Calculate the pressure of the gas (in atmospheres) when its volume is reduced to two-thirds of the original value. The temperature of the gas constant throughout the change: the piston is tight-fitting, allowing no gas to escape. Indicate on the diagram the approximate positions of the mercury surface after the gas has been compressed. (Take the pressure of one atmosphere to be equal to that of a 76 cm column of mercury).

[JUNE 87/P1/Q3]

6.In terms of kinetic theory (i.e. in terms of motion of molecules) explain briefly

(a)why the evaporation of a liquid causes to be cooled,

(b)why the rate of evaporation of a liquid increases when it is heated.

[JUNE 87/P1/Q4]

7.Air of volume 1000 cm3 at atmospheric pressure 1.0 x l05 Pa enters the cylinder of a diesel engine at a temperature of 17°C. Write down this temperature on the Kelvin scale.[1]

When the air is compressed its volume is reduced to 50 cm3 and the temperature rises to 870 K. Calculate the pressure of the air in the cylinder under these conditions. [4]

Suggest a type of thermometer which could be used to measure the temperature of the compressed air under these conditions. Give two reasons for your choice. [3]

If the air pressure in the cylinder acts on a piston of area 0.012 m2 calculate the force exerted on the piston when the air is fully compressed.[2]

[NOV 87/P2/QJ]

1. A cylinder of volume 5.0 x l0-3 m3 contains carbon dioxide gas at a pressure 6.0 x 105 Pa and a temperature 20°C. Given that the internal area of the flat base of the cylinder is 2.2 x l0-2 m2. calculate the total force on the base due to the gas pressure. [2]

The valve on the cylinder is opened and gas escapes until the mass of gas which originally occupied exactly half the volume of the cylinder now occupies the whole cylinder. Given that the temperature of the gas remaining in the cylinder has fallen from 20°C to 0oC calculate the pressure of the gas now in the cylinder.[1]

In terms of the kinetic theory of gases, explain why:

(i)the reduction in the mass of gas in the cylinder leads to a decrease in pressure in the cylinder.[2]

(ii)the fall in temperature leads to a further

decrease in pressure.[2]

[NOV 88/P2/Q2]

9.A fixed mass of air occupies 9.0 litres at a temperature of 300 K and a pressure of 1.2 atmospheres. The volume is reduced to 5.0 litres by increasing the pressure to 2.3 atmospheres.

(a)Assuming that the air behaves as an ideal gas. calculate the temperature of the air alter the reduction in volume. [2]

(h)Give one reason why the actual temperature may he different from that you have calculated.[1]

[JUNE 89/I'I/Q2]

10.Figure 5.1 shows an experiment to observe the Brownian motion of smoke particles in air.

Graphic3

(a)Draw a diagram to illustrate the motion of

one of the smoke particles.[3]

(b)Explain the motion of the smoke particles

using simple kinetic theory.[2]

[JUNE 89/PI/Q5]

11.Figure 4. 1 shows the main parts of a bicycle pump with the end blocked up. When a bicycle tyre is pumped up, the volume of the air trapped in the pump is reduced and its pressure is increased.

Graphic4

(a)Explain, in terms of the motion of molecules, why the pressure increases. [2]

(b)The volume of air in the pump at start of the stroke is 20 cm3, and the pressure of the air is l.00 x 105 Pa.

Calculate the pressure when the volume has been reduced to 8.0 cm3, assuming that no air has escaped from the pump and the temperature of the air is constant. [21

(c)In practice, the temperature of the air increases as it is compressed. Explain why this is so. [2]

[NOV 90/P2/Q4]

12.State briefly how you would demonstrate Brownian motion and explain why such motion suggests that fluids are made up of moving molecules.[5]

[JUNE 91/P2/Q4]

13.Explain briefly, using the molecular theory. why

(a)liquids evaporate more quickly in a draught,

(b)rapid evaporation from a liquid cools the

liquid down.[5] [NOV 91/P2/Q4]

14.Use the molecular theory of matter to explain briefly why

(a)a gas exerts a pressure on the walls of its

container.[3]

(h)energy is required to evaporate a liquid. [2]

[JUNE 94/P2/Q5]

15.The molecules of a gas are in constant random motion. Each molecule collides frequently with other molecules.

Graphic5

(a)Draw a diagram to show a magnified picture of the motion of a single molecule as it moves between collisions with five other molecules. [3]

(b)State what is meant by the term diffusion. [1]

(c)Figure 3.1 shows a box with a central partition which can be raised. The two parts of the box are filled with different gases.

A long time after the partition has been raised the gases are found to be completely mixed. Explain how this happens and why it takes a long time.[3]

[JUNE 95/P2/Q3]

16. (a) (i)Describe the motion of the molecules of a gas.

(ii)What type of motion does a sound wave give to the molecules of air?

(iii)What effect does a sound wave have on the on the pressure of air as the wave moves through it? [4]

(b)A bicycle pump of volume 72 cm3 is filled with air at a pressure of 0.100 MPa. The volume is reduced to 30 cm3. No air leaks from the pump and the temperature stays constant. Calculate the pressure of the compressed air.[2]

[NOV 95/P2/Q2]

17. (a) (i)What is seen moving when Brownian motion is observed?

(ii)Why is a microscope necessary in order to observe Brownian motion?

(iii) Explain how Brownian motion provides evidence for the kinetic molecular model of matter. [4]

(b)State what is meant by the term

diffusion.[2]

[JUNE 96/P2/Q4]

18. (a)Figure 11.1 shows a tall cylinder filled with water. The bottom of the cylinder rests on a block of ice.

Graphic6

Explain, with reasons, whether the temperature of the water in the cylinder is higher at the top, constant all the way up or higher at the bottom. Assume that the cylinder has been in place for a long time, that room temperature is steady at about 30°C and that there are no draughts. [3]

(b)The mercury in a school thermometer has a mass of 8.0 g, the glass of the thermometer has a mass of 20.0 g. The specific heat capacity of mercury is 140 J/(kg K) and that of the glass is

670 J/(kg K). Calculate the energy required to raise the temperature of the whole thermometer from 20°C to 100°C. [5]

(c)Temperature may be measured by means of a mercury-in-glass thermometer or by means of a thermocouple. State, giving your reasons in each case, which type of thermometer you would use for

(i)investigating the rate of cooling for 250 g of water in a beaker,

(ii)checking the rapidly varying temperature of a thermistor as the current in it varies.[4]

(d)A mercury-in-glass thermometer is used to determine the temperature of a hot environment. Explain, in terms of changes involving the atoms and molecules of the glass in the bulb of the thermometer, how energy is transferred from a hot environ-ment to the cooler mercury.[3]

[JUNE 96/P2/QII]

19.This question is about the rate of evaporation from a pool of water.

(a)Complete the table below by entering 'increases' or 'decreases' or 'no effect', as appropriate, in each of the empty boxes of

the second row.[1]

| | temperature of water increase | surface area of water increases | wind speed over water increase |
|---|---|---|---|
| effect of each increase on rate of evaporationfront the pool of water | | | |

**Table 1: Table1**

(h)State your reasons for your answers to (a). (Temperature, Surface area, Wind speed) [4]

[NOV 96/P2/Q5]

20.(a) Describe briefly the differences between the motions of the molecules of ice, water and steam. [3]

(b) State and explain what happens to the molecules in a block of ice when the temperature of the ice is increased and

tile ice does not melt. [2]

(c) Explain, in terms of the energy changes involved, why a liquid cools as it evaporates. [3]

[JUNE 97/P2/Q3]

21. (a)Draw a labelled diagram of the apparatus you would use to demonstrate Brownian mo-tion. [4]

(h)Explain clearly what an observer, using the apparatus you have drawn, would sec. [2]

(C)State and explain the conclusions that can be drawn from Brownian motion [3]

[NOV 97/P2/Q5]

22.Figure 4. 1 shows a line of wet clothes drying in the open air. It takes time for water in the clothes to evaporate and for the clothes to dry.

Graphic7

(a)State two changes to the atmospheric conditions that might make the clothes dry faster.

change 1 ____________________

change 2 ____________________[2]

(b)Use the molecular theory of matter to explain why evaporation of water causes cooling. [3]

[JUNE 98/P2/Q4]

23. (a)A syringe contains trapped air, as shown in Figure 3.1. The piston inside the syringe is free to move up and down in the syringe. When the syringe is placed in hot water, the air inside expands, as shown in Figure 3.2.

Graphic8

Explain, in terms of the motion of the molecules,

(i)why the air inside the syringe exerts a pressure on the piston,

(ii)why the piston is pushed upwards when the syringe is placed in hot

water.[4]

(b)Another syringe contains 80 cm3 of trapped air at room temperature. The piston is slowly pushed inwards, compressing the air. Some information about the air inside the syringe is given in the table.

* syringe in cold water o syringe in cold water

| | beforecompression | aftercompression |
|---|---|---|
| volume of air | 80 cm3 | 20 cm3 |
| temperature of air | 25°C | 25°C |
| pressureof air | 1.0 x l05 Pa | P |

**Table 2: Table2**

Calculate the pressure P of the air after compression.

P= ______________[3]

[NOV 98/P2/Q3]