Questions

Q1.

Figure 1 shows air inside a cylinder with a movable piston.

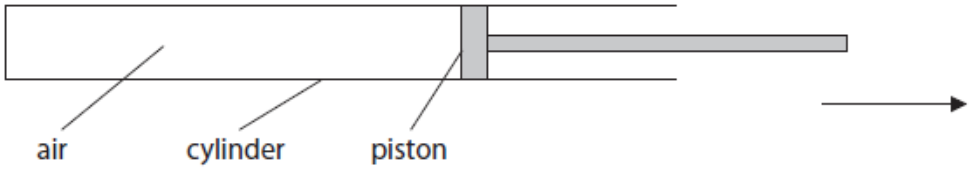

Figure 1

The piston is pulled a little way in the direction of the arrow, but stays inside the cylinder.

Which of these increases?

(1)

☒ **A** The mass of the air inside the cylinder.

☒ **B** The rate at which air particles collide with the walls of the cylinder.

☒ **C** The volume of the air inside the cylinder.

☒ **D** The pressure of the air inside the cylinder.

(Total for question = 1 mark)

Q2.

Room temperature is 20 °C.

What is 20 °C on the kelvin temperature scale?

(1)

☒ **A** 293 K

☒ **B** 273 K

☒ **C** 253 K

☒ **D** 120 K

(Total for question = 1 mark)

Q3.

Figure 1 shows some gas in a container.

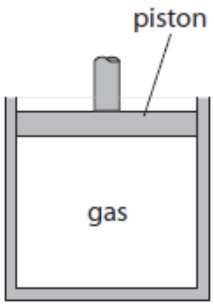

Figure 1

Explain, in terms of particles, how the gas exerts a pressure on the piston.

(2)

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(Total for question = 2 marks)

Q4.

Figure 1 shows some gas in a container.

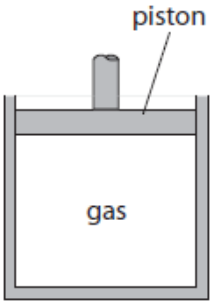

Figure 1

The piston is forced down to a new position, compressing the gas, as in Figure 2.

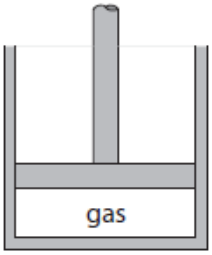

Figure 2

The temperature of the gas remains constant.
Explain, in terms of particles, why the pressure of the gas increases.

(2)

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(Total for question = 2 marks)

Q5.

Figure 2 shows a rubber tube that can be used inside a bicycle tyre.

The tube is inflated with a bicycle pump.

before being inflated

after being inflated

Figure 2

(i) The air inside the tube exerts an outward force on the wall of the tube.

State the angle that this outward force makes with the wall of the tube.

(1)

.....

.....

(ii) It takes 4.8 litres of air from the atmosphere to inflate the empty tube to a pressure of 400 000 Pa.

Atmospheric pressure is 100 000 Pa.

Calculate the volume of air inside the tube.

Assume the temperature of the air inside the tube is the same as the temperature of the air outside the tube.

Use an equation selected from the list of equations at the end of this paper.

(3)

volume = ... litres

(iii) When a bicycle pump is used to inflate the tube, the air in the bicycle pump gets warm.

You should ignore any effects of friction in the pump.

Explain why the air in the bicycle pump gets warm.

(2)

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(Total for question = 6 marks)

Q6.

The photograph shows an oxygen cylinder that can be used in an ambulance.

(i) Explain how particles of oxygen gas exert a pressure on the inside of the cylinder.

(2)

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(ii) This cylinder can release 340 litres of oxygen at a pressure of 101 000 Pa.

The inside volume of the cylinder is 2.5 litres.

Use the equation

$$P_2 = \frac{P_1 V_1}{V_2}$$

to calculate the pressure of the oxygen in the cylinder before the gas is released.

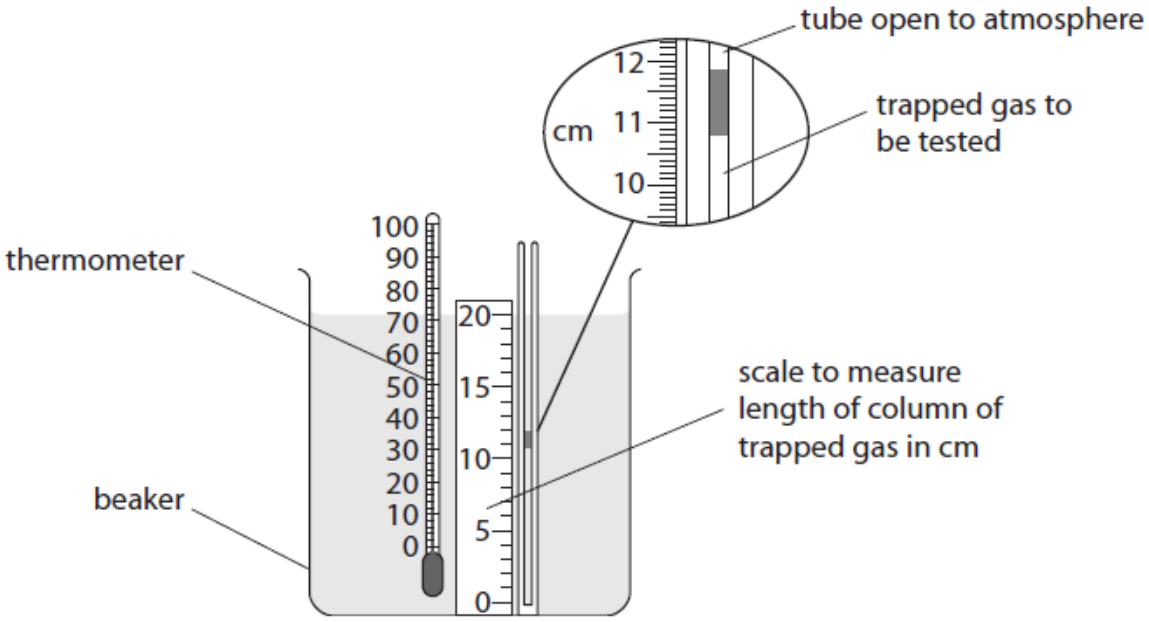
(3)

pressure of oxygen = ... Pa

Q7.

A student investigates how the volume of a gas changes when its temperature increases.

The diagram shows the equipment used and the length of the trapped gas at 25°C.



(a) (i) Use the scale to estimate the length of the column of trapped gas.

(1)

length of column of trapped gas = ... cm

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The cross-sectional area of the capillary tube is 1.94×10^{-3} cm^2.

The volume of the column of trapped gas at 25°C is about

(1)

☒ **A** $5.6 \times 10^{+3}$ cm^3

☒ **B** 2.1×10^{-2} cm^3

☒ **C** 2.1×10^{-3} cm^3

☒ **D** 5.6×10^{-4} cm^3

(iii) The gas is heated to 50°C.

The volume of the trapped gas at 50°C is 2.31×10^{-2} cm^3.

Calculate the volume of the trapped gas at 100°C.

(3)

volume of the trapped gas = ... cm^3

(b) Describe how the average kinetic energy of the particles of the gas changes as the temperature of the gas changes.

(3)

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Q8.

Kinetic theory describes the behaviour of gas particles.

(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

At −273 °C the particles in a gas are

(1)

☒ **A** moving rapidly

☒ **B** moving slowly

☒ **C** stationary

☒ **D** vibrating

(ii) The temperature of a gas changes from 300 K to 150 K.

State how the average kinetic energy of the gas particles changes.

(1)

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.....

(b) The photograph shows a weather balloon filled with helium.
When released the balloon rises rapidly to a height of 30 000 m above the Earth.

Explain how the helium gas exerts a pressure on the balloon.

(3)

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(c) On the surface of the Earth the weather balloon has a volume of 9.1 m^3, when the temperature is 0 °C and the pressure inside the balloon is 101 kPa.

At 30 000 m above the Earth, the temperature is −46 °C and the pressure inside the balloon is 1.12 kPa.

(i) Show that −46 °C is 227 K.

(1)

(ii) Calculate the volume of the weather balloon when it is at a height of 30 000 m.

(3)

volume = ... m^3

(iii) Suggest what will happen to the balloon as it carries on rising above 30 000 m.

(1)

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(Total for Question = 10 marks)