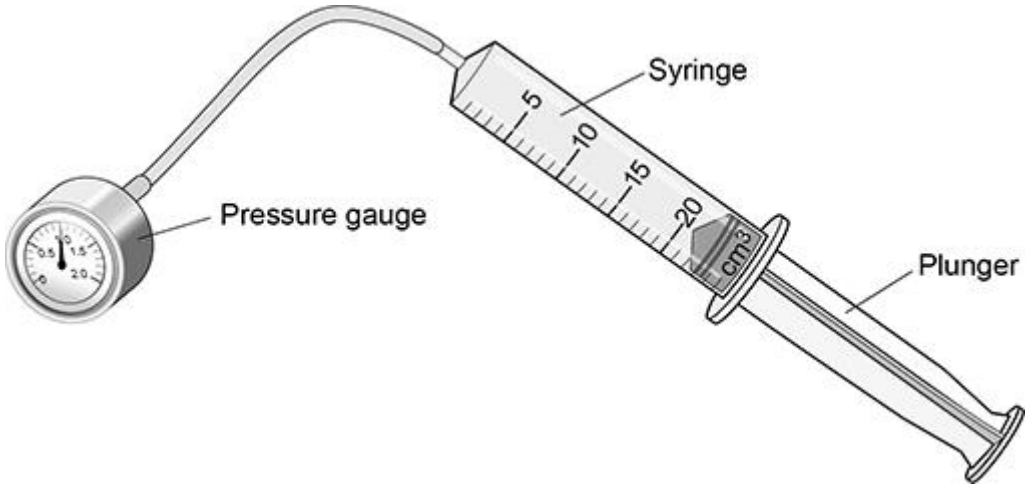
Questions are for both separate science and combined science students

Q1.

A student investigated how the pressure in a fixed mass of air varies with the volume of the air.

Figure 1 shows the equipment used.

Figure 1



When the plunger was pushed slowly into the syringe, the temperature of the air stayed the same.

(a) How did pushing the plunger in affect the volume of air in the syringe?

Tick (✓) **one** box.

The volume decreased. ☐

The volume stayed the same. ☐

The volume increased. ☐

(1)

(b) How did pushing the plunger in affect the distance between the air particles in the syringe?

Tick (✓) **one** box.

The distance decreased. ☐

The distance stayed the same. ☐

The distance increased. ☐

(1)

(c) How did pushing the plunger in affect the frequency of collisions between the air particles and the syringe walls?

Tick (✓) **one** box.

The frequency of collisions decreased. ☐

The frequency of collisions stayed the same. ☐

The frequency of collisions increased. ☐

(1)

(d) How did pushing the plunger in affect the air pressure in the syringe?

Tick (✓) **one** box.

The air pressure decreased. ☐

The air pressure stayed the same. ☐

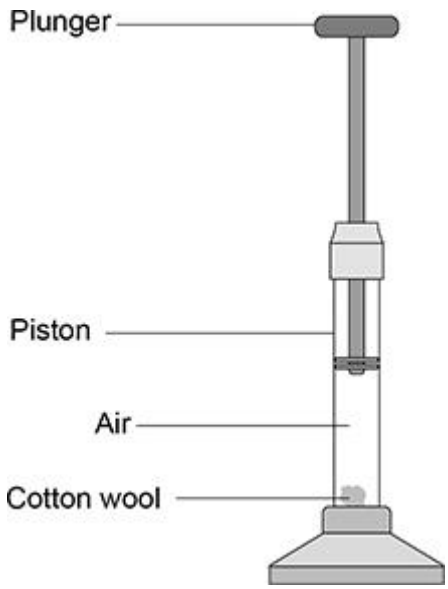
The air pressure increased. ☐

(1)

A fire piston is a special type of syringe that can be used to start fires.

Figure 2 shows a fire piston.

Figure 2



The plunger is pushed quickly downwards and compresses the air.

When the air is compressed quickly, the temperature of the air increases.

(e) How does an increase in temperature affect the mean speed of the air particles inside the syringe?

Tick (✓) **one** box.

The mean speed of the particles decreases. ☐

The mean speed of the particles does not change. ☐

The mean speed of the particles increases. ☐

(1)

(f) When the air is hot enough, a small piece of cotton wool in the piston catches fire.

The energy transferred to the air in the piston is 0.0130 J.

The mass of air in the piston is 2.60×10^{-8} kg.

specific heat capacity of air = 1010 J/kg °C

Calculate the temperature change of the air.

Use the Physics Equations Sheet.

Temperature change = _____ °C

(3)

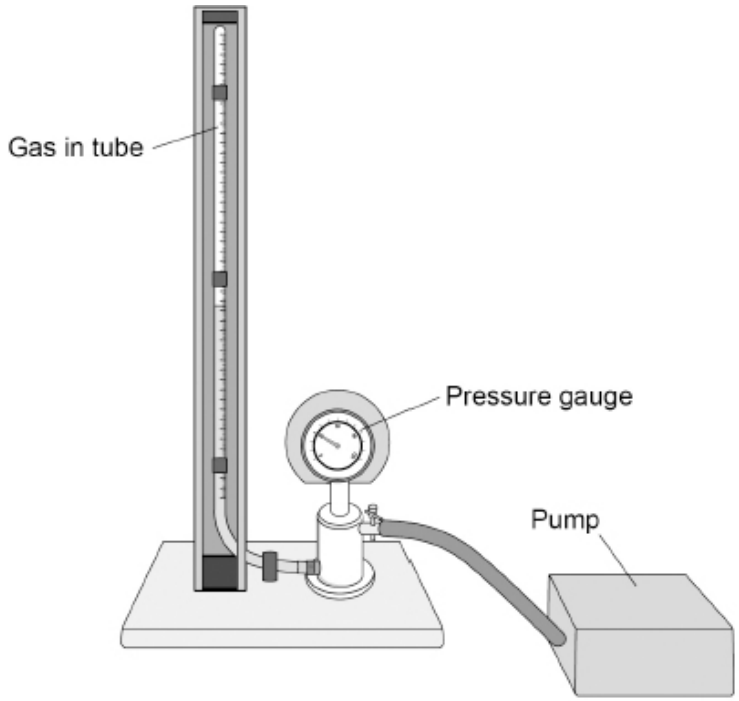
(Total 8 marks)

Q2.

A teacher demonstrated the relationship between the pressure and the volume of a fixed mass of gas at a constant temperature.

Figure 1 shows the equipment used.

Figure 1



(a) Complete the sentence.

Choose the answer from the box.

circular paths	random directions	the same direction

Particles in a gas move in _____.

(1)

(b) Complete the sentence.

Choose the answer from the box.

a constant speed	a constant velocity	a range of speeds

Particles in a gas move with _____.

(1)

(c) The table below shows some of the results.

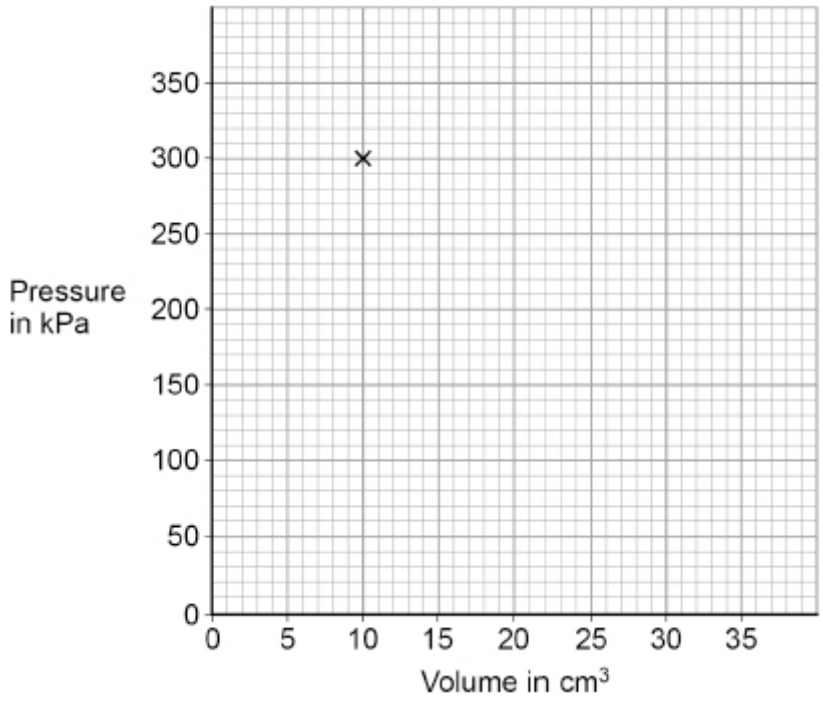
Pressure in kPa	Volume in cm^3
300	10
200	15
150	20
120	25
100	30

Complete **Figure 2**. The first point has been plotted for you.

You should:

- plot the points from the table above
- draw the line of best fit.

Figure 2



(3)

(d) The relationship between the pressure and the volume of a gas is given by the equation:

pressure × volume = constant

Calculate the constant when the pressure of the gas was 300 kPa.

Use the table above.

_____

_____

_____

_____

Constant = _____ kPa cm^3

(2)

(e) When the volume of the gas increases, the pressure in the gas decreases.

The temperature of the gas stays the same.

How does increasing the volume affect each of the following quantities?

Tick (✓) **one** box in **each** row.

Quantity	**Decreases**	**Stays the same**	**Increases**
Mean time between collisions of the particles with the tube			
Mean distance between the particles			
Mean speed of the particles			

(3)

(Total 10 marks)