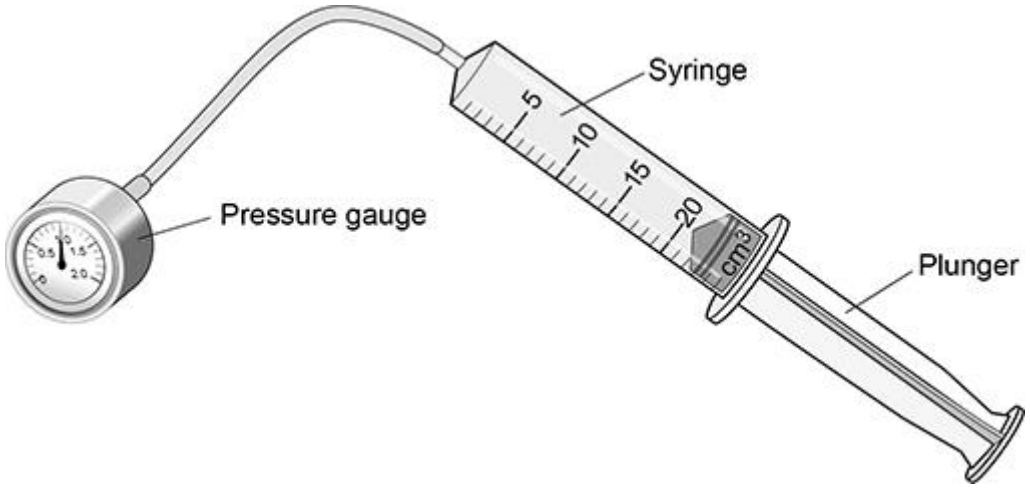
Questions are for both separate science and combined science students unless indicated in the question

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



(a) When the plunger was pushed slowly into the syringe, the pressure in the syringe increased.

The temperature of the air remained constant.

Explain why the pressure increased. **(Physics only)**

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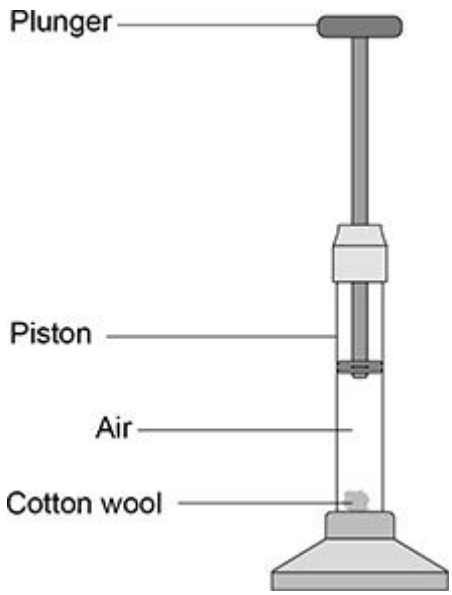
(3)

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.

(b) How does an increase in temperature affect the air particles inside the piston?

Tick (✓) **one** box. **(HT only) (Physics only)**

The mean kinetic energy of the particles increases. ☐

The mean potential energy of the particles increases. ☐

The mean separation of the particles increases. ☐

(1)

(c) 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 = 1.01 kJ/kg °C

Calculate the temperature change of the air.

Use the Physics Equations Sheet.

Temperature change = _____ °C

(4)

(Total 8 marks)

Q2.

The image below shows air being pumped into a car tyre.

(a) Complete the sentence.

Air particles in the tyre move quickly in _____ directions.

(1)

(b) When the tyre is at the correct pressure, pumping more air into the tyre causes the pressure to increase further.

The volume and temperature of the air in the tyre do **not** change.

Explain why the pressure increases as more air is pumped into the tyre.
(HT only) (Physics only)

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(2)

(c) The air pressure in a car tyre changes if the temperature of the air in the tyre increases.

Explain why. **(HT only) (Physics only)**

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(4)

(Total 7 marks)