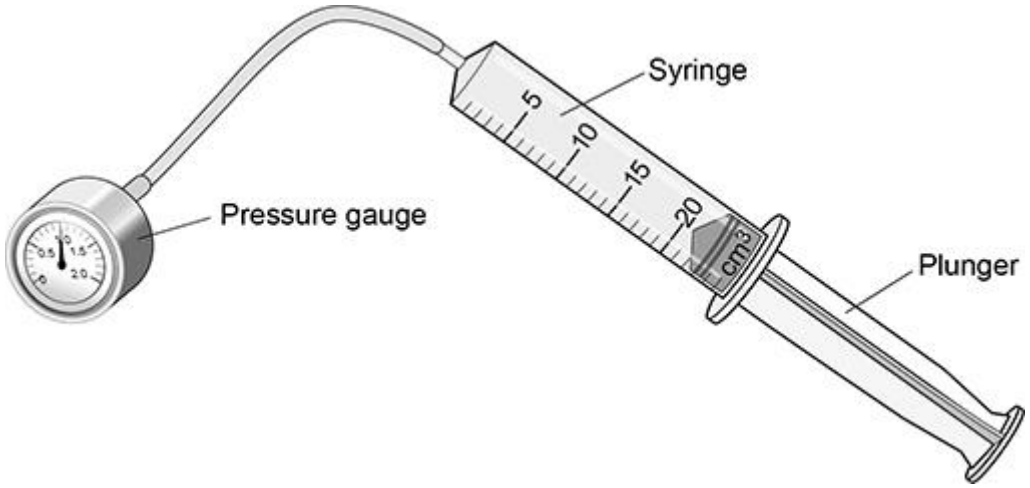
Questions are for both separate science and combined science students

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



(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.

_____

_____

_____

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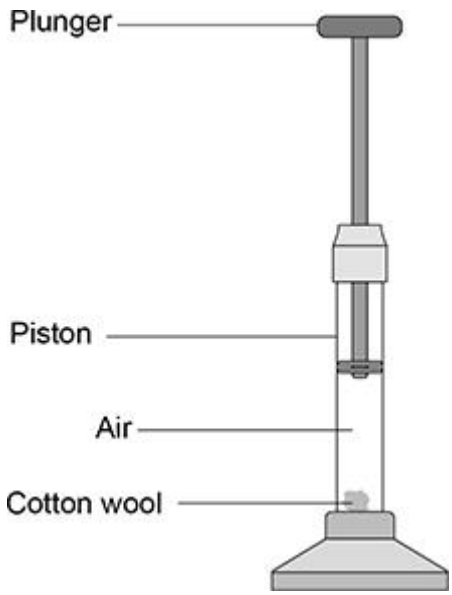
_____

(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.

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)

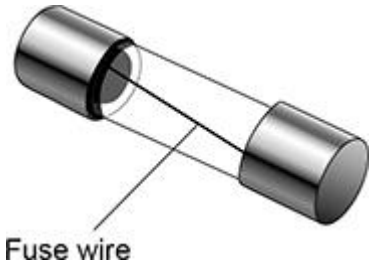
(Total 8 marks)

Q2.

The live wire in a three-core cable is connected to a fuse inside a plug.

A fuse contains a wire that is designed to melt when the current gets too great.

The figure below shows a fuse.



(a) When the fuse wire is at its melting point, the additional energy needed to melt the wire is 1.02 J.

specific latent heat of fuse wire = 60 kJ/kg

Calculate the mass of the fuse wire.

Use the Physics Equations Sheet.

_____

_____

_____

_____

_____

_____

_____

Mass = _____ kg

(4)

(b) The calculation in part (d) assumes there is no energy transferred to the surroundings.

How would the time taken for the wire to melt be affected if some energy was transferred to the surroundings?

Give a reason for your answer.

Tick (✓) **one** box.

Time taken would decrease ☐

Time taken would stay the same ☐

Time taken would increase ☐

Reason _____

_____

_____

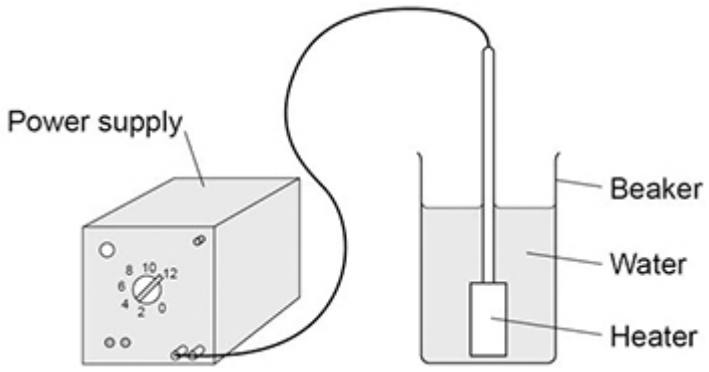
(2)

(Total 6 marks)

Q3.

A student determined the specific latent heat of vaporisation of water.

The figure below shows some of the equipment used.



This is the method used:

1. Put 50 cm^3 of water in a beaker.

2. Measure the mass of the beaker and water.

3. Use a heater to boil the water and keep it boiling for 600 seconds.

4. Measure the mass of the beaker and water after 600 seconds.

(a) What measuring instrument should be used to measure the volume of water?

_____

(1)

(b) What is a hazard in the student's investigation?

Tick (✓) **one** box.

burns ☐

boiling water ☐

heatproof gloves ☐

safety goggles ☐

(1)

(c) The initial mass of the beaker and water was 0.080 kg.

The final mass of the beaker and water was 0.071 kg.

The energy transferred by the immersion heater as the water boiled was 25 200 J.

Calculate the specific latent heat of vaporisation of water given by the student s data.

Give the unit.

Use the Physics Equations Sheet.

Specific latent heat of vaporisation = _____ Unit _____

(5)

(d) Some thermal energy was transferred to the surroundings while the water was being heated.

Explain how this affected the student's value for the specific latent heat of vaporisation of water.

(2)

(e) Some of the water evaporated before its temperature reached 100 °C.

Explain how this affected the student's value for the specific latent heat of vaporisation of water.

_____

_____

_____

_____

(2)

(Total 11 marks)