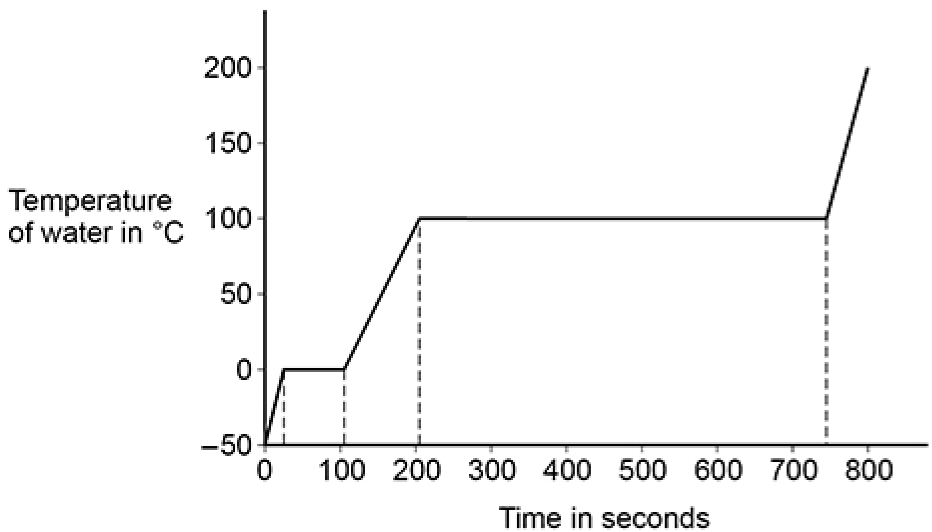
1. A student investigated how the temperature of a lump of ice varied as the ice was heated.

The student recorded the temperature until the ice melted and then the water produced boiled.

The figure below shows the student's results.

The power output of the heater was constant.



(a) The specific heat capacity of ice is less than the specific heat capacity of water.

Explain how the figure above shows this.

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(2)

(b) The specific latent heat of fusion of ice is less than the specific latent heat of vaporisation of water.

Explain how the figure above shows this.

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(2)

(c) A second student did the same investigation and recorded the temperature until the water produced boiled.

In the second student's investigation more thermal energy was transferred to the surroundings.

Describe **two** ways the results of the experiment in the figure above would have been different.

1 ____

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2 ____

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(2)

(d) When the water was boiling, 0.030 kg of water turned into steam.

The energy transferred to the water was 69 kJ.

Calculate the specific latent heat of vaporisation of water.

Give the unit.

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Specific latent heat of vaporisation = ________________

Unit ___________

(5)

(Total 11 marks)

2. A student investigated the density of different fruits.

The table below shows the results.

Fruit	**Density in g/cm^3**
Apple	0.68
Kiwi	1.03
Lemon	0.95
Lime	1.05

(a) The student determined the volume of each fruit using a displacement can and a measuring cylinder.

What other piece of equipment would the student need to determine the density of each fruit?

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(1)

(b) Write down the equation which links density (ρ), mass (m) and volume (V).

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(1)

(c) The mass of the apple was 85 g.

The density of the apple was 0.68 g/cm^3.

Calculate the volume of the apple.

Give your answer in cm^3.

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Volume = _______________ cm^3

(3)

(d) The student only measured the volume of each fruit once.

The volume measurements **cannot** be used to show that the method to measure volume gives precise readings.

Give the reason why.

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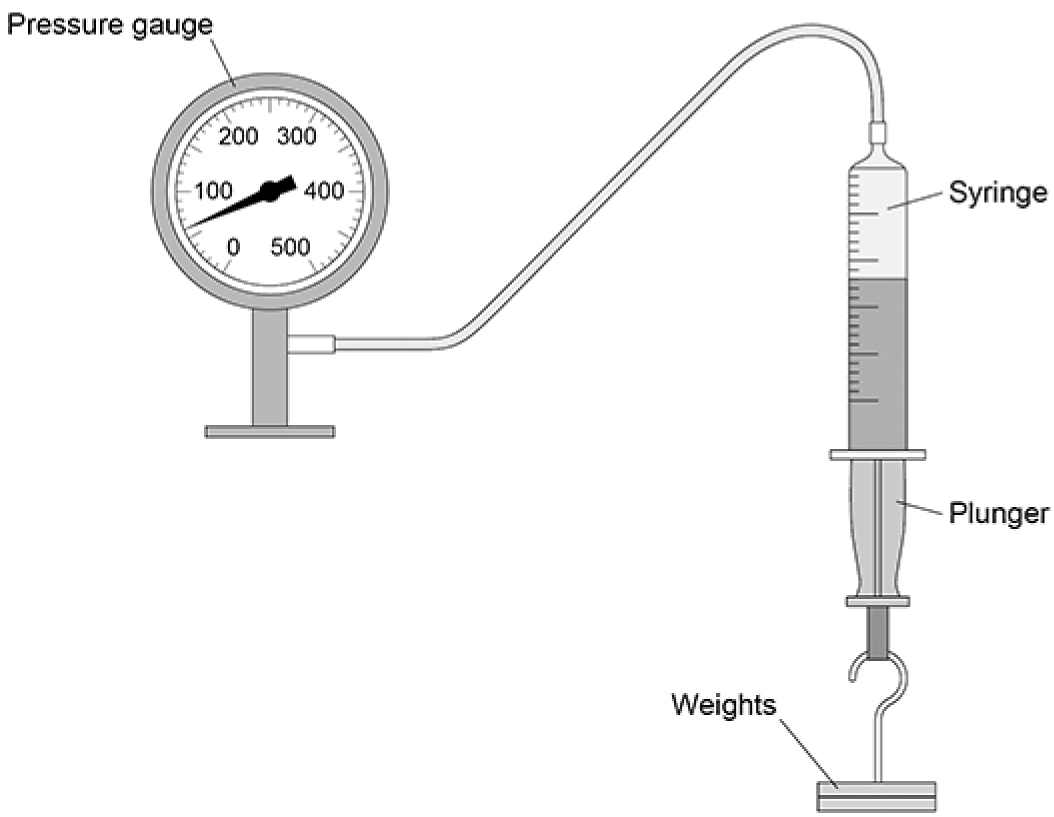
(1)
(Total 6 marks)

3. A teacher demonstrated the relationship between the pressure in a gas and the volume of the gas.

The figure below shows the equipment used.



This is the method used.

1. Record the initial volume of gas in the syringe and the pressure reading before any weights are attached.
2. Attach a 2.0 N weight to the syringe.
3. Record the volume of the gas and the reading on the pressure gauge.
4. Repeat steps 2 and 3 until a weight of 12.0 N is attached to the syringe.

(a) What was the range of force used?

From ___________ N to ___________ N

(1)

(b) Give **one** control variable in the investigation.

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(1)

(c) When the volume of gas in the syringe was 45 cm^3, the pressure gauge showed a value of 60 kPa.

Calculate the pressure in the gas when the volume of gas in the syringe was 40 cm^3.

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Pressure = ________________ kPa

(4)

(d) When the volume of gas in the syringe increased, the pressure on the inside walls of the syringe decreased.

Explain why.

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(3)

(Total 9 marks)

4. The photograph below shows a balloon filled with helium gas.

(a) Which statements describe the movement of the gas particles in the balloon?

Tick (✓) **two** boxes.

The particles all move in a predictable way.	☐
The particles move at the same speed.	☐
The particles move in circular paths.	☐
The particles move in random directions.	☐
The particles move with a range of speeds.	☐
The particles vibrate about fixed positions.	☐

(2)

(b) The pressure of the helium in the balloon is 100 000 Pa.

The volume of the balloon is 0.030 m^3.

The balloon is compressed at a constant temperature causing the volume to decrease to 0.025 m^3.

No helium leaves the balloon.

Calculate the new pressure in the balloon.

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New pressure = ________________ Pa

(4)

(c) The temperature of the helium in the balloon was increased.

The mass and volume of helium in the balloon remained constant.

Explain why the pressure exerted by the helium inside the balloon would increase.

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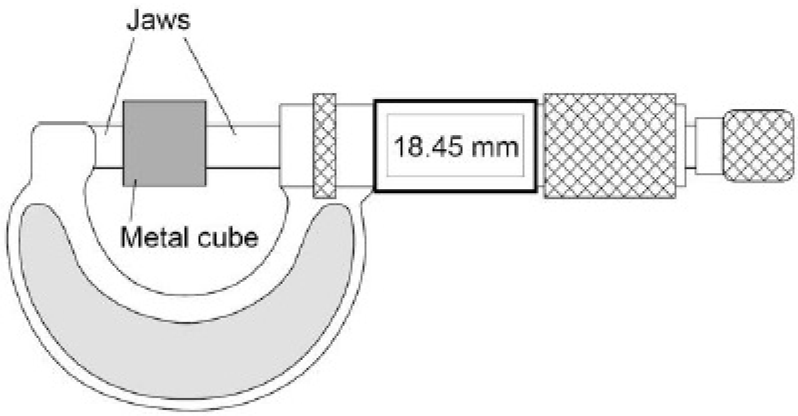
(4)

(Total 10 marks)

5. A student measured the width of a solid metal cube using a digital micrometer.

The figure below shows the micrometer.



(a) The resolution of the micrometer is 0.01 mm

The student could have used a metre rule to measure the width of the cube.

Explain how using a metre rule would have affected the accuracy of the student's measurement of width.

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(2)

(b) The mass of the metal cube was measured using a top pan balance.

The balance had a zero error.

Explain how the zero error may be corrected after readings had been taken from the balance.

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(2)

(c) The width of the cube was 18.45 mm. The density of the cube was 8.0×10^3 kg/m^3

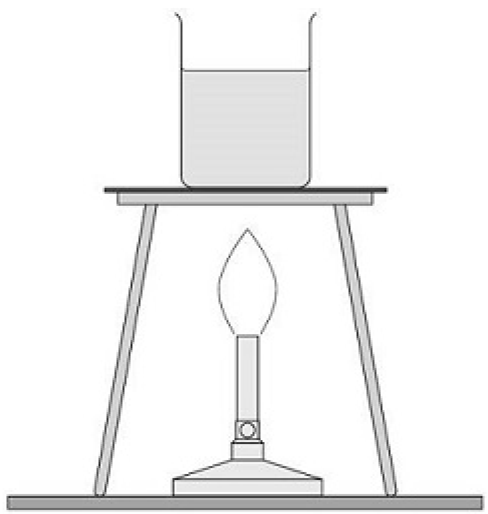
Calculate the mass of the cube.

Mass = ______________________ kg

(5)

(Total 9 marks)

6. The figure below shows a Bunsen burner heating some water in a beaker.
Eventually the water changes into steam.



(a) Explain how the internal energy of the water changes as it is heated from 20 °C to 25 °C

(2)

(b) How is the particle model used to explain the difference in density between a liquid and a gas?

Tick (✓) **one** box.

Particles in a gas have less kinetic energy than particles in a liquid. ☐

Particles in a gas have more potential energy than particles in a liquid. ☐

Particles in a liquid are further apart than particles in a gas. ☐

Particles in a liquid are larger than particles in a gas. ☐

(1)

(c) A student measured the mass of boiling water that was turned into steam in five minutes.

Explain how the student could use this information to estimate the power output of the Bunsen burner in watts.

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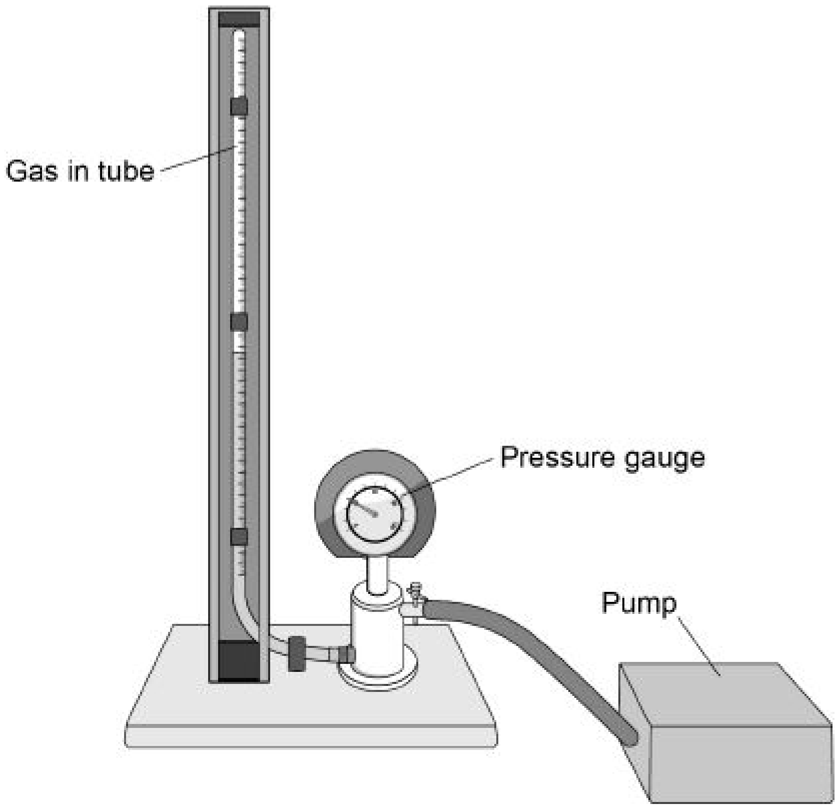
(4)

(Total 7 marks)

7. A student investigated how the pressure exerted by a gas varied with the volume of the gas.

Figure 1 shows the equipment the student used.

Figure 1



A pump was used to compress the gas in a tube. As the volume of the gas decreases, the pressure of the gas increases.

(a) The student only recorded one set of results.

Give **two** reasons why taking repeat readings could provide more accurate data.

1. ____

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2. ____

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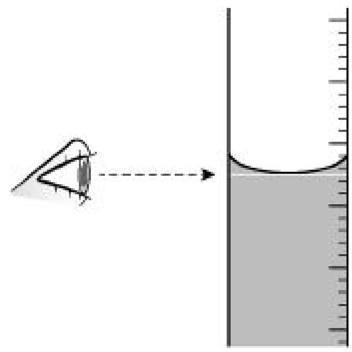
(2)

(b) **Figure 2** shows the position of the student's eye when taking volume measurements.

Figure 2



Explain what type of error would be caused if the student's eye was **not** in line with the level of the liquid in the tube.

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(2)

(c) If the gas is compressed too quickly the temperature of the gas increases.

Explain how the temperature increase would affect the pressure exerted by the gas.

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(2)

(d) One of the student's results is given below.

pressure = 1.6×10^5 Pa
volume = 9.0 cm^3

Calculate the volume of the gas when the pressure was 1.8×10^5 Pa.

The temperature of the gas was constant.

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Volume = ____________________ cm^3

(3)

(e) **Figure 3** shows a person using a bicycle pump to inflate a tyre.

Figure 3

The internal energy of the air increases as the tyre is inflated.

Explain why.

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(2)

(Total 11 marks)

8. The diagram below shows a wind turbine.

(a) At a particular wind speed, a volume of 2.3×10^4 m^3 of air passes the blades each second.

The density of air is 1.2 kg/m^3.

Calculate the mass of air passing the blades per second.

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Mass of air per second = ____________________ kg

(3)

(b) The power output of the turbine is directly proportional to the kinetic energy of the air passing the blades each second.

Describe the effect on the power output when the wind speed is halved.

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(3)

(c) At a different wind speed, the wind turbine has a power output of 388 kW.

The mass of air passing the wind turbine each second is 13 800 kg.

Calculate the speed of the air passing the blades each second.

Assume that the process is 100% efficient.

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Speed of air = ______________________ m/s

(3)

(Total 9 marks)