Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

C420U20-1

S18-C420U20-1

eduqas
Part of WJEC

PHYSICS – Component 2
Applications in Physics

FOUNDATION TIER

FRIDAY, 15 JUNE 2018 – MORNING

1 hour 15 minutes

For Examiner's use only			
	Question	Maximum Mark	Mark Awarded
Section A	1.	5	
	2.	7	
	3.	7	
	4.	7	
	5.	10	
	6.	9	
Section B	7.	15	
	Total	60	

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ADDITIONAL MATERIALS

In addition to this paper you will require a calculator, a ruler and a resource booklet.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

This paper is in 2 sections, **A** and **B**.

Section **A**: 45 marks. Answer **all** questions. You are advised to spend about 50 minutes on this section.

Section **B**: 15 marks. Read the article in the resource booklet carefully then answer **all** questions. You are advised to spend about 25 minutes on this section.

The number of marks is given in brackets at the end of each question or part-question.

The assessment of the quality of extended response (QER) will take place in question **5*(b)***.

EQUATION LIST

final velocity = initial velocity + acceleration × time	$v = u + at$
distance = ½ × (initial velocity + final velocity) × time	$x = \frac{1}{2}(u + v)t$
(final velocity)^2 = (initial velocity)^2 + 2 × acceleration × distance	$v^2 = u^2 + 2ax$
change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = mc\Delta\theta$
thermal energy for a change of state = mass × specific latent heat	$Q = mL$
energy transferred in stretching = ½ × spring constant × (extension)^2	$E = \frac{1}{2}kx^2$
for gases: pressure × volume = constant (for a given mass of gas at a constant temperature)	pV = constant
potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_1I_1 = V_2I_2$

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SECTION A

Answer **all** *questions.*

1. The strength of a magnet can be determined by how many steel paper clips it picks up. A student predicts:

"A big magnet is stronger than a small magnet".

He decides to test his prediction. He uses two different size magnets in his experiment.

(a) **Complete the diagram** by drawing one line from each box on the left to the correct box on the right. [2]

Size of magnet	Controlled variable
Number of steel paper clips picked up	Dependent variable
Size of paper clips	Independent variable

(b) He records his results in a table.

Size of magnet	Number of paper clips picked up
Big	70
Small	81

Explain whether his results agree with his original prediction. [2]

....

....

(c) State **one** improvement to the experiment to increase confidence in the conclusion. [1]

....

....

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2. *(a)* In a laboratory, a radiation detector was placed in front of a radioactive source for 1 minute. The reading from the detector was recorded. The detector was reset back to zero and another reading recorded after 1 minute. The process was repeated another 4 times.

Detector reading (counts per minute)	74	76	72	75	74	73

(i) Put a tick (✓) alongside the **one** correct reason below for the readings not being the same every minute. [1]

Detector was probably not working properly.	
Radioactive decay is random.	
The source was faulty.	
The times were not carefully measured.	
The detector was not reset back to zero.	

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(ii) Calculate the mean number of counts per minute (cpm). [2]

Mean count rate = ... cpm

(iii) The **background count** was stated as **23 counts per minute**. Calculate the mean count rate of the source in cpm. [1]

Mean count rate of the source = ... cpm

(b) A thick sheet of aluminium is now placed between the radioactive source and the radiation detector. The detector reading drops to **23 cpm**. A student suggests that the radioactive source **only emits** beta radiation and **no** alpha radiation. Explain whether you agree. [3]

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7

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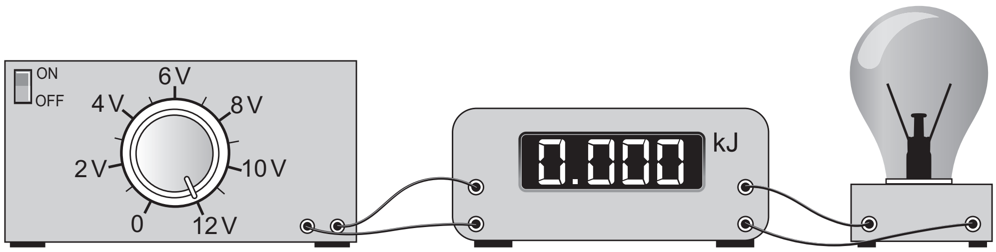
3. A factory that produces lamps has a quality control section. It carries out checks on some of the lamps to make sure their power is close to 25 W.
The apparatus they use is shown below. The energy meter is set to zero.



d.c. power supply — energy meter — 25 W, 12 V lamp

(a) The lamp transfers electrical energy into two other energy types.
Complete the energy transfer equation for the lamp. [1]

Electrical energy → .... energy + ... energy

(b) Name the meter that could be used to check that the output potential difference of the power supply is 12 V. [1]

....

(c) The lamp is switched on for 8.7 s and the energy meter reads 0.225 kJ at the end of this time.

(i) State how many joules of energy are used by the lamp. .... J [1]

(ii) Use the equation:

energy transferred = power × time

to calculate the power of the lamp in watts (W). [2]

Power = ... W

(iii) The lamps should have a power of 25 W. Lamps whose power is more than 8% above or below this value are rejected. Explain whether the lamp tested should be rejected. [2]

....

....

....

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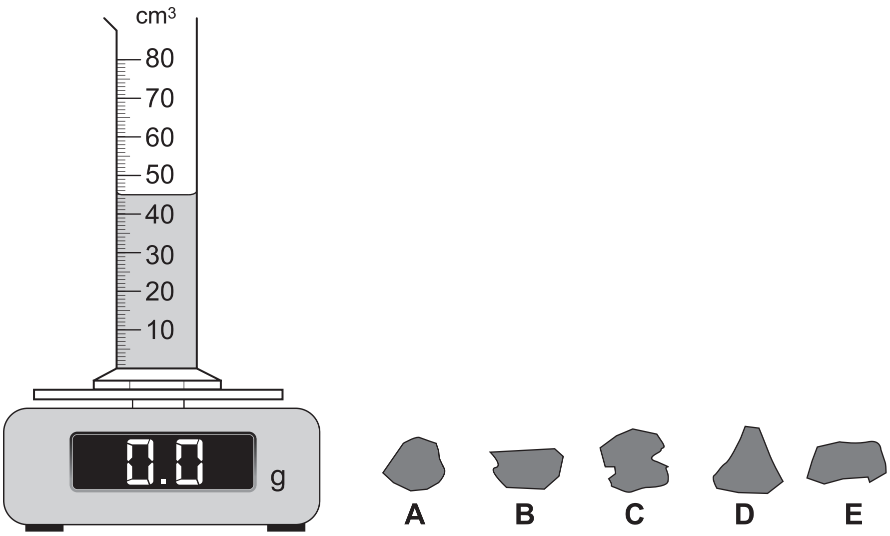
Examiner only

4. *(a)* During a school trip to a slate quarry a student collects 5 small irregular shaped samples of slate.

- He labels them **A**, **B**, **C**, **D** and **E**.
- He places a measuring cylinder, containing water, on to a balance.
- He 'zeros' the reading by pressing the reset button.
- The reading is now 0.0 g.



State the volume of water in the measuring cylinder. .... cm^3 [1]

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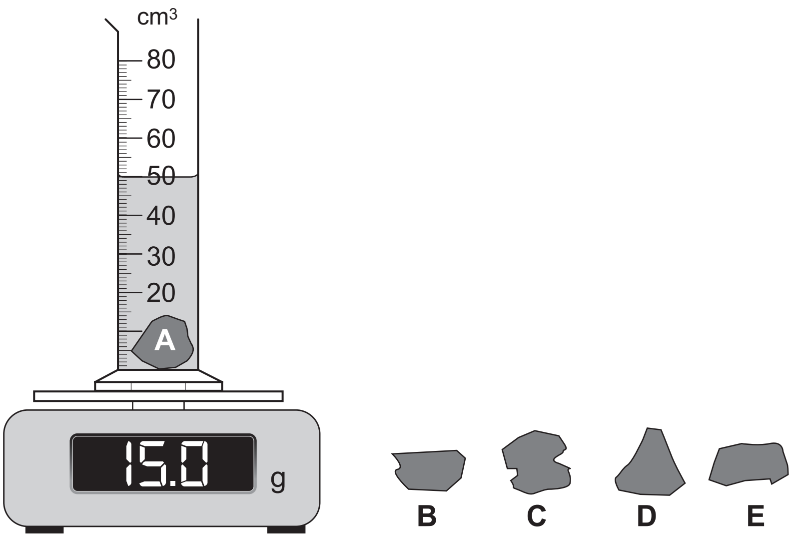
(b) The piece of slate labelled **A** is added to the measuring cylinder. This is shown in the diagram below. The new volume and the mass from the display of the balance are recorded.



(i) Calculate the volume of slate sample **A**. [1]

Volume = ... cm^3

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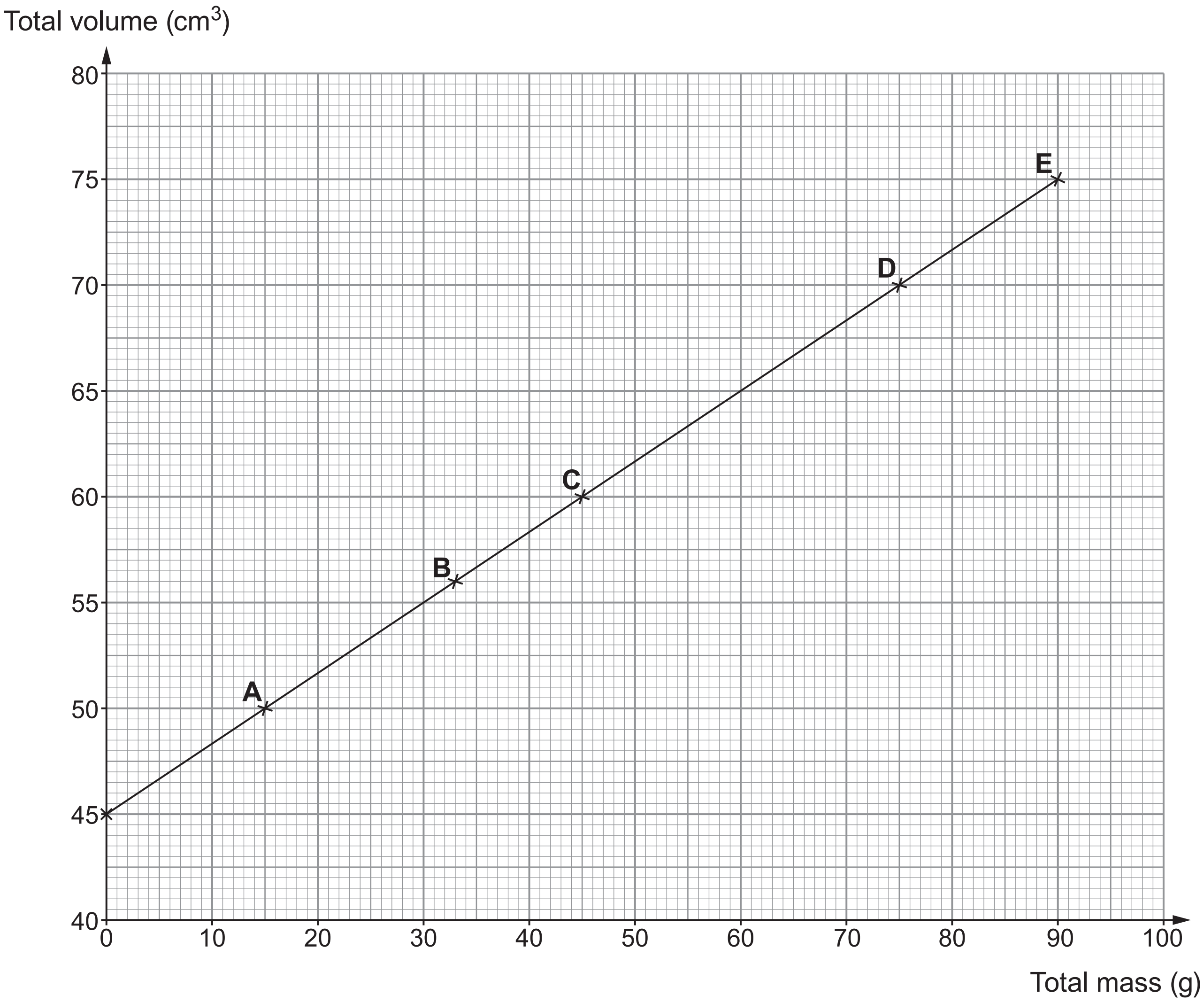
(ii) Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

to calculate the density of slate sample **A**. [2]

Density = ... g/cm^3

(c) **Without removing slate sample A**, slate sample **B** is added to the measuring cylinder. The new volume and mass are recorded. This is continued by adding pieces of slate **C**, then **D** and finally **E**. The graph below shows the results.



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(i) State which slate sample (**A**, **B**, **C**, **D** or **E**) has the largest mass. [1]

....

(ii) State which **two** slate samples have the same volume. [1]

.... and ....

(d) Without calculation, state the density of slate sample **D**. [1]

Density = ... g/cm^3

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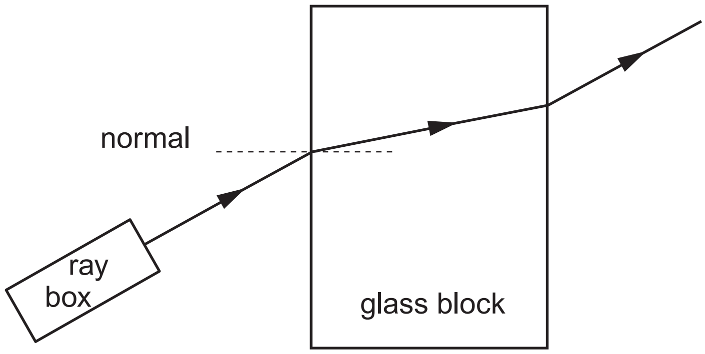
5. The diagram shows a ray of light incident on a rectangular glass block.



(a) Complete the risk assessment. [1]

Hazard	Risk	Control measure
Hot ray box and lamp	Can burn skin if touched	....

(b) You are given the apparatus above and asked to carry out an experiment using the glass block. You are also provided with **a protractor, plain A4 paper, a ruler and a pencil**.

Describe how you could use the apparatus to investigate how the angle of incidence of the light ray is linked to its angle of refraction. [6 QER]

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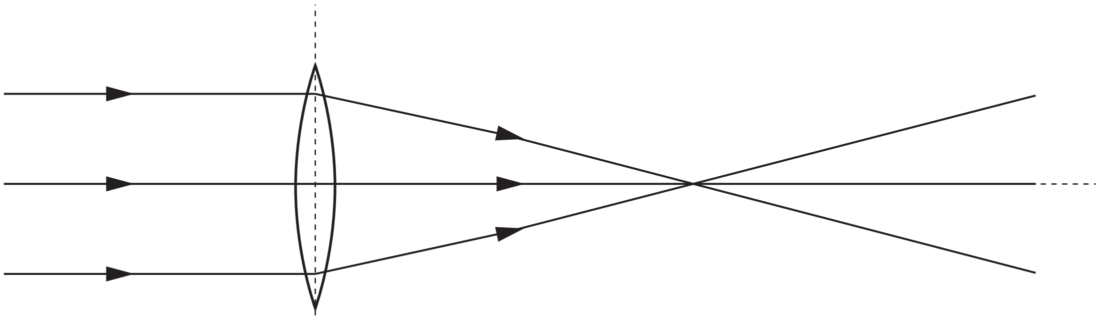
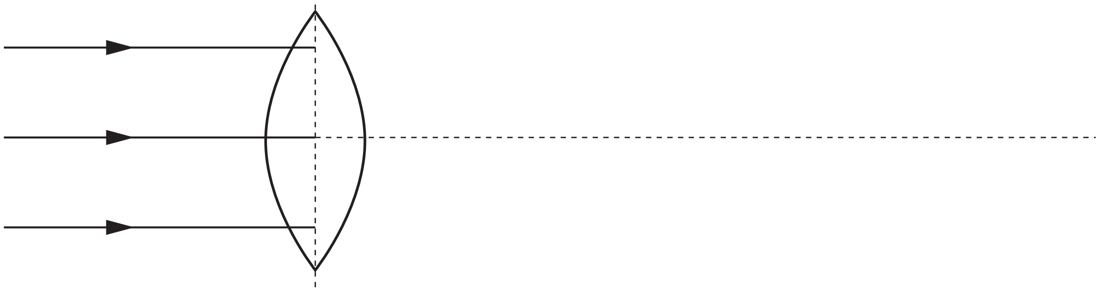
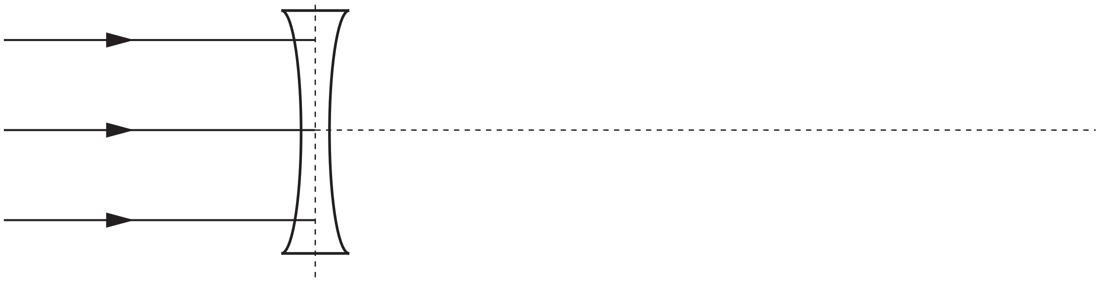
(c) Parallel rays of light are incident on three different glass lenses.



thin convex lens



thick convex lens



thin concave lens

(i) Measure the focal length of the **thin convex** lens. [1]

Focal length = ... cm

(ii) **Complete** the ray diagram for the thick convex lens. [1]

(iii) **Complete** the ray diagram for the thin concave lens. [1]

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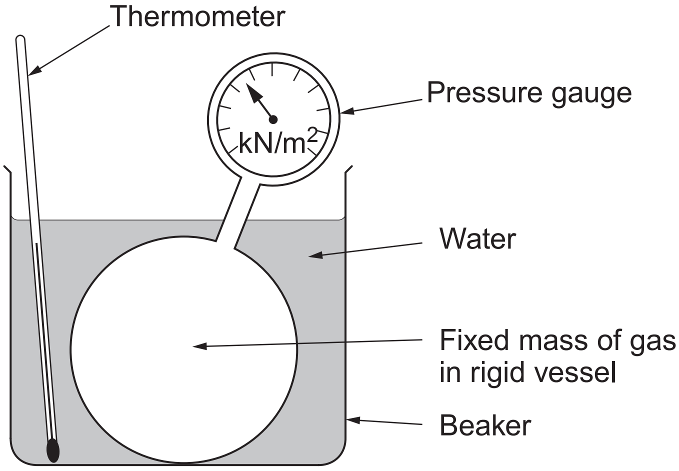
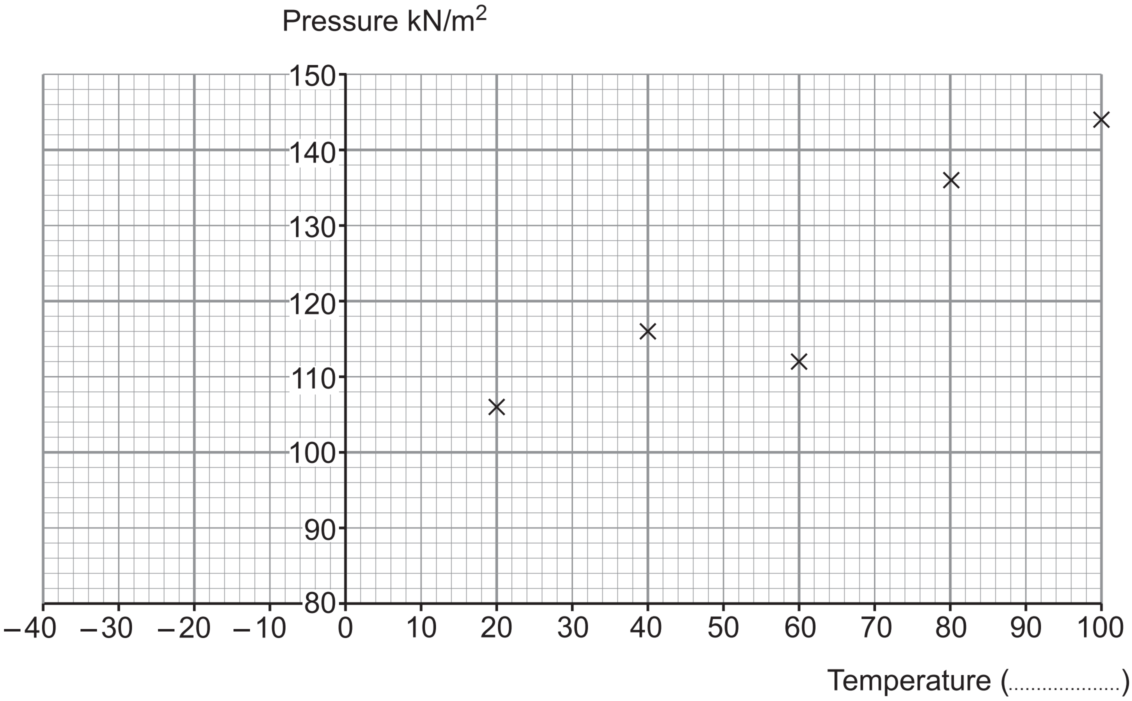
6. A rigid vessel containing a fixed mass of gas is placed in a beaker. Boiling water is poured into the beaker as shown. The water is allowed to cool. As the water cools, its temperature and pressure are measured.



The results from the experiment are plotted on the grid below.



(a) (i) **On the graph** complete the label on the temperature axis. [1]

(ii) **Circle** the anomalous point on the grid. [1]

(iii) **On the graph** draw a suitable straight line. [1]

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(iv) Describe the relationship between the temperature of the gas and its pressure. [2]

....

....

(b) The apparatus from the experiment is placed in the school freezer. The pressure gauge reads 90 kN/m^2. Estimate the inside temperature of the freezer and show on your graph how you arrived at your answer. [2]

Temperature = ...

(c) The inside surface area of the rigid vessel used in the experiment is 5.3×10^{-4} m^2.

The company who make the apparatus state that the maximum force the vessel can withstand without breaking is 100 N.

Use the equation:

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

to calculate the maximum pressure the vessel can safely withstand. [2]

Pressure = ... N/m^2

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Turn over.

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SECTION B

Read the article in the resource booklet carefully and answer **all** *the questions that follow.*

7. *(a)* Refer to **Diagram 1** to answer questions (i) to (iii).

(i) State how the diagram shows the Universe has changed over time. [1]

....

(ii) Our Milky Way galaxy is labelled C. Compare how the distances of galaxies A and D from the Milky Way have changed from the early Universe to a later time. [2]

....

....

....

(iii) Arrange galaxies A, B, D and E, in order of speed of travel away from C from fastest to slowest. [1]

Fastest .... Slowest

(iv) State which of the spectra in **Diagram 2** is emitted from galaxy E. [1]

....

(b) Galaxy M87 shown below is classified as an elliptical galaxy class **E** sub-type **0**.

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Use the information in **Diagram 3** and **Table 1** to identify the class and sub-type of the galaxies shown in the diagrams below. [2]

……………………………………………

……………………………………………

TURN OVER FOR THE REST OF THE QUESTION.

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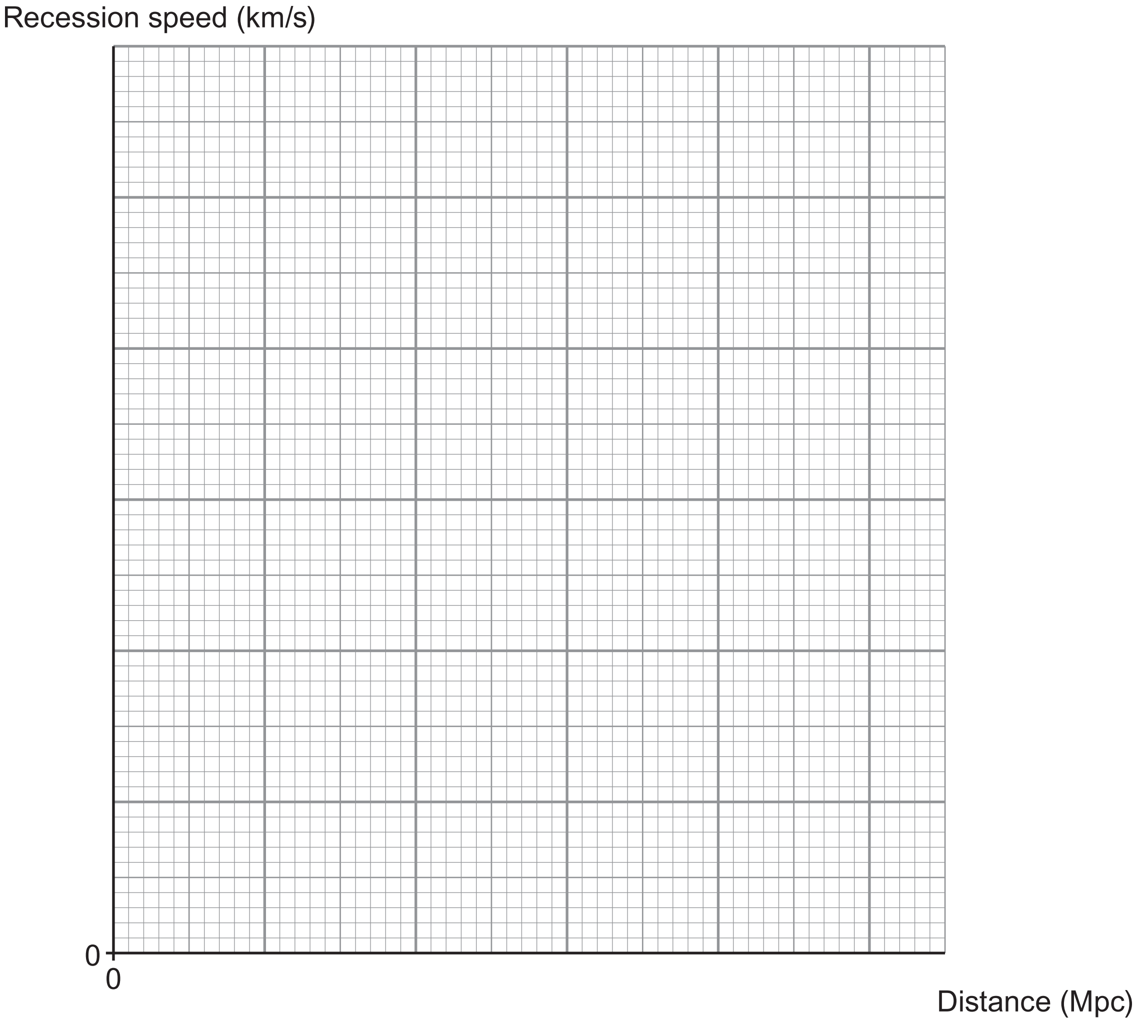
(c) (i) Use the data in **Table 2** to plot the points on the grid below and use your judgement to draw a suitable straight line of best fit. [4]



(ii) Use your graph to find a value of the Hubble constant. [2]

Hubble constant = ... km/s/Mpc

(iii) Explain why another person may arrive at a different value of the Hubble constant from the same plotted points. [2]

....

....

....

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END OF PAPER