(b) A hairdryer connected to the mains supply takes a current of 5.5 A.

(i) Which of these fuses should be used with the hairdryer?

(1)

- ☒ **A** 3 A
- ☒ **B** 5 A
- ☒ **C** 7 A
- ☒ **D** 13 A

(ii) Explain your answer.

(1)

(iii) The hairdryer has a plastic case so there is no need for an earth wire connection in the plug.

Explain why the hairdryer is still safe to use.

(2)

(Total for Question 1 = 6 marks)

2 A student measures the density of water.

She uses a measuring cylinder and an electronic balance.

(a) State the equation linking density, mass and volume.

(1)

(b) A correct unit for density is

(1)

- ☒ **A** g/cm
- ☒ **B** kg/cm
- ☒ **C** g/cm^2
- ☒ **D** g/cm^3

(c) Complete the table to show what is measured by an electronic balance.

(1)

Measuring instrument	What it measures
measuring cylinder	volume
electronic balance	

(d) Describe how the student should use each instrument to make her measurements as accurate as possible.

(4)

Measuring cylinder

Electronic balance

(e) The student wants to make sure her experiment is a fair test.

(i) State **one** factor that she should keep the same throughout her experiment.

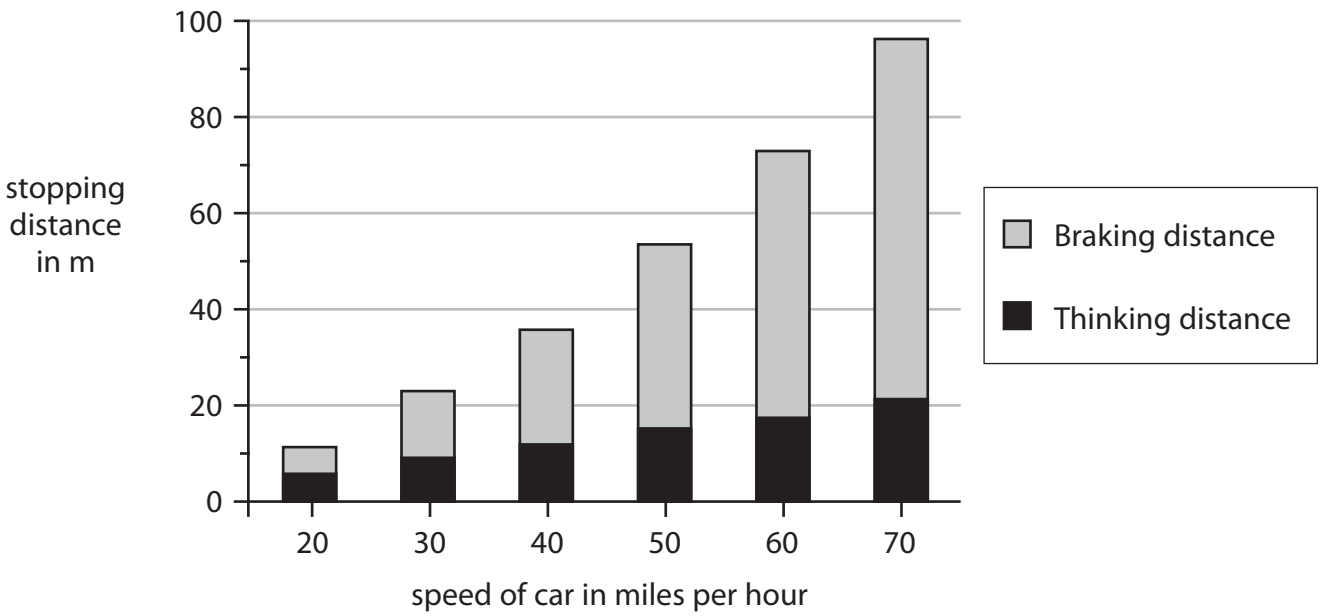
(1)

(ii) Why is it important that she keeps this factor constant?

(1)

(Total for Question 2 = 9 marks)

3 The graph shows the minimum stopping distances, in metres, for a car travelling at different speeds on a dry road.



(a) Complete the equation to show the link between stopping distance, thinking distance and braking distance.

(1)

Stopping distance = ...

(b) Describe the patterns shown in the graph.

(2)

.....

.....

.....

.....

.....

(c) Use the graph to estimate the stopping distance for a car travelling at 35 miles per hour.

(1)

Stopping distance = ... m

(d) To find the minimum stopping distance, several different cars were tested.

Suggest how the data from the different cars should be used to give the values in the graph.

(1)

(e) The tests were carried out on a dry road.

If the road is icy, describe and explain what change there would be, if any, to

(i) the thinking distance

(2)

(ii) the braking distance

(2)

(Total for Question 3 = 9 marks)

4 A student is investigating refraction of light.

(a) What is **refraction**?

(1)

.....

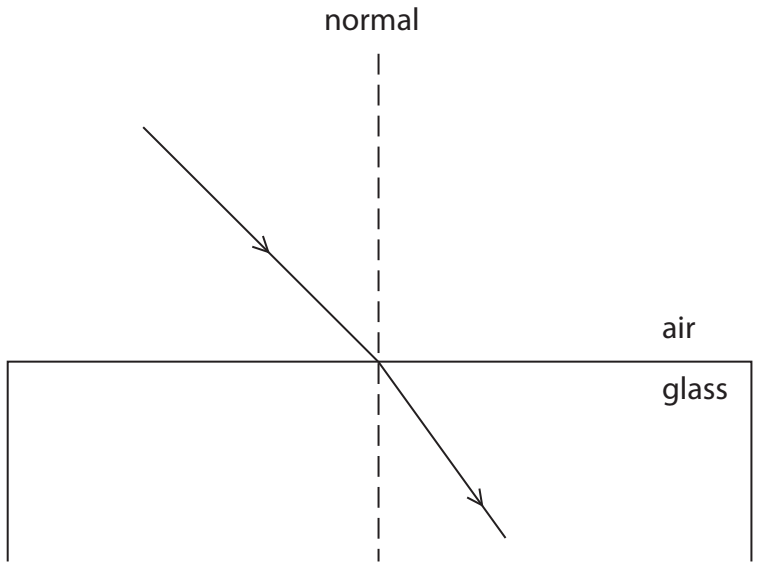
.....

.....

(b) The diagram shows a ray of light travelling from air to glass.

Add labels to show the angle of incidence, *i*, and the angle of refraction, *r*.

(2)

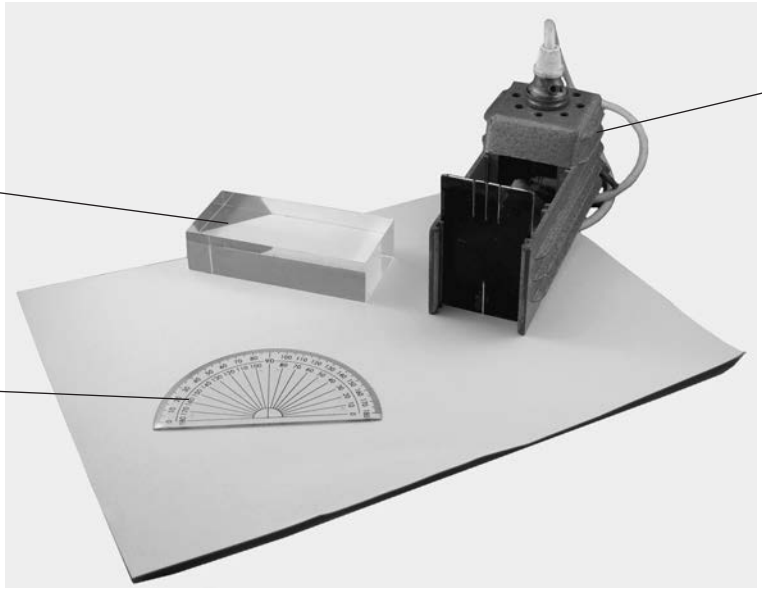


(c) The student wants to find the refractive index of the glass.

(i) State the equation linking refractive index, angle of incidence and angle of refraction.

(1)

(ii) The photograph shows the apparatus the student has available.



Describe how the student should carry out the experiment.

You should include:

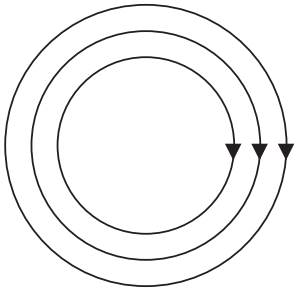
- what the student should measure
- how the measurements should be made
- how the student should use a graph to find the refractive index.

(6)

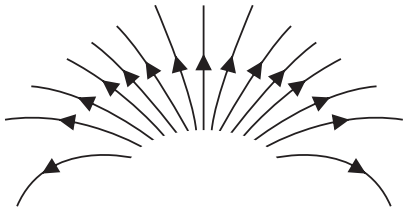
(Total for Question 4 = 10 marks)

5 A magnetic field pattern can be shown using lines.

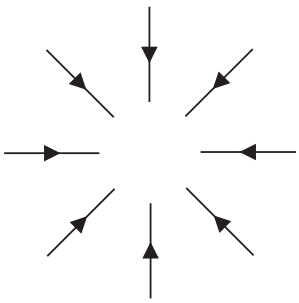
(a) The diagram shows some magnetic field patterns.



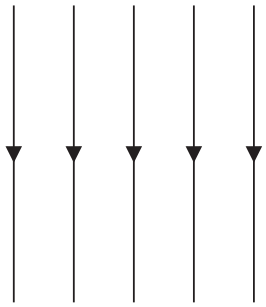
A



B



C



D

Which pattern shows a **uniform** magnetic field? Explain your answer.

(2)

Pattern .....

Explanation .....

.....

.....

(b) Explain how to produce a uniform magnetic field.

(3)

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(Total for Question 5 = 5 marks)

6 A teacher shows his class how to investigate the half-life of a radioactive source.

(a) The readings from the counter need to be corrected for background radiation.

(i) State **one** source of background radiation.

(1)

.....

(ii) Describe the method the teacher should use to correct for background radiation.

(3)

.....

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.....

.....

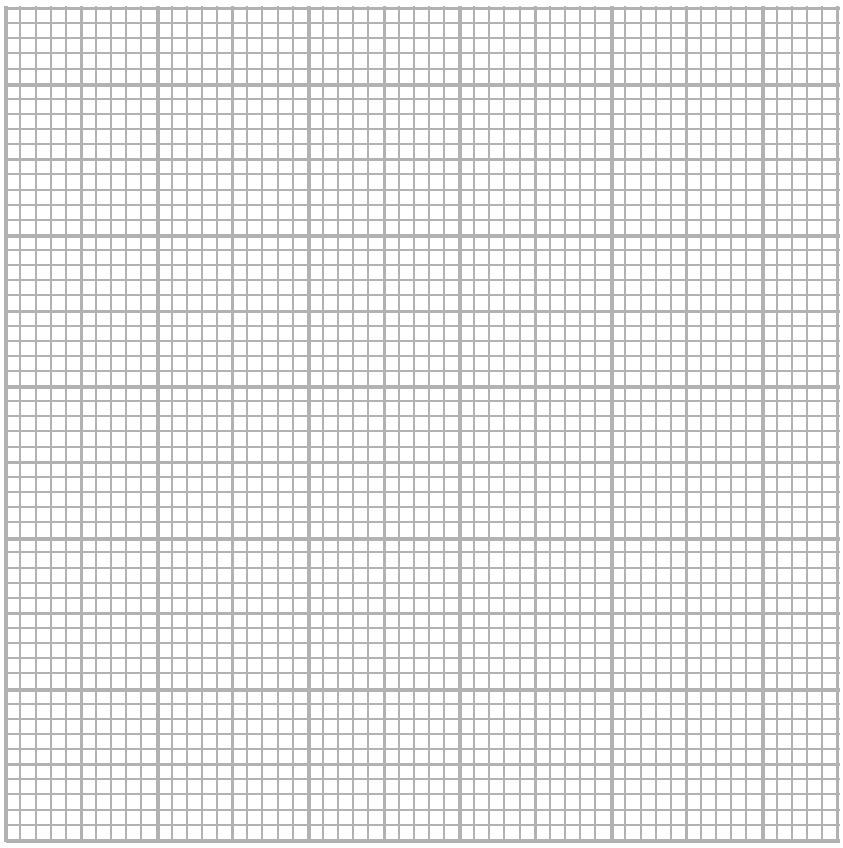
(b) Every half a minute, the teacher records the count rate.

He corrects for background radiation and produces this results table.

Time in minutes	Corrected count rate in Bq
0	49
0.5	30
1.0	24
1.5	18
2.0	15
2.5	11
3.0	10
3.5	9
4.0	5
4.5	6

(i) Draw a graph of corrected count rate against time for these results.

(5)



(ii) Use your graph to estimate the half-life for this material.

(1)

Half-life = ... minutes

(c) The isotope technetium-99 is a gamma emitter with a half-life of 6 hours. It is used as a radioactive tracer in medicine.

The technetium-99 is injected into a patient's bloodstream and carried around the body by the blood. The radiation it emits is detected outside the body.

Explain why technetium-99 is suitable for use as a tracer in this way.

(3)

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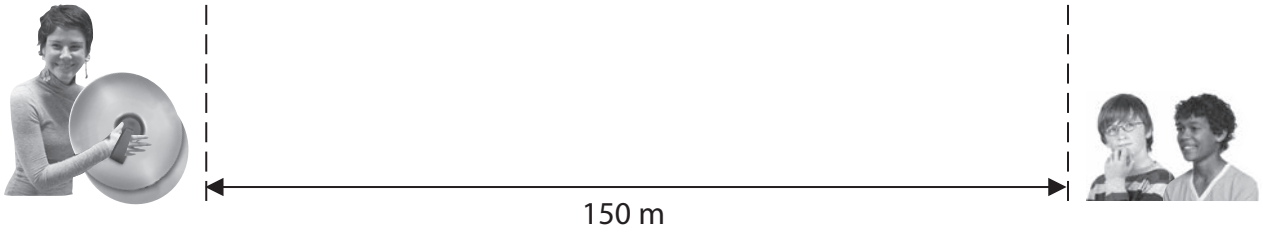
(Total for Question 6 = 13 marks)

7 A teacher and two students are measuring the speed of sound.



The teacher makes a loud sound by hitting two cymbals together.

Each student starts a stopwatch when they see the teacher hit the cymbals. They each stop their stopwatch when they hear the sound.

(a) Describe how a sound wave moves through the air.

(3)

(b) The students repeat the experiment and record their readings in a table.

Student	Time in s
Andrew	0.44, 0.46, 0.44, 0.48, 0.43
Kefe	0.5, 0.6, 0.4, 0.4, 0.6

(i) State the precision of Andrew's readings.

(1)

.....

(ii) State the equation linking speed, distance travelled and time taken.

(1)

(iii) The teacher was standing 150 m from the students.

Use the experimental data recorded by each student to complete the table below.

Give your answers to an appropriate number of significant figures.

(3)

Student	Mean (average) time in s	Speed of sound in m/s
Andrew		
Kefe		

(c) The students look in a data book and find that the speed of sound in air is given as 341 m/s.

The students discuss their results.

My experiment was more accurate because my answer was closest to 341 m/s.

No, you didn't allow for reaction time. My result is the best that you can get with this method.

No, reaction time didn't matter because I had to react twice and it cancelled out.

Andrew

Kefe

Evaluate these conclusions.

(5)

(Total for Question 7 = 13 marks)

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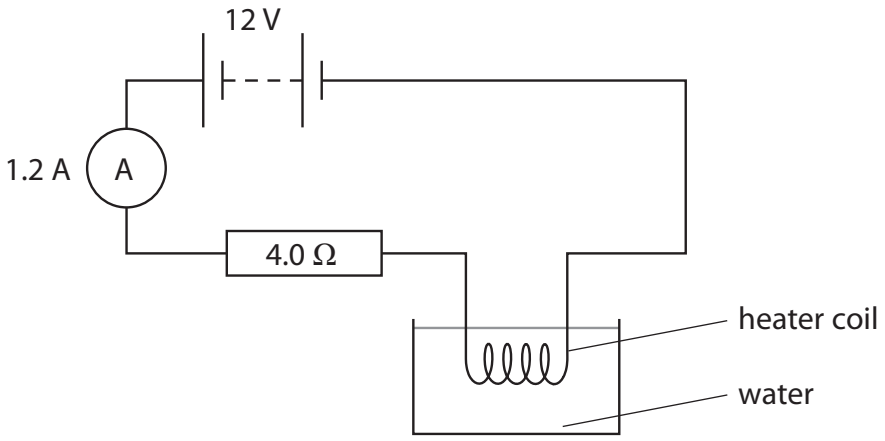
8 The diagram shows a heater coil and a resistor connected to a 12 V battery and an ammeter. The ammeter reading is 1.2 A.



(a) (i) State the equation linking voltage, current and resistance.

(1)

(ii) Calculate the voltage across the 4.0 Ω resistor.

(2)

Voltage = ... V

(iii) Show that the voltage across the heater coil is about 7 V.

(2)

(iv) Calculate the energy transferred to the heater coil in 5.0 minutes.

(3)

Energy transferred = ... J