OCR
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Accredited

GCSE (9–1) Physics B (Twenty First Century Science)
H
J259/03 Breadth in physics (Higher Tier)
Sample Question Paper

Date – Morning/Afternoon
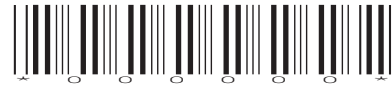Time allowed: 1 hour 45 minutes

Version 2.2

You must have:
• a ruler (in mm)
• the Data Sheet

You may use:
• a scientific or graphical calculator

First name	
Last name	

Centre number						Candidate number				

INSTRUCTIONS
• Use black ink. HB pencil may be used for graphs and diagrams only.
• Complete the boxes above with your name, centre number and candidate number.
• Answer **all** the questions.
• Write your answer to each question in the space provided.
• Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
• Do **not** write in the bar codes.

INFORMATION
• The total mark for this paper is **90**.
• The marks for each question are shown in brackets **[ ]**.
• This document consists of **24** pages.

Turn over

Answer **all** the questions.

1 **(a) (i)** Define density.

....

.... **[1]**

(ii) A volume of air measuring 3.0 m^3 has a mass of 3.9 kg.
Calculate its density.

Density = ………………………………. kg/m^3 **[2]**

(b) Beth does an experiment to test the hypothesis '*the reason why a solid floats or sinks in a liquid depends upon both the density of the solid and the density of the liquid*'.

She was given blocks of rubber and wood and bottles of maple syrup and baby oil.

Material	Density (g/cm^3)
Rubber	1.52
Wood	0.85
Maple Syrup	1.37
Baby Oil	0.80

| Material	Floats in Maple Syrup	Floats in Baby Oil
Rubber	No	No
Wood	Yes	No

Beth concludes that the density of both the solid and the liquid affects whether it floats or sinks.

Use the data to justify Beth's conclusion.

....

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.... **[2]**
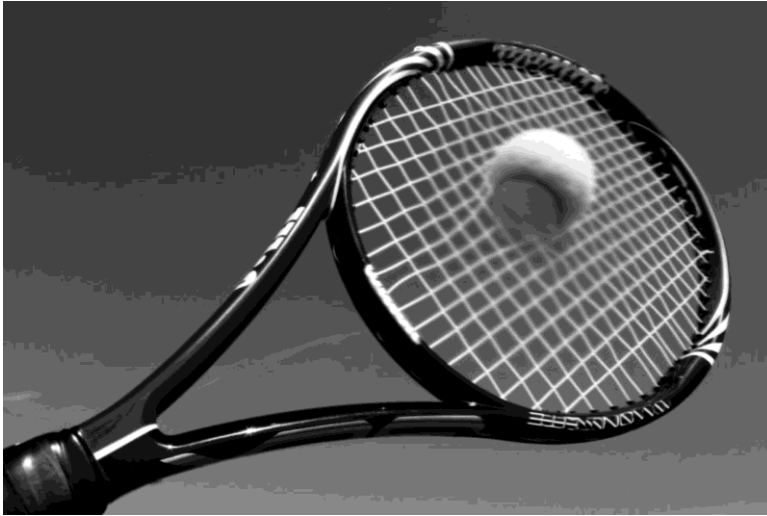
(c) A solid block is immersed in a liquid.

Which **one** of the diagrams (**A**, **B**, **C** or **D**), best shows the **direction** of all the force(s) on the solid caused by the liquid pressure?
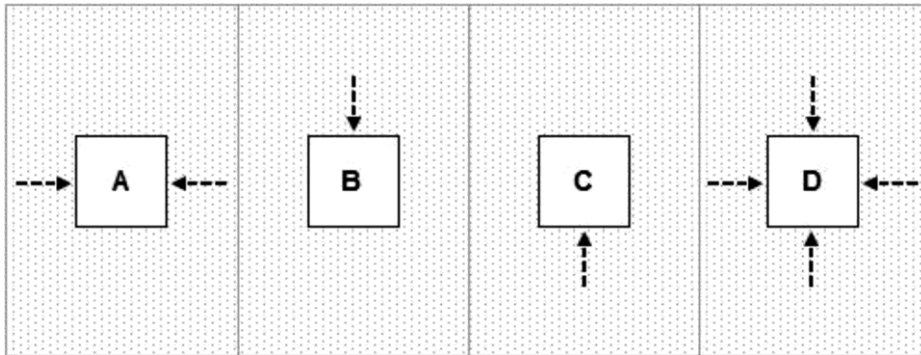
.... **[1]**

2 This is a picture of a tennis ball being hit.

(a) The racket exerts an average force of 1000 N on the tennis ball.

Complete the following table to show whether each statement about the average force exerted <u>by</u> the tennis ball <u>on</u> the racket is **true** or **false**.

Put ticks (✓) in the correct boxes.

	True	False
The average force is a vector quantity		
The average force acts in the same direction as the ball is moving		
The average force equals 1000 N		
The average force depends upon the weight of the ball		

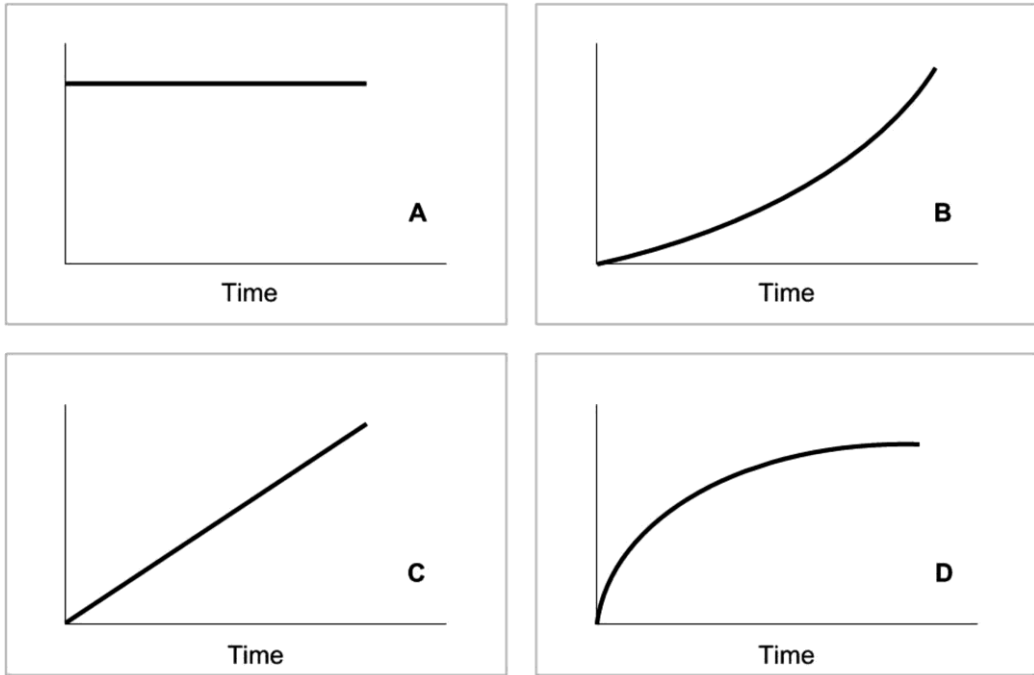**[2]**

(b) The tennis ball has a mass of 0.06 kg.

Calculate the momentum of the ball (in kg m/s) as soon as it leaves the racket at 50 m/s.

Momentum = ………………………………… kg m/s **[3]**

(c) Calculate the weight in newtons of the tennis ball. Gravitational field strength = 10 N/kg.

Weight = ………………………………….N **[3]**

3 **(a)** A coin is dropped to the floor.

(i) Which graph represents the distance–time graph of the coin dropping?

Graph...[1]

(ii) Which graph represents the speed–time graph of the coin dropping?

Graph...[1]

(b) The coin falls through a distance of 150 cm in a time of 0.8 seconds.

Calculate the average speed at which the coin falls.

Speed   =   distance   ÷   time

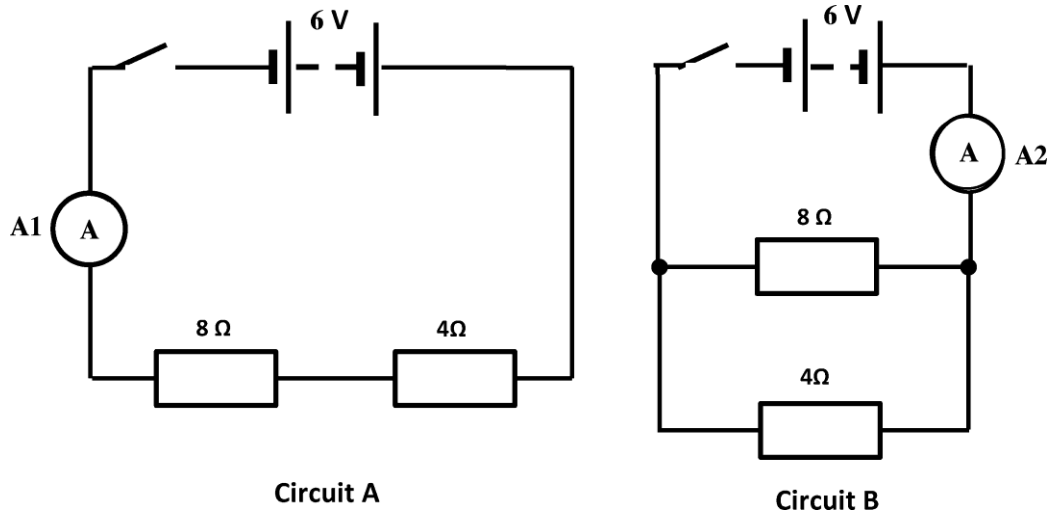Average speed = ………………………………… m/s **[3]**

(c) Explain the **difference** between vectors and scalars as it applies to velocity and speed.

....

....

.... **[3]**

4   Layla is comparing series and parallel circuits in an experiment.

Layla sets up the two circuits (**A** and **B**) below.

Circuit A   **Circuit B**

(a) Layla decides to check the battery voltage in the circuits.

Using the correct symbol add a meter to circuit **A** to show how she could do this.   **[1]**

(b) Layla switches on both circuits.

Put a tick (✓) in the box next to the correct answer.

The p.d. across A_2 is very large ☐

The p.d. across the 8 Ω resistor is the same in both circuits. ☐

The reading on A_1 is less than the reading on A_2. ☐

The total resistance in circuit **B** is 6 Ω. ☐   **[1]**

(c) Layla replaces the 4 Ω resistor with a 6 Ω resistor in each circuit.

Complete the table to show whether each statement is true for the two circuits.

Put ticks (✓) in the correct boxes.

Statement	True for circuit A	True for circuit B	True for both A and B
The current from the battery decreases.			
Each unit of charge does less work on the 8 Ω resistor.			
The current in the 8 Ω resistor does **not** change.			

[3]

5 Ultrasonic testing is a technique widely used in industry to detect defects or flaws in many materials including metals and plastics.

The diagram shows ultrasound testing of a steel plate.
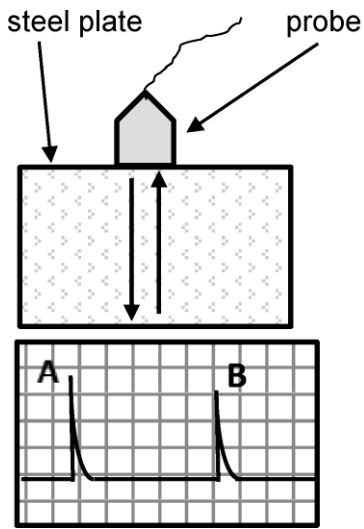
The probe sends out a sound wave into a sample of steel plate.

There are two signals displayed:

- one signal from the outgoing pulse (**A**)
- one signal due to an echo from the bottom surface (**B**).

For the sound waves,

- Frequency = 100 kHz
- Speed = 330 m/s

Calculate the wavelength of the sound waves.

Wavelength = …………………………………. m **[4]**

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TURN OVER FOR THE NEXT QUESTION

Turn over

6 This question is about the magnetic effect of an electric current.

(a) (i) Which diagram (**A**, **B**, **C** or **D**) correctly shows the magnetic field caused by a wire conducting an electric current?
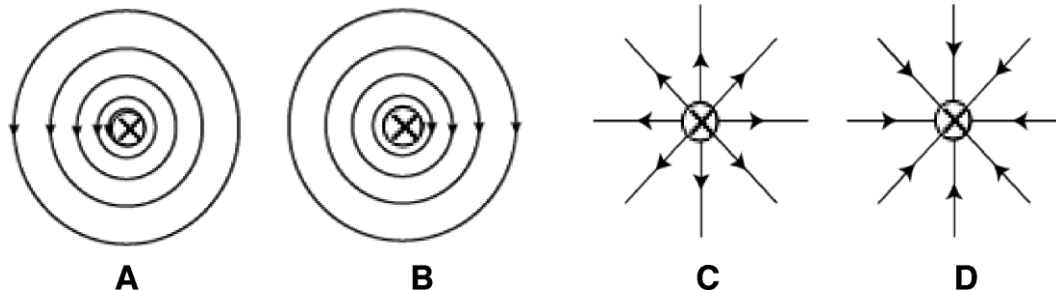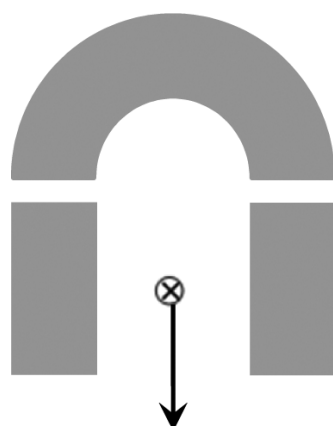
(The electric current is flowing **into the paper**.)

A	**B**	**C**	**D**

Diagram:...**[1]**

A wire is placed between the North and South poles of a permanent magnet and at right angles to the magnetic field.

- The current is switched on (electric current flowing **into the paper**).

- This creates a force on the wire in the direction shown.

Direction of force

(ii) Complete the diagram by labelling the North and South poles of the permanent magnet N and S **and** sketching the resulting magnetic field between the poles. **[2]**
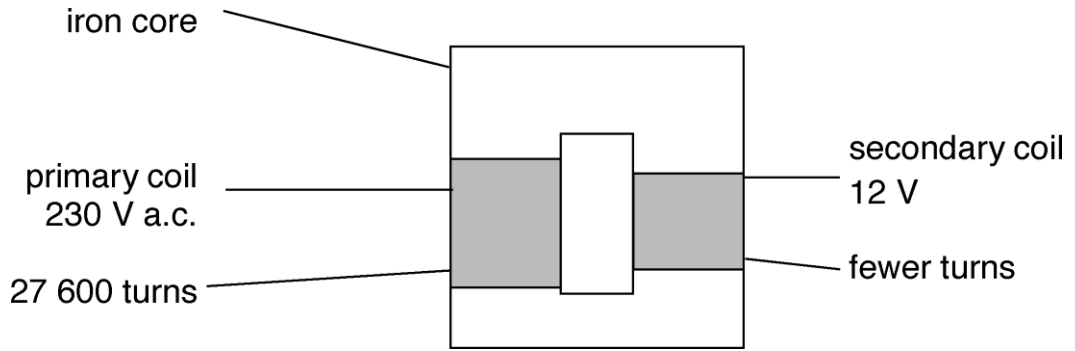
(iii) The current in the wire in **(ii)** is 0.2 A, and the magnetic flux density is 0.036 T.

The force experienced is 5.4×10^{-4} N.

Calculate the length of wire inside the magnetic field.

Length = ………………………………… m   **[3]**

(b) This is a diagram of a simple transformer.

iron core

primary coil
230 V a.c.

secondary coil
12 V

fewer turns

27 600 turns

The secondary coil produces an output of 12 V.

Calculate the number of turns needed on the secondary coil.

Number of turns =..**[2]**

(c) A National Grid transformer in a sub-station converts 30 000 V into 230 V to power a town.

The transformer is 99% efficient.

Using appropriate estimates, discuss the energy consequences **for the transformer sub-station** if the efficiency is less than 100%.

....

....

....

.... **[2]**

7 Two students are investigating springs and forces.

- They begin by comparing **three** different springs.

- They measure how much each spring stretched after attaching different weights.

Here are their results:

SPRING A		SPRING B		SPRING C	
Force (N)	Extension (cm)	Force (N)	Extension (cm)	Force (N)	Extension (cm)
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.7	1.0	0.6	1.0	1.6
2.0	1.4	2.0	1.0	2.0	3.2
3.0	2.1	3.0	1.6	3.0	4.8
4.0	2.8	4.0	2.4	4.0	6.4
5.0	3.5	5.0	3.8	5.0	8.0

(a) One of the students makes a comment about the data.

The data for all of the springs follow a linear relationship.

Is this student correct?

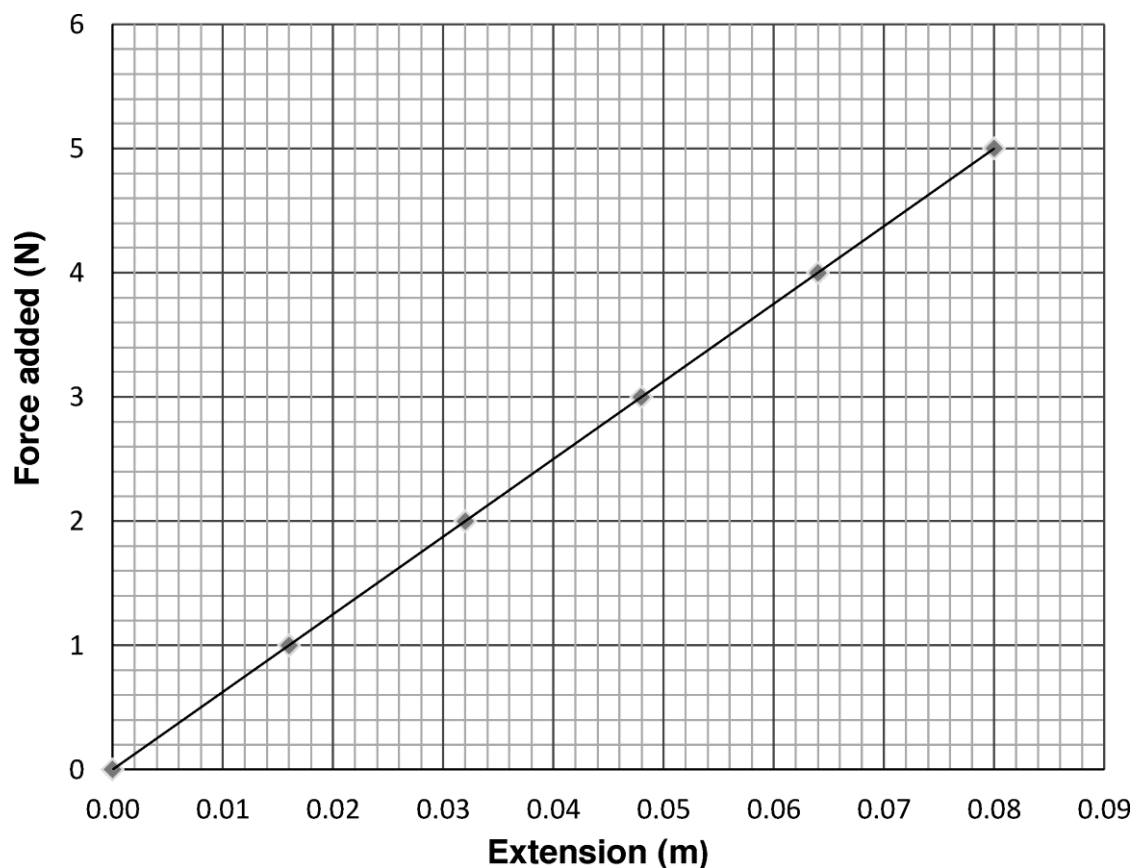Use your understanding of what is meant by a linear relationship to help explain your answer.

....

....

.... **[2]**

(b) The students plotted a force–extension graph in **Fig. 7.1** for **spring C**.

(Note that the extension of the spring is in metres).

Fig 7.1

Use the graph to calculate the amount of work done (in joules) in stretching the spring over the first 8 cm (0.08 m).

Work done = ………………………………… J **[2]**

(c) When a rubber band is pulled, it stretches quite easily at the start and then becomes more difficult to stretch.

Sketch a curve on the graph in **Fig. 7.1** to show this behaviour. **[1]**

8 This question is about changing ideas about our Universe.

(a) In 1917, scientists suggested that the Universe was not changing in size.

Explain the effect that gravity would have in a Universe that is **not** changing in size.

....

.... **[1]**

(b) About this time, Edwin Hubble noticed **red-shifts** in the light from the galaxies.
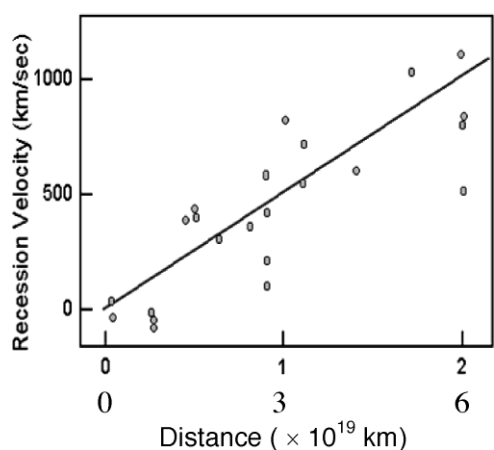
This provided evidence that galaxies were moving away from each other at high speeds.

(i) Explain what is meant by red-shift and how this shows that galaxies are moving away from each other.
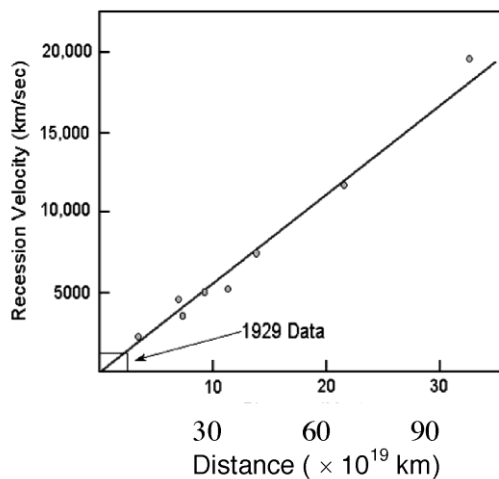
....

....

.... **[2]**

The graphs in **Fig. 8.1** show how the speed that galaxies are moving away from us is linked to their distance from us.

Fig. 8.1

(ii) Describe the trend shown in **Fig. 8.1** and explain how the data provides evidence which leads to the Big Bang model of the Universe.

....

....

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....

....

.... **[3]**

(iii) From the graphs in **Fig. 8.1**, astronomers can work out the age of the Universe.

Explain how the data can be used to calculate the age of the Universe.

Assume that the speeds of the galaxies have remained reasonably constant over time.

....

....

....

.... **[2]**

(iv) Suggest **two** reasons why present day estimations of the age of the Universe are more valid than Hubble's initial values.

....

....

....

.... **[2]**

9　**(a)** Nuclear medicine uses radioactive isotopes as tracers and to help diagnose and treat different types of cancer.

Some details about four radioactive isotopes of iodine are shown in **Table 9.1**.

Isotope	Radiation emitted	Half-life
Iodine–123	gamma	13 hours
Iodine–128	beta	25 minutes
Iodine–129	Beta and gamma	15.7 million years
Iodine–131	Beta and gamma	8 days

Table 9.1

(i) Iodine–123 is widely used as a **tracer**.

Explain why iodine–123 is the most suitable iodine isotope for use as a tracer, from the four isotopes listed in **Table 9.1**.

Explain in terms of:

- the radiation emitted
- the half-life.

....

....

.... **[2]**

(ii) Iodine–129 and iodine–131 are both produced by the fission of uranium atoms during the operation of nuclear reactors.

Here is a diagram of a fission reaction.
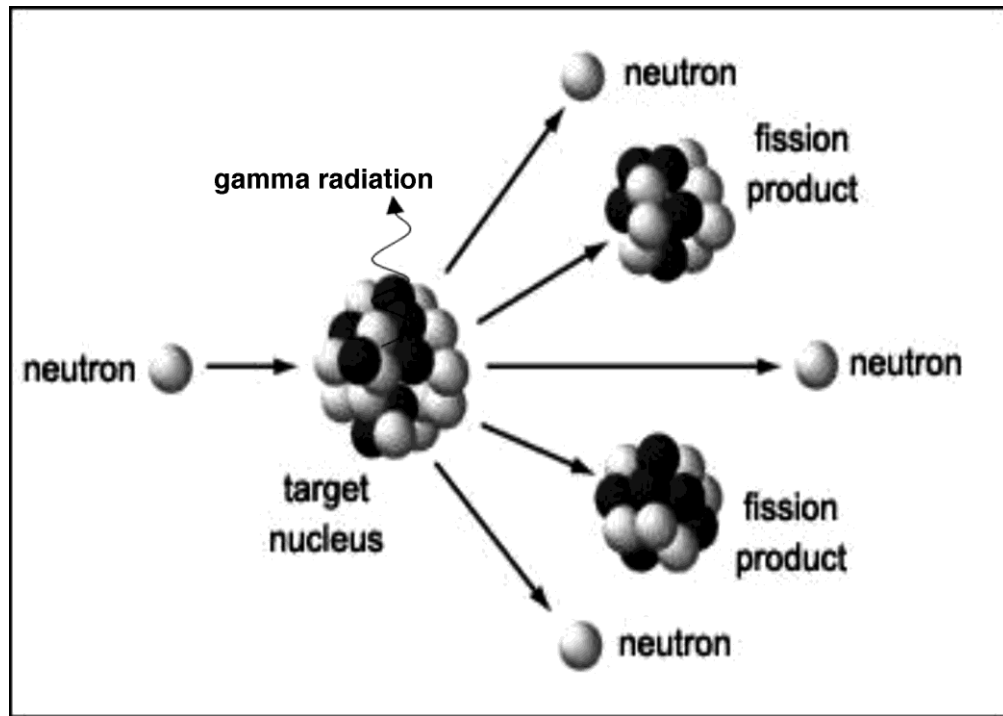
How is the energy released in this reaction carried away from the target nucleus after fission?

....

....

.... **[2]**

(b) Describe the process of Nuclear **Fusion**.

....

....

.... **[2]**

10 Jack uses the equipment below.
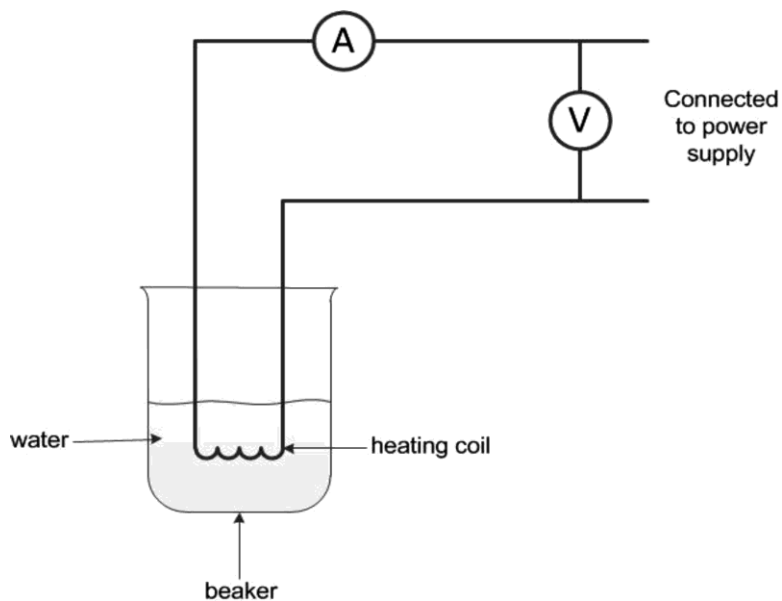
From the results, he is able to calculate the specific heat capacity of water.

(a) (i) State **one** safety issue Jack needs to consider in a risk assessment and explain what he can do to prevent this issue.

....

.... **[2]**

(ii) Jack uses a mass of water of 0.10 kg.

He obtains a temperature change of 30°C.

He calculates the change in thermal energy to be 12 900 J.

Calculate the specific heat capacity of water

Specific heat capacity = ………………………………. J/kg°C   **[3]**

(iii) State and explain how Jack could improve the experiment to get a more accurate result.

....

....

.... **[2]**

(b) Jack then does another experiment.

• He fills two beakers with equal masses of liquids **X** and **Y,** at the same temperature.
• The liquids are left and their temperatures are monitored throughout the experiment.

A graph of the temperature of the liquids with time is shown below.
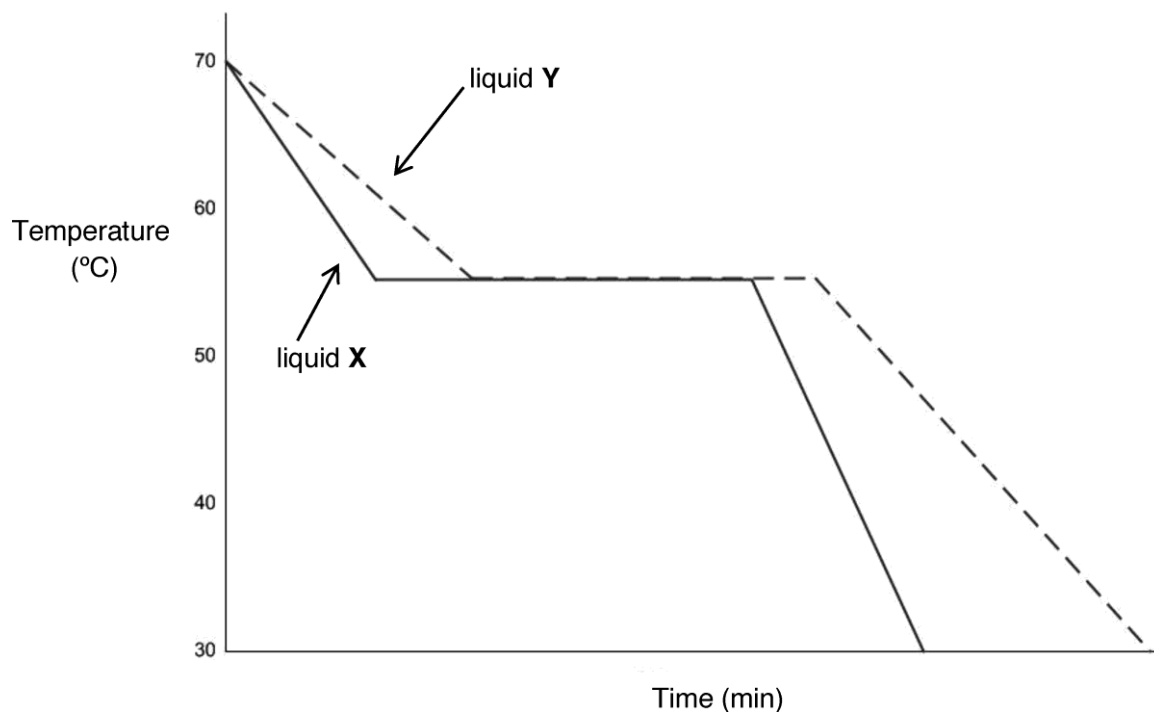
Use the graph to compare what happens to liquids **X** and **Y** at 55°C.

Suggest what is happening to the liquids at this temperature.

....

....

....

.... **[3]**

(c) Jack concludes that liquids **X** and **Y** are the same substance.

State what evidence there is to support this?

....

.... **[1]**

(d) A beaker contains hot water.

Jack wants to calculate the thermal energy lost by the hot water when he puts a cold aluminium block into it.
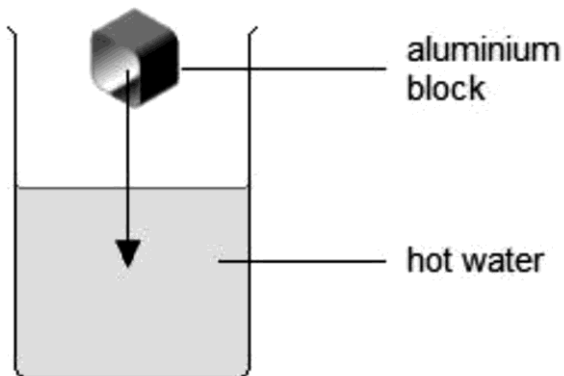
What information will he need to make this calculation?

....

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.... **[3]**

11 **(a)** In a coal-burning power station, large amounts of heat energy are needed to convert water into steam. The steam then drives the turbine to generate energy.

coal   furnace and boiler   turbine and generator   cooling towers   transformer
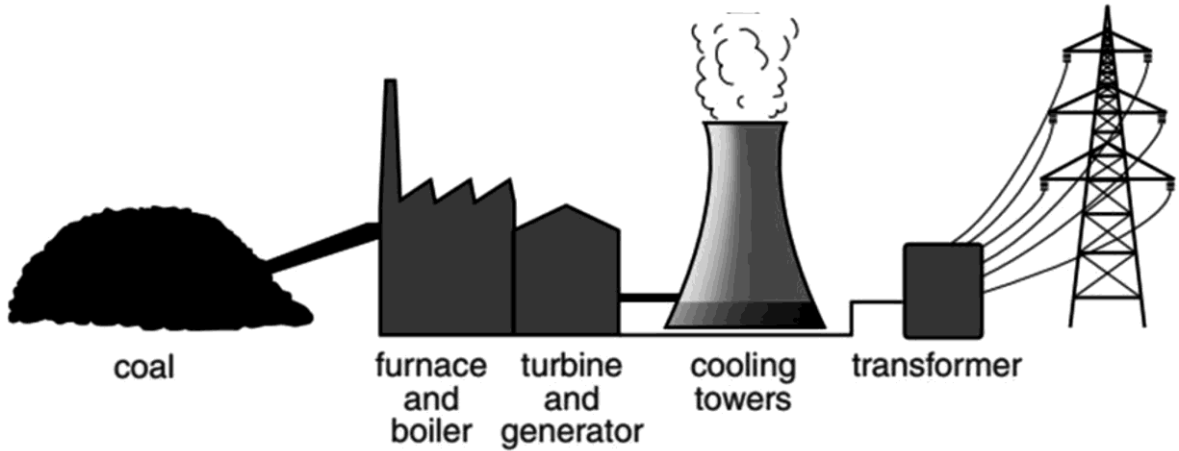
(i) Name an energy resource which does **not** need a furnace or boiler, as it can drive the turbine directly when generating electricity.

.... **[1]**

(ii) Write down **one** advantage and **one** disadvantage that the method of generating electricity in **(i)** has over a coal-burning power station.

Advantage: ....

....

Disadvantage: ....

.... **[2]**

(b) Some coal-burning power stations can use some of their waste energy to heat local houses and industries. However, the efficiency of these Combined Heat and Power stations is less than from a typical coal-burning power station.

Select **one** answer below to give a location where this process would be useful.

Place a tick (✓) in the correct box.

Town **A**: small population far from power station	
Town **B**: large population close to power station	
Town **C**: large population far from power station	
Town **D**: small population close to power station	

[1]

12 A group of students are designing an experiment to investigate the relationship between stopping distance and speed.
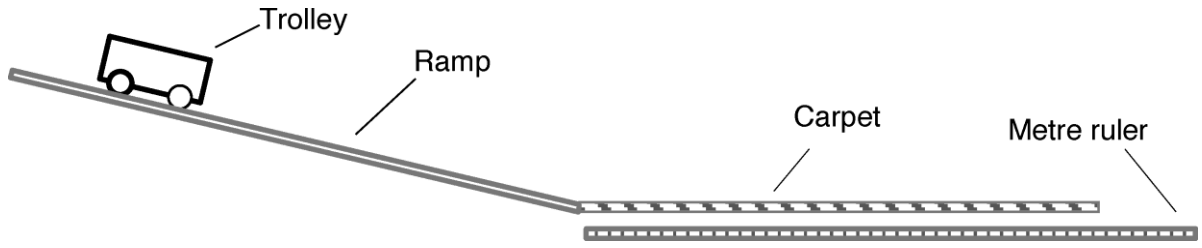
The apparatus

- The trolley has a mass of 200 g and is placed on a gently sloping ramp.
- The thick carpet is used to slow down the trolley.
- The metre ruler is used to measure the stopping distance.

(a) How could the student calculate the 'top speed' of the trolley at the bottom of the ramp, just before it reaches the carpet?

Name the additional apparatus required and explain how it should be used.

....

....

....

.... **[3]**

The procedure

- The trolley is released and allowed to run freely down the slope.
- The distance it takes for the trolley to come to rest is measured.

The experiment is repeated by releasing the trolley from different positions up the ramp. This changes the 'top speed'.

The results
The speed and stopping distance are shown in the table.

Speed (m/s)	Stopping distance (m)
0.52	0.18
0.39	0.11
0.66	0.28
0.79	0.40
0.82	0.44
0.94	0.62

(b) A graph is plotted from the results.

Complete the plotting of the points below and draw a smooth curve of best fit.
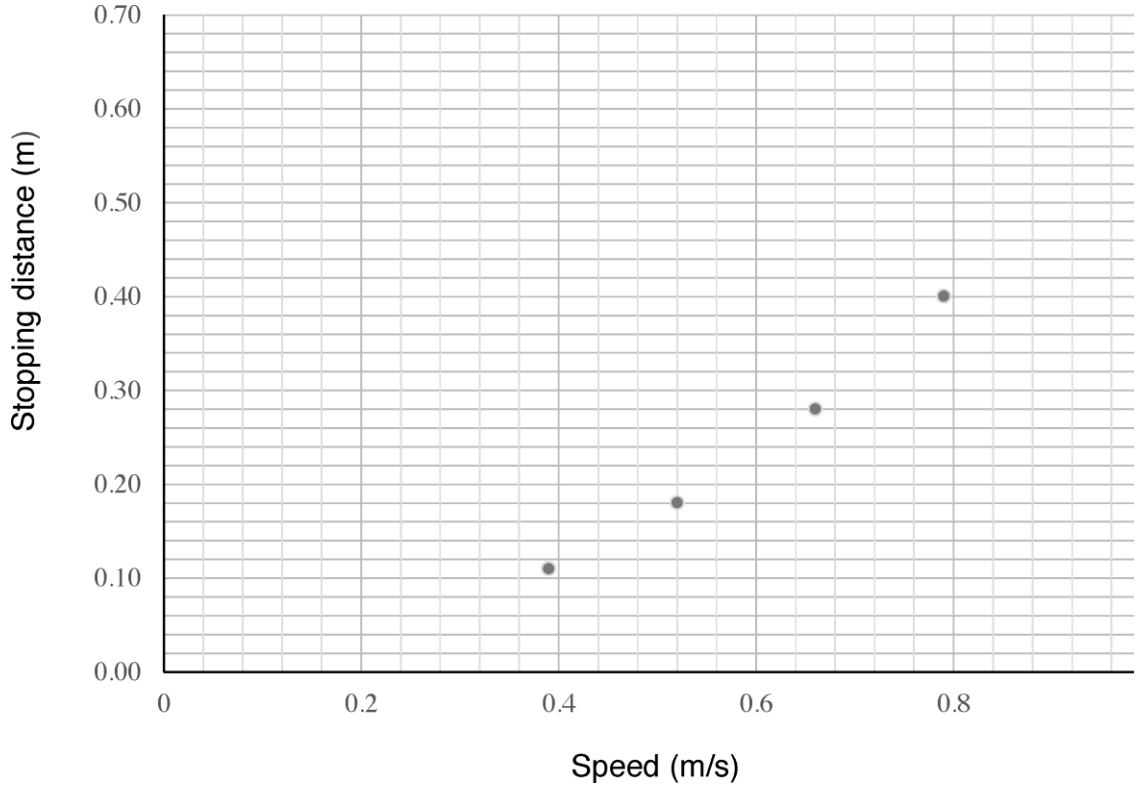
[2]

(c) Describe the pattern shown on the graph.

....

....

.... **[2]**

(d) Describe and explain how this graph would differ if the trolley had an 800 g mass placed on top of it.

....

....

.... **[3]**

END OF QUESTION PAPER

Summary of updates

Date	Version	Details
October 2021	2.2	Updated copyright acknowledgements.

![OCR Oxford Cambridge and RSA]

…day June 20XX – Morning/Afternoon
GCSE (9–1) Physics B (Twenty First Century Science)
J259/03 Breadth in physics (Higher Tier)

SPECIMEN MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK   90

This document consists of 16 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1.   Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2.   Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3.   Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

     YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1.   Mark strictly to the mark scheme.

2.   Marks awarded must relate directly to the marking criteria.

3.   The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4.   If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.
   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

Annotations

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

The breakdown of Assessment Objectives for GCSE (9-1) in Physics B:

		Assessment Objective
AO1		**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1		Demonstrate knowledge and understanding of scientific ideas.
AO1.2		Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2		**Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.**
AO2.1		Apply knowledge and understanding of scientific ideas.
AO2.2		Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3		**Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.**
AO3.1		Analyse information and ideas to interpret and evaluate.
AO3.1a		Analyse information and ideas to interpret.
AO3.1b		Analyse information and ideas to evaluate.
AO3.2		Analyse information and ideas to make judgements and draw conclusions.
AO3.2a		Analyse information and ideas to make judgements.
AO3.2b		Analyse information and ideas to draw conclusions.
AO3.3		Analyse information and ideas to develop and improve experimental procedures.
AO3.3a		Analyse information and ideas to develop experimental procedures.
AO3.3b		Analyse information and ideas to improve experimental procedures.
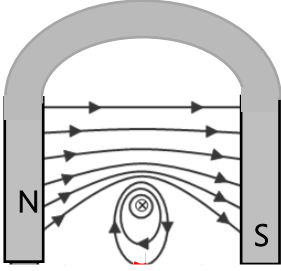
Question			Answer	Marks	AO element	Guidance
1	(a)	(i)	Density = mass ÷ volume ✓	1	1.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 1.3 (kgm/s) award 2 marks** 3.9 ÷ 3.0 ✓ =1.3 (kg/m^3) ✓	2	2.1	
	(b)		She is correct: Density of solid > Density of liquid → Solid sinks ORA; ✓ Quotes data from the table in support of claim ✓	2	1.1 3.2b	No mark for just stating Beth is correct
	(c)		D ✓	1	1.1	
2	(a)		(see table below)	2	2.2	4 correct = 2 marks 2 or 3 correct = 1 mark 1 or 0 correct = 0 marks

	True	False
It is a vector quantity	✓	
The force acts in the same direction as the ball…..		✓
The force equals 1000 N	✓	
The force depends upon the weight of the ball		✓

Question			Answer	Marks	AO element	Guidance
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 3.0 (kgm/s) award 3 marks** Recall: Momentum = mass x velocity ✓ = 0.06 x 50 ✓ = 3.0 (kgm/s) ✓	3	 1.1 2.1 2.1	Correct substitution gains first 2 marks (if equation is missing)
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 0.6 (N) award 3 marks** Recall: Weight (N) = mass (kg) x gravitational field strength (N/kg) ✓ =0.06 kg x 10 N/kg ✓	3	 1.1 2.1	Correct substitution gains first 2 marks (if equation is missing)

Question			Answer	Marks	AO element	Guidance
			= 0.6 (N) ✓		2.1	

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	B ✓	1	3.2a	
		(ii)	C ✓	1	3.2a	
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 1.88(m/s) award 3 marks** Recall speed = distance ÷ time ✓ Converts cm into m = 150cm = 1.5m ✓ 1.5 m ÷ 0.8 s = 1.88 (m/s) ✓	3 1.1 2.1 2.1		
	(c)		The speed of an object does not give indication of a direction ✓ The velocity of an object at a given moment is its speed, together with an indication of its direction. ✓ Velocity is a vector and speed is a scalar ✓	3	1.1	

Question			Answer	Marks	AO element	Guidance
4	(a)		(V) connected in parallel with battery in circuit A ✓	1	2.2	Correct symbol needed and across battery **ONLY ALLOW** if correctly drawn in circuit A
	(b)		The reading on A_1 is less than the reading on A_2. ☑	1	2.1	
	(c)		*(see table below)*	3		One mark for each correct row
5	(a)		**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 3.3 x 10^{-3} (m) award 4 marks**	4		
			Recall and apply $v = f \times \lambda$ ✓		1.1	
			Rearrange to get $\lambda = v \div f$ ✓		1.1	
			Convert kHz to Hz 100 kHz = 100000 Hz ✓		2.1	
			330 m/s ÷ 100000 Hz = 3.3 x 10^{-3} (m) ✓		2.1	

Table for question 4(c):

Statement	True for **circuit A**	True for **circuit B**	True for **both**	AO element
The current from ……			✓	1.1
Each unit of charge does ……	✓			2.1
The current in the 8……		✓		2.1

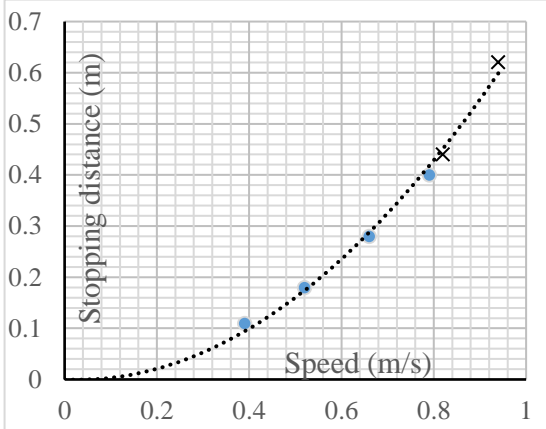| Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	B ✓	1	2.1	
		(ii)	N and S pole correctly labelled; ✓ Magnetic field pattern correct direction between poles **and** over the top of the wire ✓ 	2	2.1	
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 7.5 x 10^{-2} (m) award 3 marks** Select F=BIL Rearrange to get L = F ÷ (BI) ✓ 5.4 x 10^{-4} N ÷ (0.036 x 0.2) ✓ 7.5 x 10^{-2} (m) ✓	3	 1.1 2.1 2.1	
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 1 440 (turns) award 2 marks** $\dfrac{230}{27600} = \dfrac{12}{X}$ ✓ **OR** $\dfrac{230 \times 12}{27600}$ / **AW** ✓	2	1.2 2.1	

Question			Answer	Marks	AO element	Guidance
			1 440 (turns) ✓			
	(c)		Energy dissipated in transformer will result in heat up of substation. If not removed it will result in a meltdown. ✓ Large amount of energy justified by estimate e.g. 1 to 5kW per person. Typical output current at 230V of 200 - 10 000 A ✓	2	2.1	
7	(a)		(The student is incorrect / partly correct) Springs A **and** C follow a linear relationship / spring B does not follow a linear relationship; ✓ In a linear relationship the extension increases in equal amounts (as the force does) / the graph is a straight line from the origin ✓	2	3.1a	Marks are for the **explanation**
	(b)		Area under graph OR 0.5 x 5 x 0.08 ; ✓ 0.2 (J) ✓	2	2.2	
	(c)		Curve line drawn starting 0,0 parabola-like curve with increasing gradient.	1	2.2	

Question			Answer	Marks	AO element	Guidance
8	(a)		Gravity would cause the universe to contract / collapse ✓	1	2.1	**ALLOW** galaxies would move towards each other
	(b)	(i)	Light (from distant galaxies) is shifted towards the red end of the spectrum ✓ Wavelengths are increased / frequencies are decreased ✓	2	1.1	**DO NOT ALLOW** 'light is redder'
		(ii)	Further galaxies are moving away faster; ✓ Space (or universe) is expanding; ✓ **Any one from:** Universe was much smaller in the past ✓ Universe may have started from a single point ✓	3	1.1 1.1 2.1	**ALLOW** the relationship is proportional
		(iii)	Read distance and speed data from graph ✓ Calculate time = distance ÷ speed ✓	2	3.1a 2.1	
		(iv)	**Any two from:** More observations/more precise measurements have been made; ✓ Telescopes / technology has improved; ✓ Observations can be made from outside the earth's atmosphere / radiations other than visible light can be observed. ✓	2	1.2 1.1	

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	Gamma radiation penetrates tissue, so can be detected outside the body / Beta radiation is absorbed in the body and cause more damage to cells; ✓	2	1.1	
			Isotope needs to have a short half-life to reduce the length of time of exposure to the radiation ✓		3.2a	
		(ii)	<u>Kinetic energy</u> of the particles / fission products (and neutrons); ✓	2	1.1	**IGNORE** K.E. of neutrons 'Radiation' is insufficient
			Gamma / ionising radiation ✓			
	(b)		Hydrogen nuclei can fuse into helium nuclei ✓	2	1.1	
			Releasing energy ✓			

Question			Answer	Marks	AO element	Guidance
10	(a)	(i)	Risk from burning from hot water/heating element ✓ Prevent risk by using care when around hot water/putting lid on the beaker/putting heating element in the water before turning it on and waiting for it to cool before removing it. ✓	2	2.2 3.3a	**ALLOW** any other sensible risk and linked precaution
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If the answer = 4300 (J/kg°C) award 3 marks.** Select: $E = m \times c \times \theta$ Rearrange to get $\theta = E \div m \times c$ ✓ = 12 900 J ÷ (0.1kg x 30°C) ✓ =4300 (J/kg°C)✓	3	1.1 2.1 2.1	
		(iii)	Any reference to insulation/lagging ✓ Reduce heat transfer to surroundings✓	2	3.3b	
	(b)		They stay at 55 °C for the same amount of time ✓ X (solidifies) before Y ✓ At 55 °C both X and Y solidify / freeze ✓	3	3.1b 3.2b 3.2b	
	(c)		Same temperature for solidification/freezing ✓	1	3.2b	
	(d)		Specific heat capacity (of water) ✓ Mass of hot water ✓ Temperature change ✓	3	3 x 1.2	**ALLOW** initial and final temperatures

Question			Answer	Marks	AO element	Guidance
11	**(a)**	**(i)**	Wind / tidal / wave / HEP ✓	**1**	**1.1**	**DO NOT ALLOW** 'solar'
		(ii)	Any suitable advantage relating to d(i) – renewable/sustainable/no greenhouse gases during power generation/no emissions that cause acid rain. ✓ Any suitable disadvantage ✓ e.g. damage to habitats	**2**	**1.1**	**DO NOT ALLOW** 'cleaner'
	(b)		Town D ✓	**1**	**3.1a**	

Question			Answer	Marks	AO element	Guidance
12	**(a)**		Light gate / electronic timer / data logger; ✓ Measures the time for trolley to travel a (known) distance ✓ Use speed = distance ÷ time ✓	**3**	**1.2**	
	(b)		 Last two points both plotted correctly; ✓ Smooth curve drawn going through (0.0) ✓	**2**	**1.2**	
	(c)		As the speed of the trolley increases, the stopping distance increases; ✓ The stopping distance increases more quickly at higher speeds ✓	**2**	**1.2**	**ALLOW** 'the braking force is proportional to speed' for 1 mark
	(d)		(More gpe to start with i.e.) more ke when reaching carpet ✓ The resistive force of the carpet would be unchanged ✓ The stopping distance would be greater at each speed ✓	**3**	**1.2**	**ALLOW** wrong answer to force but must be consistent. **ALLOW** attempts to quantify

Summary of updates

Date	Version	Change
May 2018	2	We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website