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INTERNATIONAL GCSE

Physics (9-1)

SAMPLE ASSESSMENT MATERIALS

Pearson Edexcel International GCSE in Physics (4PH1)

For first teaching September 2017
First examination June 2019
Issue 2

Pearson

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INTERNATIONAL GCSE

Physics

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Acknowledgements

These sample assessment materials have been produced by Pearson on the basis of consultation with teachers, examiners, consultants and other interested parties. Pearson would like to thank all those who contributed their time and expertise to the development.

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All information in this document is correct at time of going to publication.

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Summary of Pearson Edexcel International GCSE in Physics Issue 2 changes

Summary of changes made between previous issue and this current issue	Page number
A symbolic equation has been included for the formula force = change in momentum/ time taken	50
The equation change in thermal energy = mass × specific heat capacity has been corrected to: change in thermal energy = mass × specific heat capacity × change in temperature	50

Earlier issues show previous changes.

If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com/en/support/contact-us.html.

Contents

Introduction

The Pearson Edexcel International GCSE in Physics is designed for use in schools and colleges. It is part of a suite of International GCSE qualifications offered by Pearson.

These sample assessment materials have been developed to support this qualification and will be used as the benchmark to develop the assessment students will take.

General marking guidance

- All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme – not according to their perception of where the grade boundaries may lie.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification/indicative content will not be exhaustive.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, a senior examiner must be consulted before a mark is given.
- Crossed-out work should be marked unless the candidate has replaced it with an alternative response.

Subject specific marking guidance

Symbols, terms used in the mark scheme

- Round brackets ( ): words inside round brackets are to aid understanding of the marking point but are not required to award the point
- Curly brackets { }: indicate the beginning and end of a list of alternatives (separated by obliques), where necessary, to avoid confusion
- Oblique /: words or phrases separated by an oblique are alternatives to each other and either answer should receive full credit.
- ecf: indicates error carried forward which means that a wrong answer given in an early part of a question is used correctly to a later part of a question.

You will not see 'owtte' (or words to that effect). Alternative correct wording should be credited in every answer unless the mark scheme has specified specific.

The Additional Guidance column is used for extra guidance to clarify any points in the mark scheme. It may be used to indicate:

- what will not be accepted for that marking point in which case the phrase 'do not accept' will be alongside the relevant marking point
- it might have examples of possible acceptable answers which will be adjacent to that marking point

Write your name here

Surname	Other names

Pearson Edexcel International GCSE (9 - 1)

Centre Number	Candidate Number

Physics

Paper 1

Sample Assessment Material for first teaching September 2017	Paper Reference
Time: 2 hours	**4PH1/1P** **4SD0/1P**

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Calculators may be used.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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S 5 2 9 1 7 A 0 1 2 8

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EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad V = \frac{2 \times \pi \times r}{T}$$

(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)

$$v^2 = u^2 + (2 \times a \times s)$$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

Where necessary, assume the acceleration of free fall, g = 10 m/s^2.

Answer ALL questions. Write your answers in the spaces provided.

1 (a) Which of these objects orbits a planet?

(1)

☒ **A** comet

☒ **B** dwarf star

☒ **C** galaxy

☒ **D** moon

(b) What is the correct name for our galaxy?

(1)

☒ **A** Crab Nebula

☒ **B** Milky Way

☒ **C** Solar System

☒ **D** Universe

(c) Which of these objects has the largest mass?

(1)

☒ **A** artificial satellite

☒ **B** comet

☒ **C** Earth

☒ **D** Sun

(d) Which of these stars is the coolest?

(1)

☒ **A** blue star

☒ **B** orange star

☒ **C** red star

☒ **D** yellow star

(Total for Question 1 = 4 marks)

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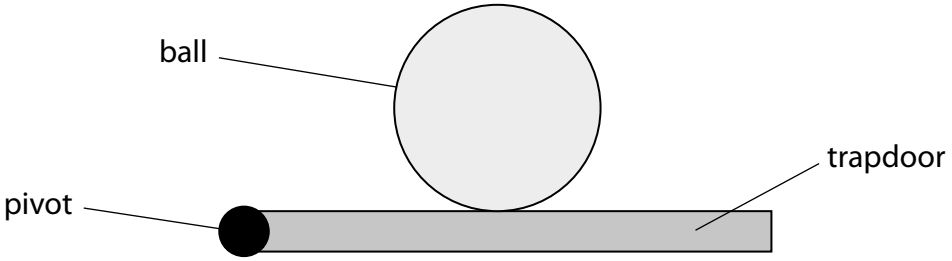
2 This question is about the motion of a ball.

(a) A ball is at rest on a trapdoor.

Complete the diagram to show the forces acting on the ball.

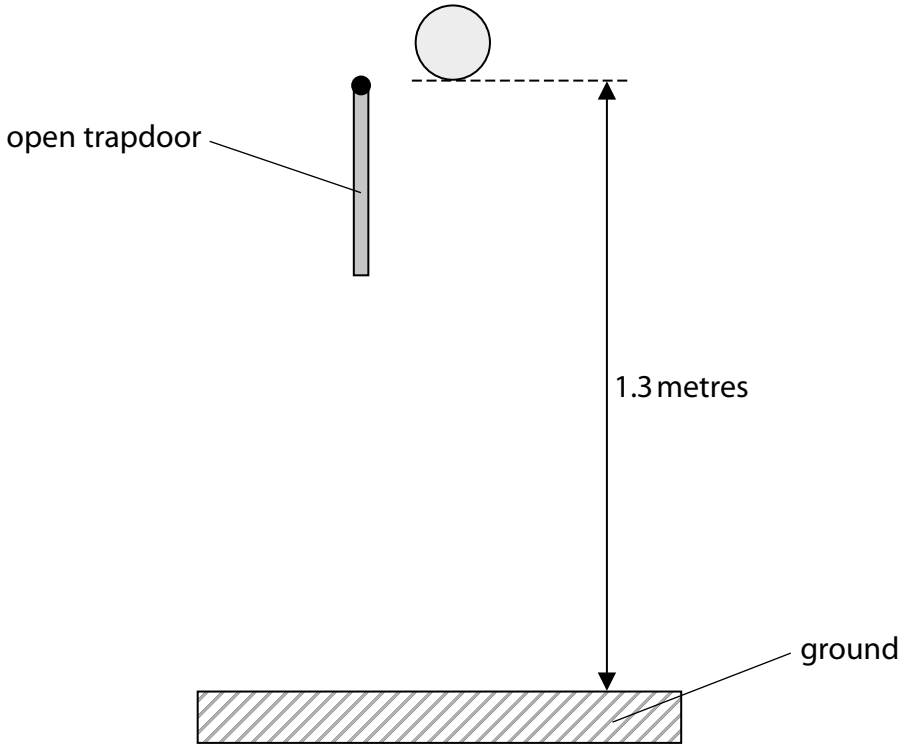
Label the forces.

(3)



(b) The trapdoor swings open and the ball falls to the ground.

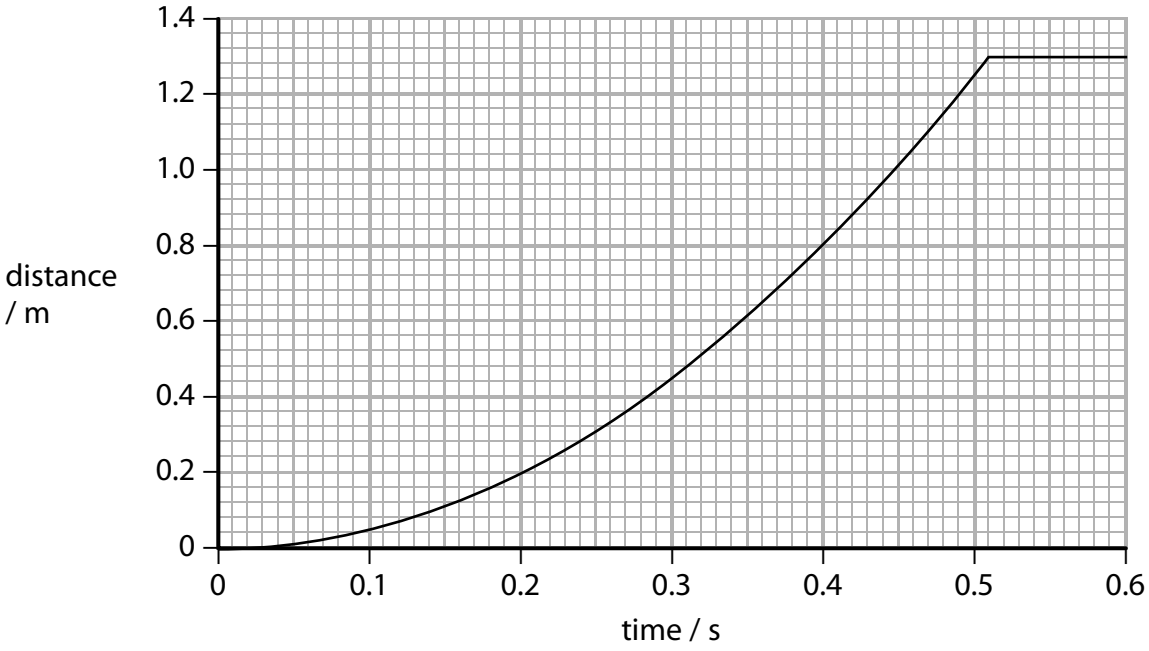
The ball does not bounce when it hits the ground.



Show that the final speed of the ball at the instant before it hits the ground is about 5 m/s.

(3)

(c) The graph shows how the distance travelled by the ball changes with time.



(i) Determine the time taken for the ball to hit the ground.

(1)

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(ii) State the equation relating average speed, distance moved and time taken.

(1)

(iii) Calculate the average speed of the ball after 0.40 s.

(1)

average speed = ... m/s

(iv) Explain how the graph shows that the ball accelerates when it falls.

(3)

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(Total for Question 2 = 12 marks)

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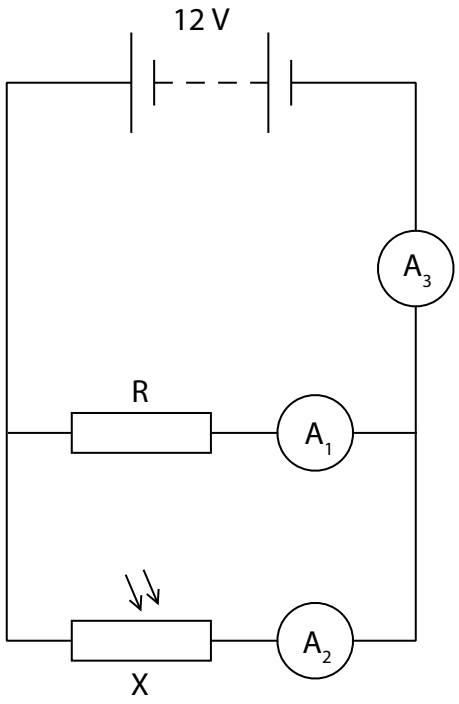
TURN OVER FOR QUESTION 3

3 A 12V battery is connected to a component, X, and a fixed resistor, R, as shown.



(a) (i) State the name of component X.

(1)

.....

(ii) Draw a voltmeter on the circuit diagram connected to show the voltage of component X.

(2)

(b) The voltage across component X is 12 V.

The resistor R has a value of 840 Ω.

Show that the current in ammeter A_1 is approximately 0.01 A.

Use the equation

voltage = current × resistance

(2)

(c) When the circuit is placed in daylight, the current in A_2 is 0.011 A.

(i) Calculate the value of the current through A_3.

(1)

current = ... A

(ii) Explain what happens to the current through A_3 when the circuit is placed in a darkened room.

(2)

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(Total for Question 3 = 8 marks)

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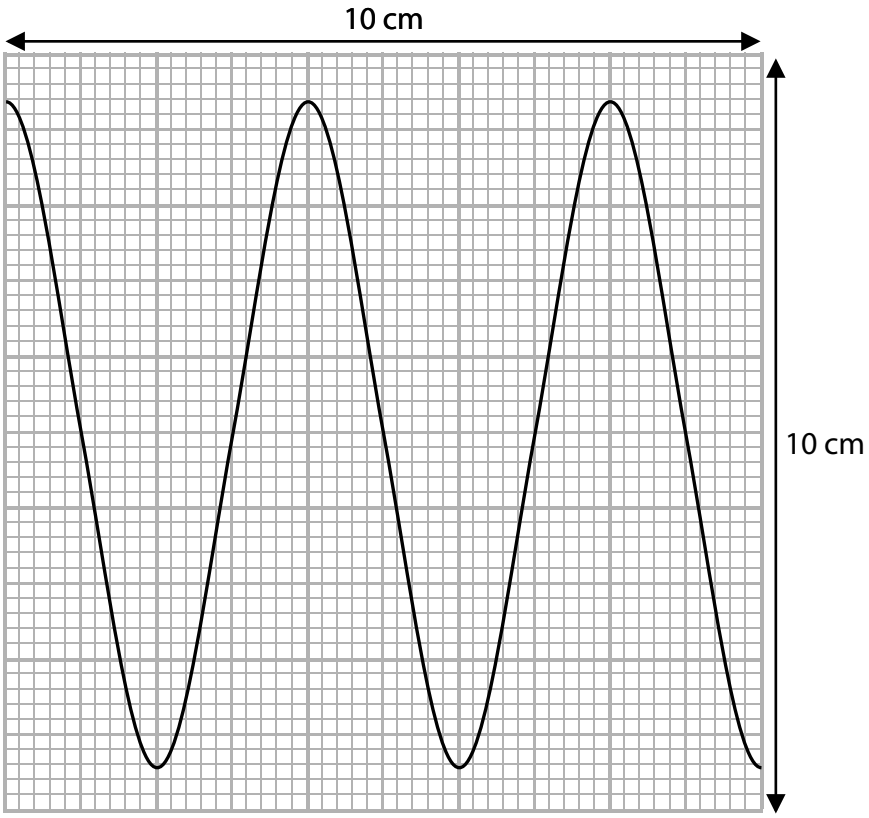
4 This question is about waves.

(a) The diagram shows a wave.



(i) What is the wavelength of the wave?

(1)

- ☒ **A** 4.0 cm
- ☒ **B** 4.4 cm
- ☒ **C** 5.0 cm
- ☒ **D** 8.8 cm

(ii) What is the amplitude of the wave?

(1)

- ☒ **A** 4.0 cm
- ☒ **B** 4.4 cm
- ☒ **C** 5.0 cm
- ☒ **D** 8.8 cm

(b) The diagram shows the types of radiation in the electromagnetic spectrum.

radio waves	microwaves	infrared	visible light	ultraviolet	x-rays	gamma rays

(i) Which of the following statements about electromagnetic waves is correct?

(1)

- ☐ **A** they all have the same amplitude
- ☐ **B** they all have the same frequency
- ☐ **C** they all have the same speed in free space
- ☐ **D** they all have the same wavelength

(ii) Electromagnetic waves have many different uses.

Explain the uses of **three** different radiations in the electromagnetic spectrum.

(6)

1 .....

Use .....

.....

2 .....

Use .....

.....

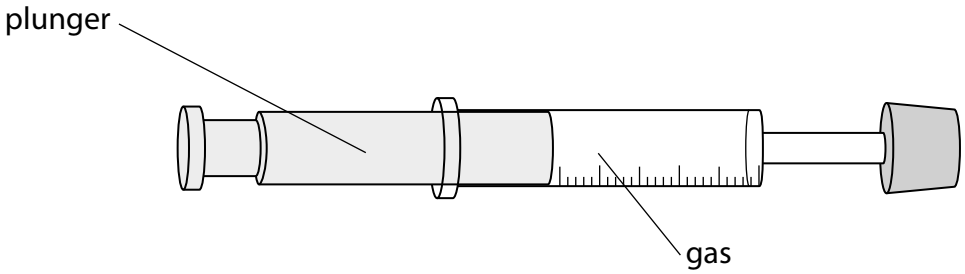
3 .....

Use .....

.....

(Total for Question 4 = 9 marks)

5 A gas is contained inside a sealed syringe.



(a) The plunger is pushed so that the gas is compressed and its volume reduces at constant temperature.

(i) Before compression, the gas pressure is 100 kPa and the volume of the gas is 7.5 cm^3.

After compression, the volume of the gas is 5.0 cm^3.

Calculate the pressure of the gas after compression.

(3)

pressure = ... kPa

(ii) Explain why decreasing the volume changes the pressure of the gas in the syringe.

You should use ideas about particles in your answer.

(3)

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(b) The plunger of the syringe is released and the gas returns to its original pressure of 100 kPa.

The plunger is then held in position so that the volume of the gas cannot change.

The gas is now heated and its temperature increases.

(i) Describe how the average kinetic energy of the gas particles changes when the temperature of the gas increases.

(3)

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(ii) The temperature of the gas increases from 20 °C to 65 °C.

Calculate the pressure of the gas after it is heated.

(4)

pressure = ... kPa

(Total for Question 5 = 13 marks)

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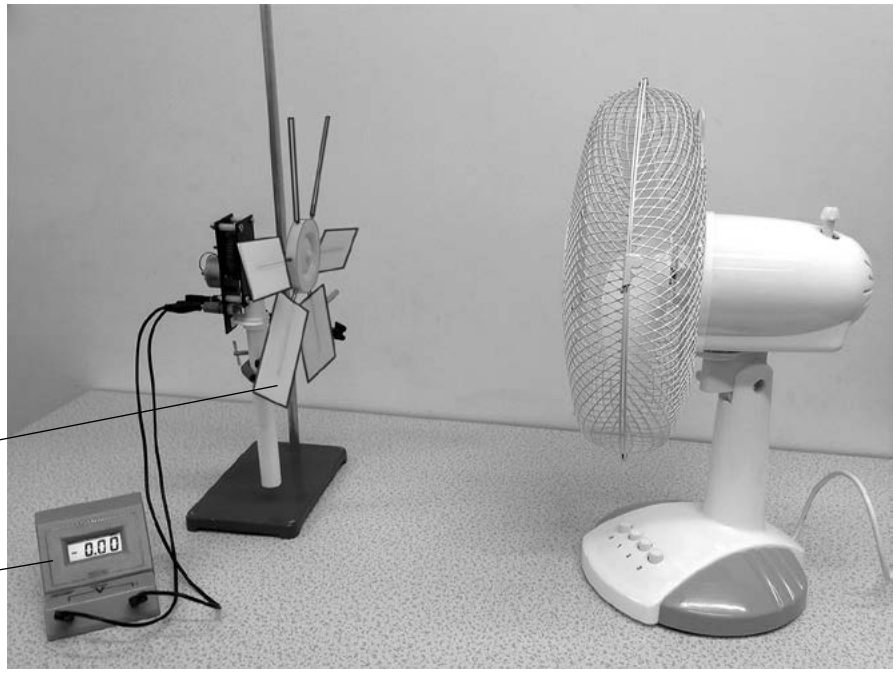
6 A student investigates a wind turbine.

The student places an electric fan in front of the wind turbine.

The wind turbine is connected to a voltmeter.

When the wind turbine turns, it generates a voltage.



(a) The student decides to investigate how the angle of the blades of the wind turbine affects the voltage it generates.

State **two** control variables for this investigation.

(2)

1 .....

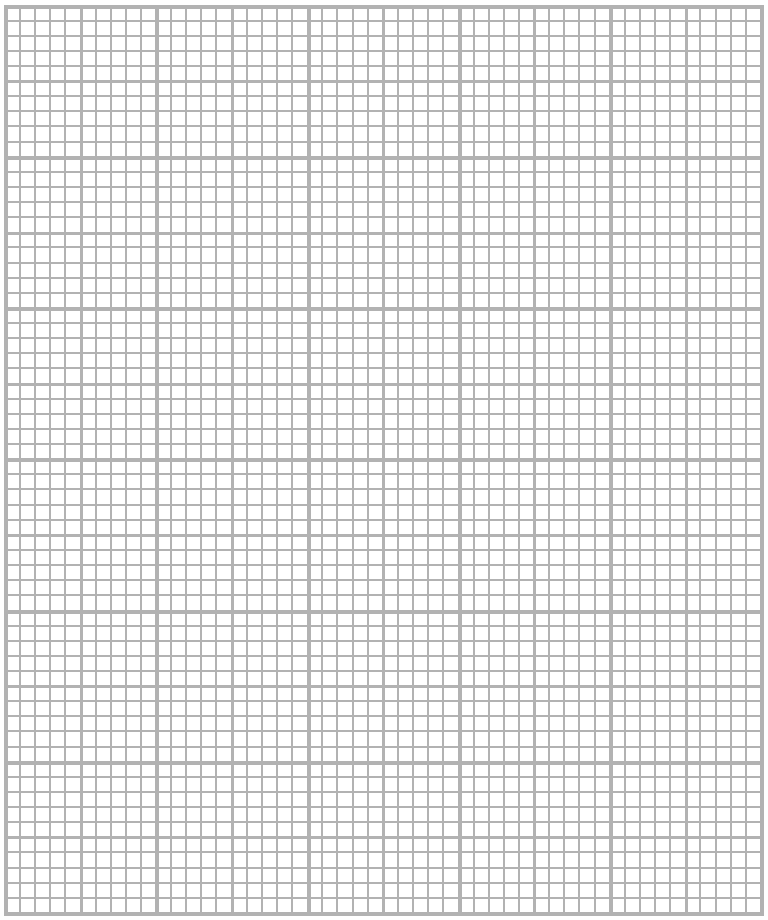
2 .....

(b) The student obtains the following results.

Blade angle / degree	Voltage / V
0	0.0
10	2.0
20	2.2
30	2.0
40	1.7
50	1.4
60	1.0
70	0.6
80	0.2
90	0.0

(i) Plot the student's results on the grid.

(3)



(ii) Draw a curve of best fit on the graph.

(2)

(iii) Describe the relationship between the blade angle and the voltage.

(2)

.....

.....

.....

.....

(c) The student decides to change the investigation to see how the voltage is affected by the number of blades.

(i) State the type of graph the student should use to display the results.

(1)

.....

(ii) Justify your choice of graph.

(1)

.....

.....

(Total for Question 6 = 11 marks)

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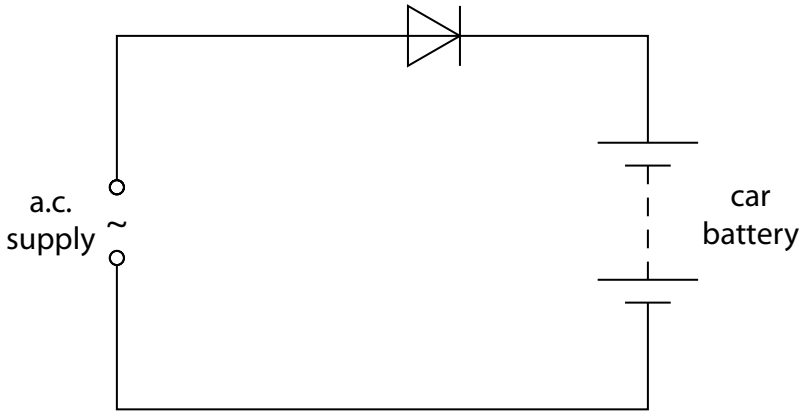
7 The circuit shows a car battery charging from an alternating current (a.c.) supply.



(a) Sketch a graph to show what is meant by a.c.

(2)

(b) State the reason why the circuit contains a diode.

(1)

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.....

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(c) The 12 V car battery is connected to two identical filament lamps so that the voltage across each lamp is 6.0 V.

(i) Draw the circuit diagram.

(2)

(ii) State the equation relating power, current and voltage.

(1)

.....

(iii) The power of each lamp is 330 mW.

Calculate the current in a lamp.

(2)

current = ... A

(Total for Question 7 = 8 marks)

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8 Sound travels as a wave.

(a) Which of these statements about sound waves is **incorrect**?

(1)

☒ **A** they can be reflected

☒ **B** they can travel through a vacuum

☒ **C** they can be refracted

☒ **D** they transfer energy

(b) Sound waves are a type of wave known as longitudinal waves.

(i) Name the other type of wave.

(1)

.....

(ii) Give **one** example of this other type of wave.

(1)

.....

(c) A buzzer produces a sound wave of frequency 2.9 kHz and wavelength 12 cm.

(i) State the equation relating wave speed, frequency and wavelength.

(1)

.....

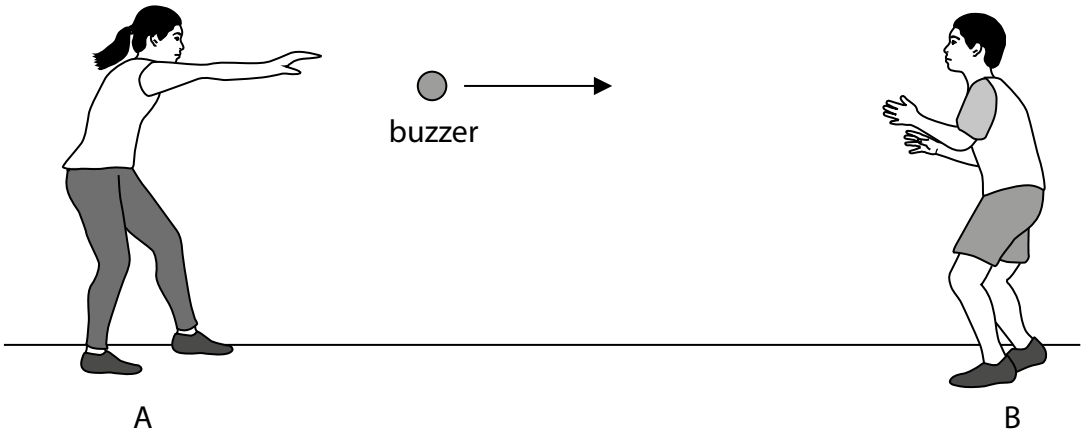
(ii) Calculate the speed of the sound wave.

(3)

speed = ... m/s

(d) Two students investigate the Doppler effect by throwing a buzzer to each other.

Student A throws the buzzer to student B.



When the buzzer is thrown, student A notices that the sound produced changes.

Explain how the sound heard by student A changes.

You may include a diagram in your answer.

(3)

(Total for Question 8 = 10 marks)

9 This is a question about nuclear energy.

(a) Nuclear fusion can take place between different isotopes of hydrogen to produce an isotope of helium.

(i) Complete the nuclear equation for this process.

(2)

$$^{2}_{1}H + ^{3}_{1}H \longrightarrow \square\ ^{}_{2}He + ^{1}_{}n + \square$$

(ii) This process also results in the release of energy.

State where the fusion process takes place naturally.

(1)

(iii) Explain why the isotopes of hydrogen must be heated to a very high temperature for fusion to take place.

(3)

(b) Nuclear fission also results in a release of energy.

Explain how nuclear fission differs from nuclear fusion.

(2)

(Total for Question 9 = 8 marks)

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10 The International Space Station (ISS) is a satellite that orbits the Earth at a height of 409 km above the surface of the Earth.

The ISS has an orbital speed of 7.66 km/s and a period of 92.7 minutes.

(a) (i) Calculate the orbital radius of the ISS.

Give your answer to 3 significant figures.

(4)

orbital radius = ... km

(ii) Calculate the radius of the Earth using your value for the orbital radius.

(1)

Earth radius = ... km

(Total for Question 10 = 5 marks)

11 Main sequence stars can vary in brightness, colour and mass.

Describe the evolution of both low mass stars and high mass stars after they join the main sequence.

(6)

(Total for Question 11 = 6 marks)

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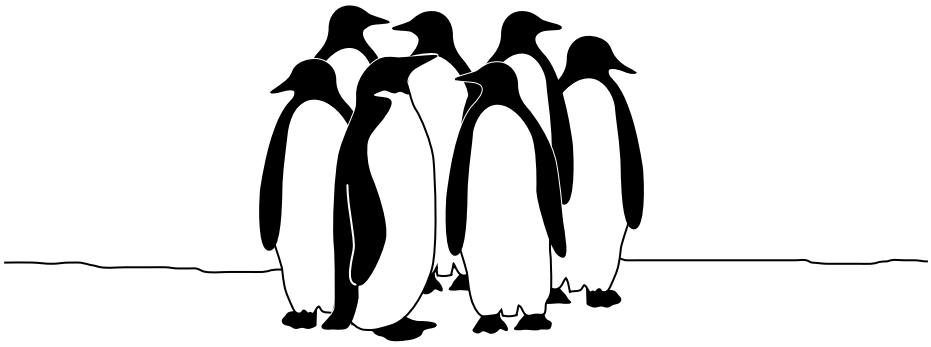
12 Penguins are adapted to survive in cold conditions.

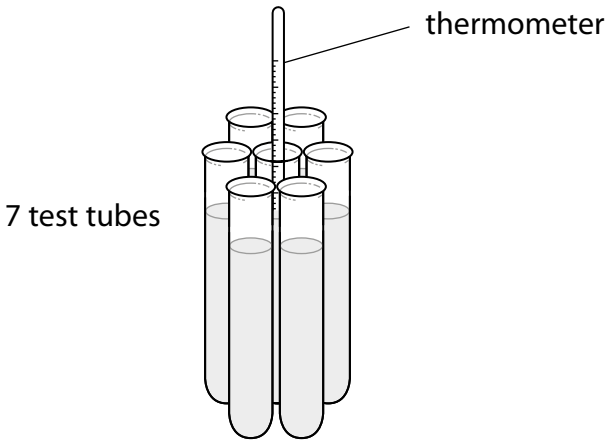
The adaptations help them to maintain a constant body temperature of 39 °C.
Penguins also crowd together in groups of many penguins.



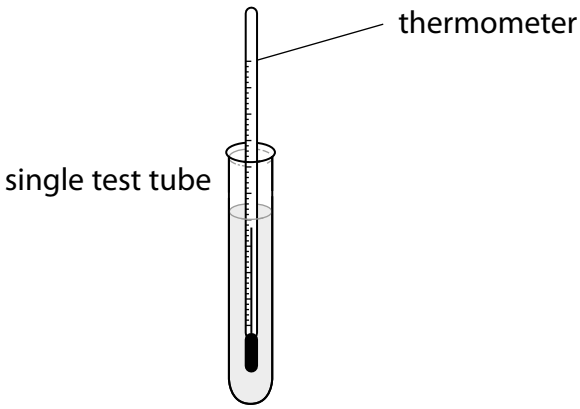
(a) A student wants to investigate how the temperature of a penguin is affected when they crowd together in groups.

She uses this apparatus.

Each test tube represents a penguin.



represents a huddle of 7 penguins



represents a single penguin

(i) These statements describe the method she should use.

The statements are in the wrong order.

Put them into the correct order by numbering the boxes.

Some have been done for you.

(3)

Statements	Order
record the data in a table	8
take the temperature of the two test tubes	
tie 7 test tubes together	1
heat the water to 90 °C	2
take the temperatures every minute	
place equal volumes of water in all test tubes	
put thermometers into the middle test tube and single test tube	
record data for 15 minutes	

(ii) The student draws a table to record her results.

Add suitable headings to her table.

(2)

Time/	.....	
	.....	.....

(iii) Predict how the temperature change for the single test tube will differ from the temperature change for the group of test tubes.

(1)

.....

.....

(iv) Draw a sketch graph of the results you predict the student will obtain.

Label and use the axes below.

(4)

(v) Explain your prediction using ideas about thermal energy transfer.

(3)

(b) Here are two adaptations that help penguins to maintain a constant body temperature.

- Most of their bodies are covered with layers of fat.
- They have flat overlapping feathers.

Explain why these features help penguins to maintain a constant body temperature.

(3)

Layers of fat

Flat overlapping feathers

(Total for Question 12 = 16 marks)

TOTAL FOR PAPER = 110 MARKS

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Paper 1 (4PH1/1P and 4SD0/1P)

Question number	Answer	Mark
1(a)	D	1

Question number	Answer	Mark
1(b)	B	1

Question number	Answer	Mark
1(c)	D	1

Question number	Answer	Mark
1(d)	C	1

Total for Question 1 = 4 marks

Question number	Answer	Additional guidance	Mark
2(a)	• downward arrow labelled 'weight' (1) • upward arrow labelled 'reaction' (1) • both arrows of approximately equal length and drawn in line within ball (1)	ignore 'gravity' allow 'gravitational force', 'force due to gravity' allow 'normal reaction force', 'normal contact force'	**3**

Question number	Answer	Additional guidance	Mark
2(b)	Process should include: • substitution • rearrangement • evaluation to at least 2 significant figures (s.f.) e.g. $v^2 = 0 + (2 \times 10 \times 1.3)$ (1) $v = \sqrt{2 \times 10 \times 1.3}$ (1) $v = 5.1$ (m/s) (1)	allow 5.10, 5.099, 5.09	**3**

Question number	Answer	Additional guidance	Mark
2(c)(i)	0.51 (seconds)	allow value in range 0.50–0.52 (seconds)	**1**

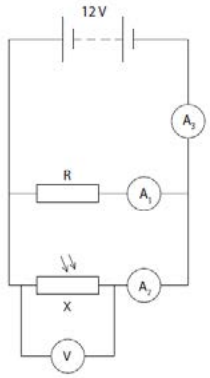
Question number	Answer	Additional guidance	Mark
2(c)(ii)	Average speed = distance moved/time taken	allow in accepted symbols or rearranged.	**1**

Question number	Answer	Additional guidance	Mark
2(c)(iii)	(Speed =) 2.0 (m/s)	accept 2	**1**

Question number	Answer	Mark
2(c)(iv)	An explanation that makes reference to the following points: • gradient is equal to the {speed/velocity} of the ball (1) • gradient is increasing over time (1) • (therefore) the {speed/velocity} is increasing with time (1)	**3**

Total for Question 2 = 12 marks

Question number	Answer	Mark
3(a)(i)	An LDR (light-dependent resistor)	1

Question number	Answer	Mark
3(a)(ii)	• correct symbol (1) • correct position in parallel with X (1)  	2

Question number	Answer	Additional guidance	Mark
3(b)	rearrangement • $I = V/R$ (1) substitution • I = 12/840 (= 0.014 (A)) (1)	0.01429 (A) some evidence of working required for two marks	2

Question number	Answer	Additional guidance	Mark
3(c)(i)	correct addition of current in A_1 with current in A_2 = 0.021 (A) (1)	ecf from 3(b) 0.025 (A) award full marks for correct numerical answer without working	1

Question number	Answer	Mark
3(c)(ii)	An explanation that makes reference to the following points: • resistance of LDR increases (1) • hence current in A_2/A_3 decreases (1)	2

Total for Question 3 = 8 marks

Question number	Answer	Mark
4(a)(i)	A	1

Question number	Answer	Mark
4(a)(ii)	B	1

Question number	Answer	Mark
4(b)(i)	C	1

Question number	Answer	Additional guidance	Mark
4(b)(ii)	2 marks max. available for each named part of the spectrum for each use: • 1 mark for a simple use • 1 mark for a supporting description e.g. for gamma rays: • used to sterilise medical tools (1) • (because) gamma kill bacteria (1) for x-rays: • used to photograph bones (1) • (because) x-rays can penetrate soft tissues but not bone (1) for ultraviolet: • used for detecting security ink (1) • (because) it fluoresces with ultraviolet lighting (1) for infrared: • used for optical fibre communications (1) • (because) they can undergo total internal reflection (1) for micro waves: • used for satellite communications (1) • (because) microwaves can penetrate Earth's atmosphere (1) for radio waves: • used for long-range communications (1) • (because) they can be reflected from the Earth's atmosphere (1)	no mark for simply naming a part of the spectrum	6

Total for Question 4 = 9 marks

Question number	Answer	Mark
5(a)(i)	Process should include: • substitution • rearrangement • evaluation e.g. 100 × 7.5 = p_2 × 5.0 (1) p_2 = (100 × 7.5)/5.0 (1) (p_2 =) 150 (kPa) (1)	**3**

Question number	Answer	Additional guidance	Mark
5(a)(ii)	An explanation that makes reference to the following points: • particles collide with walls (of container) (1) And any two from: • more frequently/time between collisions is less (1) • (resulting in) larger force (1) • (over a) smaller surface area (1)	 allow 'more often'	**3**

Question number	Answer	Additional guidance	Mark
5(b)(i)	A description that makes reference to the following points: • (average kinetic energy) increases (1) • in (direct) proportion to (1) • Kelvin temperature (1)	 dependent on point 1 dependent on point 1	**3**

Question number	Answer	Additional guidance	Mark
5(b)(ii)	Process should include: • conversion of temperatures to Kelvin scale (1) • rearrangement (1) • substitution (1) • evaluation (1) e.g. 20 °C = 293 K OR 65 °C = 338 K (1) (p_1/T_1)/T_2= p_2 (1) p_2 = (100 x 338)/293 (1) (p_2 =) 115 (kPa) (1)	not converting to Kelvin gains 2 marks max. 100/293 = p_2/338 allow 115.358…	**4**

Total for Question 5 = 13 marks

Question number	Answer	Additional guidance	Mark
6(a)	Any two control variables (2) e.g. • distance between fan and turbine • fan speed • number of turbine blades • turbine angle • fan angle • orientation of fan with respect to turbine	 ignore type of fan/turbine	**2**

Question number	Answer	Additional guidance	Mark
6(b)(i)	Scale (1) Axes (1) Plotting (1)	both axes should occupy at least 50% of the grid both axes should be labelled with quantity and unit orientation unimportant points should be accurate within 1mm. −1 mark for each error	**3**

Question number	Answer	Additional guidance	Mark
6(b)(ii)	• curve starting at (0,0) (1) • smooth curve to a peak at (20, 2.2) (1)	curve should be smooth with roughly equal distribution of points either side	**2**

Question number	Answer	Additional guidance	Mark
6(b)(iii)	A description containing any two from: • voltage increases, then decreases as blade angle is increased (1) • maximum voltage when blade angle is 20° (1) • non-linear relationship (1)	allow range of 15°−25°	**2**

Question number	Answer	Mark
6(c)(i)	Bar chart	**1**

Question number	Answer	Mark
6(c)(ii)	(Number of blades) is a discrete/discontinuous variable	**1**

Total for Question 6 = 11 marks

Question number	Answer	Mark
7(a)	• Axes shown with either voltage or current against time AND more than one wavelength shown (1) • Continuous curve drawn that alternates to + and −, and has approximately equal displacement on either side of x-axis (1)	2

Question number	Answer	Additional guidance	Mark
7(b)	A diode only allows current in one direction	allow answers which describe what would happen to a battery with a.c.	1

Question number	Answer	Additional guidance	Mark
7(c)(i)	• All circuit symbols correct (1) • Bulbs shown in series (1)	allow cell for battery reject power supply symbol	2

Question number	Answer	Additional guidance	Mark
7(c)(ii)	Power = current × voltage	allow rearrangement and correct symbols, e.g. $P = I \times V$	1

Question number	Answer	Additional guidance	Mark
7(c)(iii)	Process includes: • rearrangement • evaluation e.g. $I = P/V$ (1) = 0.33/6.0 = 0.055 (A) (1)	1 mark max if incorrect V is used	2

Total for Question 7 = 8 marks

Question number	Answer	Mark
8(a)	B	1

Question number	Answer	Additional guidance	Mark
8(b)(i)	Transverse	allow any recognisable spelling	1

Question number	Answer	Additional guidance	Mark
8(b)(ii)	Any transverse wave e.g. electromagnetic named part of EM spectrum (surface) water waves waves on a rope seismic S waves	ignore waves on a slinky unless correctly clarified	1

Question number	Answer	Additional guidance	Mark
8(c)(i)	wave speed = frequency × wavelength	equation can be given in words or symbols	1

Question number	Answer	Additional guidance	Mark
8(c)(ii)	• Conversion of kHz to Hz OR cm to m • Substitution • Evaluation e.g 2.9 kHz = 2900 Hz (1) (v =) 2900 x 0.12 (1) (v =) 350 (m/s) (1)	seen anywhere allow 348 (m/s) 0.348, 0.35, 34800, 35000 gains 2 marks 34.8, 35 gains 1 mark	3

Question number	Answer	Additional guidance	Mark
8(d)	An explanation including: • frequency decreases (1) • wavelength increases (1) • (because) wave speed is constant (1)	Ignore references to volume or loudness Allow 'pitch' for frequency	**3**

Total for Question 8 = 10 marks

Question number	Answer	Mark
9(a)(i)	4 (1) 0 (1)  	2

Question number	Answer	Additional guidance	Mark
9(a)(ii)	(Centre of) stars	allow the Sun	1

Question number	Answer	Mark
9(a)(iii)	An explanation that makes reference to the following points: • hydrogen nuclei repel (1) • need a high speed/kinetic energy (1) • to get close enough to fuse together (1)	3

Question number	Answer	Additional guidance	Mark
9(b)	An explanation that makes reference to the following points: • when fission occurs a large nucleus splits into smaller nuclei (1) • but when fusion occurs small nuclei fuse together to form a larger nucleus (1)	allow 'heavier', 'lighter' allow specific correct named isotopes	2

Total for Question 9 = 8 marks

Question number	Answer	Mark
10(a)(i)	Process includes: • rearrangement (1) • substitution (1) • evaluation of orbital radius (1) • answer to 3 s.f. (1) e.g. $r = v \times T/2\pi$ (1) $r = (7.66 \times 92.7 \times 60)2\pi$ (1) $r = 6781$ (km) (1) $r = 6780$ (km) (1)	**4**

Question number	Answer	Additional guidance	Mark
10(a)(ii)	Earth radius = r − 409 = 6370 (km)	Allow ecf Allow 6 371 (km) Allow 6 372 (km)	**1**

Total for Question 10 = 5 marks

Question number	Answer	Additional guidance	Mark
11	A description that makes reference to six of the following points: • **all** main sequence stars fuse H into He (1) • lower mass stars stay on the MS line for longer (1) • lower mass stars become red giants (1) • higher mass stars become red super giants (1) • red giant becomes a white dwarf (1) • supergiant becomes a supernova (1) • supernova becomes a neutron star (1) • supernova becomes a black hole (1)	accept numerical values allow red giant to planetary nebula	**6**

Total for Question 11 = 6 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>12(a)(i)</td><td>

answer 3 correct (1)
answers 4 and 5 in either order (1)
answers 6 and 7 in either order (1)

<table>
<tr><th>Statements</th><th>Order</th></tr>
<tr><td>record the data in a table</td><td>8</td></tr>
<tr><td>take the temperature of the two test tubes</td><td>5</td></tr>
<tr><td>tie 7 test tubes together</td><td>1</td></tr>
<tr><td>heat the water to 90 °C</td><td>2</td></tr>
<tr><td>take the temperatures every minute</td><td>6</td></tr>
<tr><td>place equal volumes of water in all test tubes</td><td>3</td></tr>
<tr><td>put thermometers into the middle test tube and single test tube</td><td>4</td></tr>
<tr><td>record data for 15 minutes</td><td>7</td></tr>
</table>
</td><td>3</td></tr>
</table>

Question number	Answer	Mark
12(a)(ii)	• correct units shown (1) • temperature and indication of two different thermometers' readings (1)	**2**

Question number	Answer	Mark
12(a)(iii)	The single test tube will cool faster/RA	**1**

Question number	Answer	Mark
12(a)(iv)	• correct labels on axes (x = time, y = temperature) (1) • both lines start on y-axis at the same temperature (1) • both lines show that temperature decreases with time (1) • line for single tt thermometer is below other line at all points (1)	**4**

Question number	Answer	Additional guidance	Mark
12(a)(v)	An explanation that makes reference to the following three points: • thermal energy loss by convection is reduced because of the air pockets in the 7 tt (1) • causes the single tt to lose more thermal energy/RA (1) • radiation loss is the same for both (1) • conduction losses for 7 tt are not high/layer of tt acts as an insulator (1)	allow heat for thermal energy accept alternative descriptions of 7 tt e.g. huddle	**3**

Question number	Answer	Mark
12(b)	**Fat** Acts as an insulator so keeps penguins warm(1) **Feathers** Feathers trap pockets of air (1) and either reduce thermal energy loss by convection (1) or air is a poor conductor so thermal energy loss is reduced (1)	**3**

Total for Question 12 = 16 marks

TOTAL FOR PAPER = 110 MARKS

Write your name here

Surname	Other names

Pearson Edexcel International GCSE (9 - 1)

Centre Number	Candidate Number

Physics

Paper 2

Sample Assessment Material for first teaching September 2017

Time: 1 hour 15 minutes

Paper Reference

4PH1/2P

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 70.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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S 5 2 9 1 8 A 0 1 2 0

PEARSON

EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad V = \frac{2 \times \pi \times r}{T}$$

(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)

$$v^2 = u^2 + (2 \times a \times s)$$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken}} \qquad F = \frac{(mv - mu)}{t}$$

$$\frac{\text{change of wavelength}}{\text{wavelength}} = \frac{\text{velocity of a galaxy}}{\text{speed of light}} \qquad \frac{\lambda - \lambda_0}{\lambda_0} = \frac{\Delta\lambda}{\lambda_0} = \frac{v}{c}$$

change in thermal energy = mass × specific heat capacity × change in temperature

$$\Delta Q = m \times c \times \Delta T$$

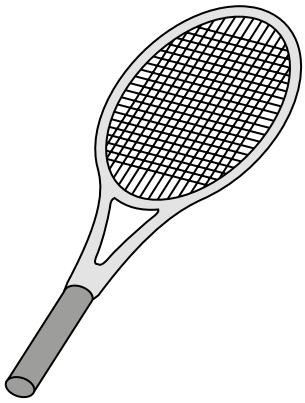
Where necessary, assume the acceleration of free fall, g = 10 m/s^2.

TURN THE PAGE OVER FOR QUESTION 1

Answer ALL questions. Write your answers in the spaces provided.

1 A tennis racket is used to hit a tennis ball.

The ball is in contact with the racket for 0.20 seconds and leaves the racket with a horizontal velocity of 46 m/s.



(a) (i) State the equation relating acceleration, change in velocity and time taken.

(1)

.....

(ii) Calculate the acceleration of the tennis ball assuming it is at rest when it is hit.

Give the unit.

(3)

acceleration = ... unit .....

(b) The tennis ball has a mass of 57 grams.

(i) State the equation relating momentum, mass and velocity.

(1)

.....

(ii) Calculate the momentum of the tennis ball when its velocity is 46 m/s.

(3)

momentum = ... kg m/s

(c) The bottom of a tennis player's shoes are thick and made from a material that compresses when the player's feet land on the ground.

Explain why these shoes reduce the risk of injury to the tennis player.

(3)

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(Total for Question 1 = 11 marks)

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2 Lightning strikes the Earth frequently and often starts in rain clouds.

Inside the clouds, powerful winds move ice particles and tiny water droplets.

The bottom of the clouds becomes negatively charged and the top becomes positively charged.

(a) Give a reason why the clouds become charged.

(1)

.....

.....

(b) The ground below the cloud becomes positively charged.

Explain why the ground becomes charged.

You should use ideas about electron movement in your answer.

(2)

.....

.....

.....

.....

(c) The build-up of charge in the cloud and in the ground causes the air to ionise.

This means that the air becomes a conductor, and a low resistance path from the cloud to the ground is formed.

(i) State what is meant by the term **ionise**.

(1)

.....

(ii) State the relationship between charge, current and time.

(1)

.....

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(iii) During one lightning strike, the mean current is 32 kA and the mean charge transferred is 15 C.

Calculate the mean time duration of a lightning strike.

(2)

mean time = ... s

(iv) The mean energy transferred during the lightning strike is 510×10^6 J.

Show that the resistance of the air is approximately 1000 Ω.

(4)

(Total for Question 2 = 11 marks)

3 Wind is a renewable resource used to generate electricity.

(a) (i) State **one** advantage and **one** disadvantage of producing electricity using wind turbines.

(2)

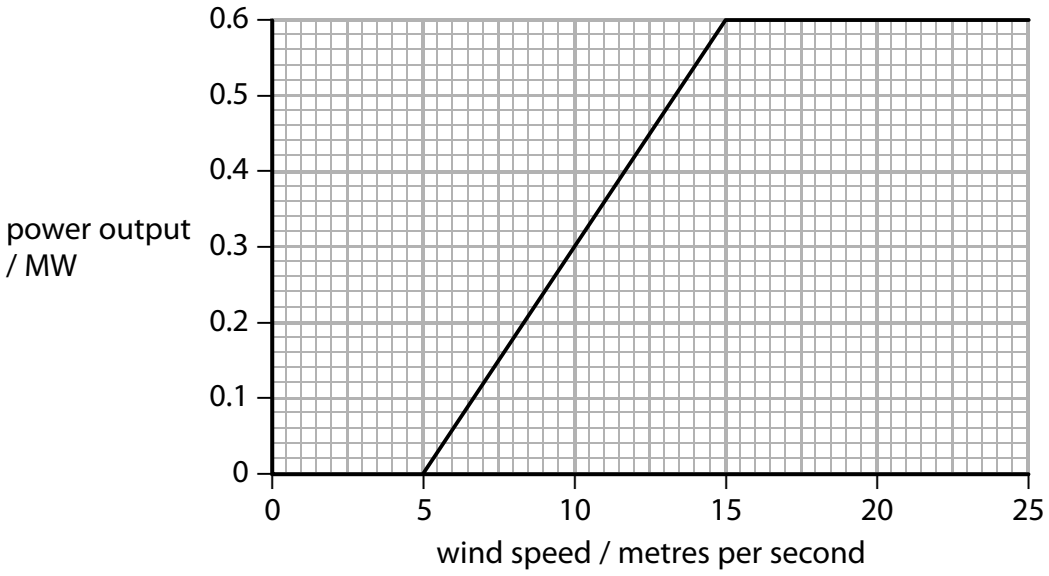
Advantage .....

.....

Disadvantage .....

.....

(ii) The graph shows how the power output of a wind turbine varies with wind speed.



Describe how the power output of a wind turbine varies with wind speed.

You should use data points from the graph in your answer.

(3)

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(b) A wind turbine produces an alternating voltage of 600 V.

The voltage needs to be increased to 132 kV before transmission to a nearby town.

The size of the voltage is changed using a transformer.

Describe the structure and operation of a suitable transformer.

You may use a diagram in your answer.

(5)

(Total for Question 3 = 10 marks)

4 This question is about heating water.

(a) Liquid water boils and becomes a gas at 100 °C.

Describe the differences between the arrangement and motion of particles in a liquid and in a gas.

You may include a diagram in your answer.

(3)

.....

.....

.....

.....

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(b) A teacher uses a 2200 W kettle to heat water.

The kettle is switched on for 2 minutes.

(i) Calculate the energy transferred by the kettle.

(3)

energy transferred = ... J

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(ii) State the equation relating change in thermal energy, mass, specific heat capacity and change in temperature.

(1)

.....

(iii) The mass of water in the kettle is 1.1 kg and its initial temperature is 20 °C.

Calculate the final temperature of the water after it has been heated for 2.0 minutes.

[the specific heat capacity of water is 4200 J/kg °C]

(4)

final temperature = ... °C

(c) The teacher measures the final temperature of the water after heating it for 2 minutes.

(i) Name a piece of equipment the teacher could use to measure the temperature of the water.

(1)

.....

(ii) Explain why the measured final temperature is different from your calculated value.

(2)

.....

.....

.....

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(Total for Question 4 = 14 marks)

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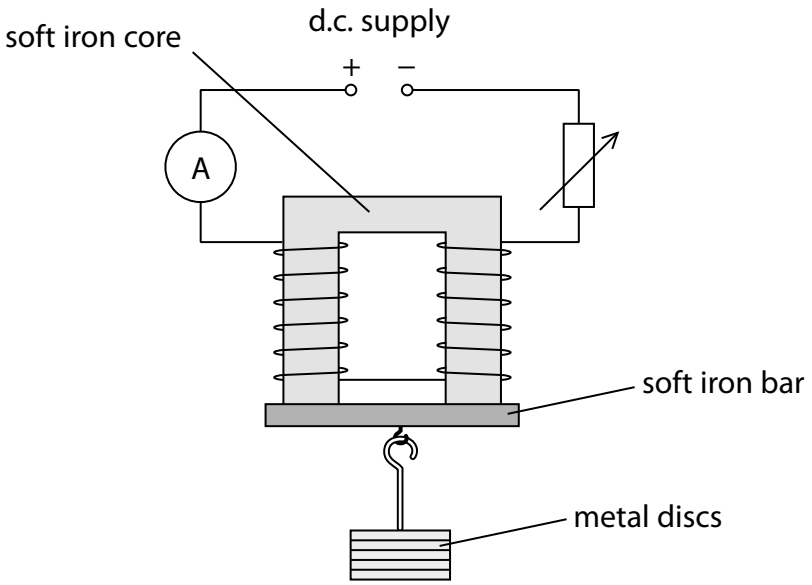
5 A student investigates how the minimum current required to support a load using an electromagnet varies as the load is increased.

He uses metal discs to increase the load and changes the current using a variable resistor.



(a) (i) State the independent variable in this investigation.

(1)

.....

(ii) Give a reason for using a core and a bar made from soft iron.

(1)

.....

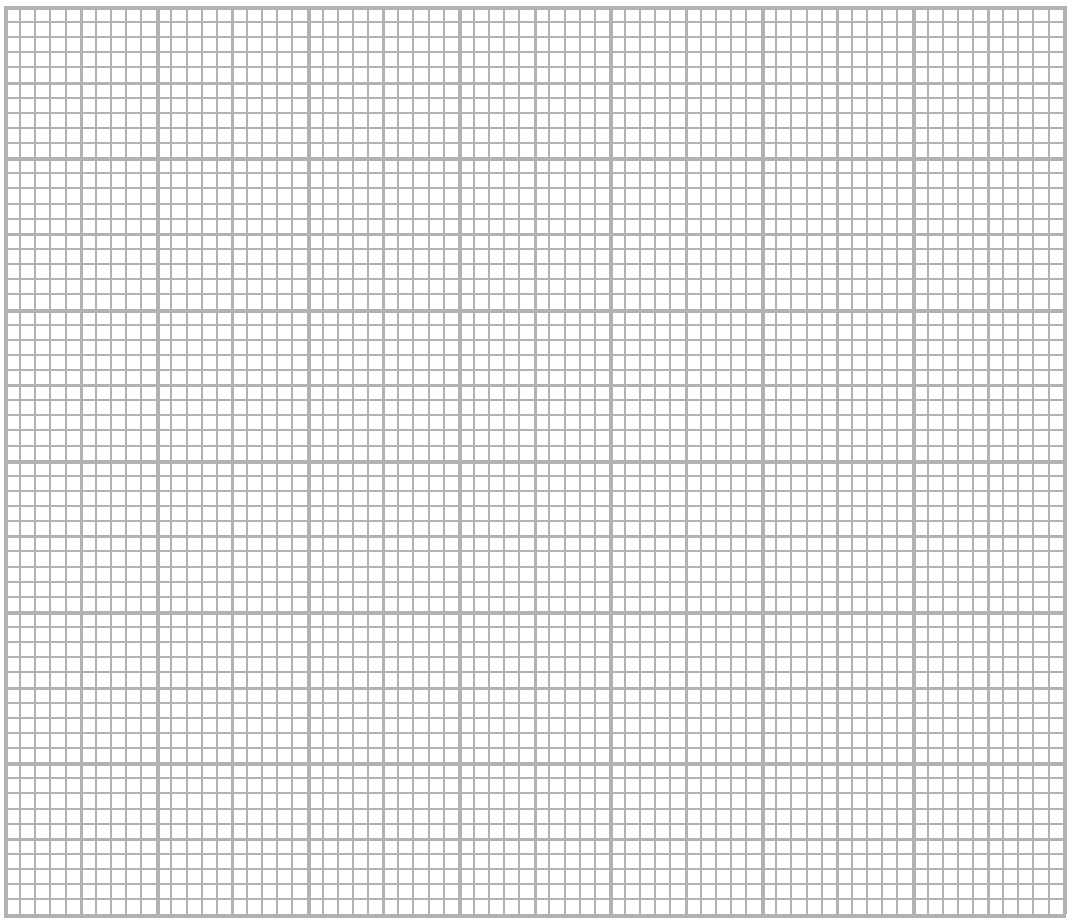
.....

(b) The student's results are given in the table.

Number of metal discs	Minimum current / mA
0	30
2	48
5	75
6	78
7	93
10	120

(i) On the grid, draw a bar chart of current against number of metal discs.

(4)



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(ii) State why a current is needed when there are no metal discs added to the load.

(1)

(iii) Explain how the student can improve his results.

(3)

(Total for Question 5 = 10 marks)

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6 This question is about astrophysics.

(a) (i) What is a star formed from?

(1)

- ☐ **A** a black dwarf
- ☐ **B** a nebula
- ☐ **C** a planet
- ☐ **D** a white dwarf

(ii) Which of these indicates that the Universe is expanding?

(1)

- ☐ **A** galaxies are moving further away from each other
- ☐ **B** galaxies rotate
- ☐ **C** it takes millions of light years for light to reach us from some stars
- ☐ **D** some stars in the Milky Way are accelerating towards our Sun

(iii) Which of these provides evidence for the Big Bang theory?

(1)

- ☐ **A** cosmic microwave background radiation
- ☐ **B** nebulae
- ☐ **C** neutron stars
- ☐ **D** ultrasound radiation

(iv) Which of these does red-shift provide evidence for?

(1)

- ☐ **A** galaxies are moving away from each other
- ☐ **B** nebulae contract to form stars
- ☐ **C** red giants shrink to red dwarfs
- ☐ **D** white dwarfs expand into red giants

(b) The spectra of stars and galaxies show lines at specific wavelengths that correspond to the spectra of hydrogen, helium and carbon.

Give reasons why lines corresponding to these elements are found in spectra from typical galaxies.

(2)

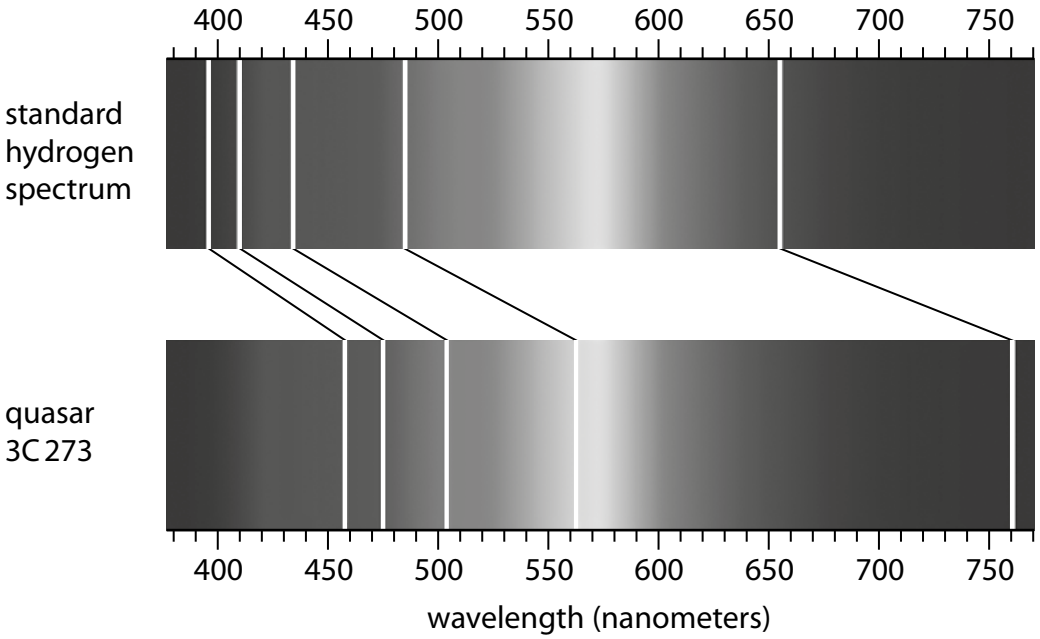
.....

.....

.....

.....

(c) The spectrum of light from an astronomical object called a quasar can be compared to the spectrum of hydrogen on Earth.



(i) Calculate the change in wavelength, $\Delta\lambda$, for the line at the red end of the spectrum.

(2)

$\Delta\lambda$ = ... nm

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(ii) Calculate a value for the recessional velocity of the quasar using your value for $\Delta\lambda$.

speed of light in free space, $c = 3.0 \times 10^5$ km/s

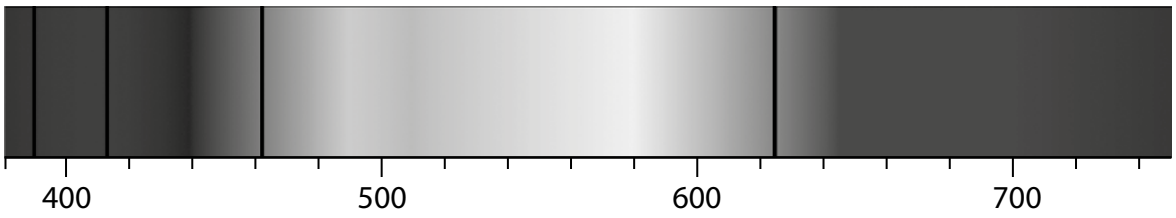
(3)

recessional velocity = ... km/s

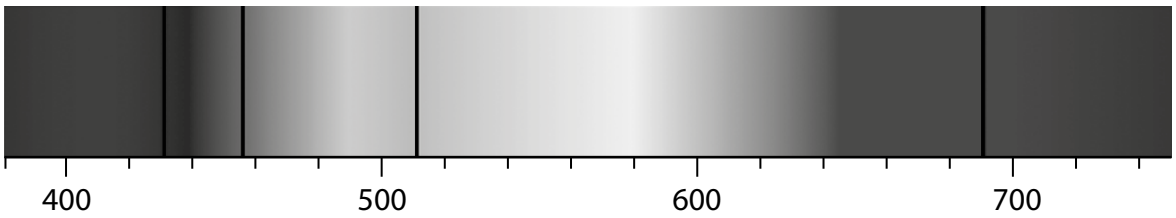
(d) An astronomer observes the light from a nearby galaxy.

She notices that the spectra for hydrogen from the right side and left side of the galaxy are different.

left side of the galaxy

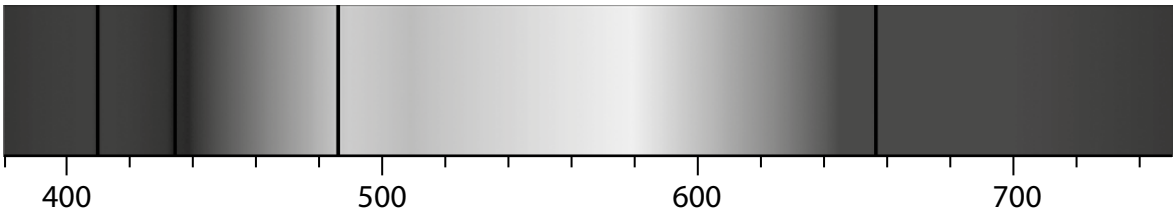


right side of the galaxy



She compares them to the spectrum for hydrogen from the centre of the galaxy.

centre of the galaxy



Explain what information the two spectra give about the movement of the galaxy.

(3)

(Total for Question 6 = 14 marks)

TOTAL FOR PAPER = 70 MARKS

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Paper 2 (4PH1/2P)

Question number	Answer	Additional guidance	Mark
1(a)(i)	Acceleration = change in velocity ÷ time taken	allow in words or acceptable symbols	**1**

Question number	Answer	Additional guidance	Mark
1(a)(ii)	Process includes: • substitution • evaluation • unit e.g. acceleration = 46/0.20 (1) acceleration = 230 (1) unit = m/s^2 (1)	mark independently	**3**

Question number	Answer	Additional guidance	Mark
1(b)(i)	Momentum = mass × velocity	allow in words or acceptable symbols e.g. $p = m \times v$	**1**

Question number	Answer	Additional guidance	Mark
1(b)(ii)	Process includes: • conversion of mass to kg • substitution • evaluation e.g. 0.057 kg seen anywhere (1) (p =) 0.057 × 46 (1) (p =) 2.6 (kg m/s)(1)	2622 gains 2 marks allow 2.622	**3**

Question number	Answer	Mark
1(c)	An explanation that makes reference to three of the following points: • increase impact time (1) • (for) same change of momentum (1) • reference to force = change of momentum/time (1) • reduces force (1)	**3**

Total for Question 1 = 11 marks

Question number	Answer	Additional guidance	Mark
2(a)	Idea of friction (between particles)	allow rubbing	**1**

Question number	Answer	Additional guidance	Mark
2(b)	An explanation linking: • electrons in the ground (1) • are repelled from the surface layers (1)	reject for one mark movement of positive charges	**2**

Question number	Answer	Additional guidance	Mark
2(c)(i)	To remove (or add) electrons from the outer shells/levels of an atom	allow turning (atoms) into ions	**1**

Question number	Answer	Additional guidance	Mark
2(c)(ii)	Charge = current × time	allow in words or any rearranged form e.g. $Q = I \times t$	**1**

Question number	Answer	Additional guidance	Mark
2(c)(iii)	• Rearrangement • Substitution and evaluation $t = Q/\mathrm{I}$ (1) = 15/32 000 = 0.00047 (s) (1)	POT error = −1 award full marks for correct numerical answer without working	**2**

Question number	Answer	Additional guidance	Mark
2(c)(iv)	Process includes: • substitution of V (= IR) into energy equation • substitution • rearrangement • evaluation $E = QIR$ (1) $510 \times 10^6 = 15 \times 32 \times 10^3 \times R$ (1) (R =) $\frac{510 \times 10^6}{15 \times 32 \times 10^3}$ (1) 1060 (Ω) (1)	allow calculation of V from $E = QV$ or $E = VIt$ allow substitution into $V = IR$ allow rearrangement of $V = IR$ 1062.5 must see answer to at least 2 significant figures in order to determine that evaluation is correct some supporting working must be seen with correct answer to receive full marks	**4**

Total for Question 2 = 11 marks

Question number	Answer	Additional guidance	Mark
3(a)(i)	Advantage: any suitable (1) e.g. • does not contribute to global warming • wind available in all parts of Earth • can be used on a large or small scale Disadvantage: any suitable (1) e.g. • noisy • visual pollution • harm to (migratory flocks of) birds	ignore renewable as given in the stem	**2**

Question number	Answer	Additional guidance	Mark
3(a)(ii)	A description that makes reference to the following three points: • no output until 5 m/s (1) • linear increase of output from 5 m/s to 15 m/s (1) • output constant at 0.6 MW for speeds over 15 m/s (1)	data points must be referenced allow 1 mark for correct trend without any data references.	**3**

Question number	Answer	Additional guidance	Mark
3(b)	A description that includes reference to five of the following points: construction: • soft iron core (1) • primary coils (1) • secondary coils (1) operation: • lower voltage applied to the primary coils/RA (1) • must be a.c. (1) • number of primary coils< secondary coils (1) • turns ratio of 220 (1)	may be shown on a labelled diagram	**5**

Total for Question 3 = 10 marks

Question number	Answer	Mark
4(a)	A description that makes reference to three of the following points. For a liquid: • molecules closely spaced (1) • molecules slide over one another (1) For a gas: • molecules spread out (1) • molecules move with random motion (1)	**3**

Question number	Answer	Additional guidance	Mark
4(b)(i)	Process includes: • Conversion of time into seconds substitution into or rearrangement of • $P = W/t$ • Evaluation e.g. time = 120 seconds (1) 2200 = W/120 (1) W = 260 000 (joules) (1)	seen anywhere in working allow 264 000 answer of 4400 (joules) gains 2 marks max	**3**

Question number	Answer	Additional guidance	Mark
4(b)(ii)	Energy transferred = mass × specific heat capacity × change in temperature	equation can be given in words or symbols e.g. $\Delta Q = m \times c \times \Delta\theta$ allow E for Q, T for θ	**1**

Question number	Answer	Additional guidance	Mark
4(b)(iii)	Process includes: • rearrangement of equation (1) • substitution into correct equation (1) • evaluation of temperature difference (1) • calculation of final temperature (1) e.g. 264 000 = 1.1 × 4200 × $\Delta\theta$ (1) $\Delta\theta = \frac{264\,000}{1.1 \times 4200}$ (1) ($\Delta\theta$ =) 57 (°C) (1) final temperature = 77 (°C) (1)	allow ecf from (b)(i)	**4**

Question number	Answer	Additional guidance	Mark
4(c)(i)	Thermometer	allow temperature sensor AND data logger	**1**

Question number	Answer	Mark
4(c)(ii)	An explanation that makes reference to the following points: • actual temperature lower than calculated (1) • energy is lost to the surroundings not all the energy is transferred to the water (1)	**2**

Total for Question 4 = 14 marks

Question number	Answer	Additional guidance	Mark
5(a)(i)	Number of metal discs	allow load	**1**

Question number	Answer	Additional guidance	Mark
5(a)(ii)	(Soft) iron is a magnetic material	easy to magnetise/demagnetise	**1**

Question number	Answer	Mark
5(b)(i)	• Scale on the y-axis (1) • Both axes labelled with variable and unit (1) • Plotted (1) • Bars drawn (1)	**4**

Question number	Answer	Mark
5(b)(ii)	To support the weight of the (soft iron) bar (1)	**1**

Question number	Answer	Additional guidance	Mark
5(b)(iii)	An explanation that makes reference to three of the following points: • repeat and average (1) • repeat anomalous result (1) • use intermediate weights e.g. 1, 3, 5, 7, 9 (1) • extend the range of the results beyond 10 weights (1) • use standard masses (1)	however expressed	**3**

Total for Question 5 = 10 marks

Question number	Answer	Mark
6(a)(i)	B	1

Question number	Answer	Mark
6(a)(ii)	A	1

Question number	Answer	Mark
6(a)(iii)	A	1

Question number	Answer	Mark
6(a)(iv)	A	1

Question number	Answer	Additional guidance	Mark
6(b)	Any two suitable reasons: e.g. • stars are made mostly of hydrogen (1) • helium is formed during fusion (1) • carbon is formed during fusion (1) • hydrogen formed after Big Bang (1)	do not allow both helium from fusion and carbon from fusion allow helium formed after Big Bang	2

Question number	Answer	Additional guidance	Mark
6(c)(i)	• Determination of λ_0 AND λ (1) • Determination of $\Delta\lambda$ (1) e.g. 760 nm, 655 nm $\Delta\lambda$ = 105 (nm)	 allow ± 5 nm	2

Question number	Answer	Additional guidance	Mark
6(c)(ii)	Rearrangement of equation $v = \frac{\Delta\lambda}{\lambda_0} \times c$ (1) substitution with correct power for c $v = \frac{3 \times 10^5 \times 105}{655}$ (1) evaluation 4.8×10^4 (km/s) (1)	allow ecf from (c)(i) if the answer is given in m/s, check that the power is 10^7 award full marks for correct numerical answer without working	**3**

Question number	Answer	Additional guidance	Mark
6(d)	An explanation that makes reference to the following three points: • RHS shows red shift (1) • LHS shows blue shift (1) • the galaxy is spinning (1)	RHS moving away from the astronomer LHS moving towards the astronomer	**3**

Total for Question 6 = 14 marks

TOTAL FOR PAPER = 70 MARKS

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