OCR
Oxford Cambridge and RSA

Accredited

GCSE (9–1) Physics A (Gateway Science)

F

J249/01 Paper 1 (Foundation Tier)

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 1 hour 45 minutes

You must have:
- the Data Sheet

You may use:
- a scientific or graphical calculator
- a ruler

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 **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

SECTION A

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

1 Which of these pairs of objects will attract each other?

A 


copper bar

B 

C 

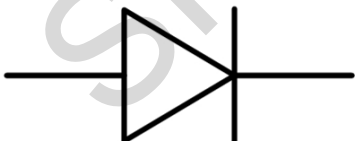
D 

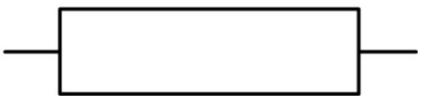

aluminium bar

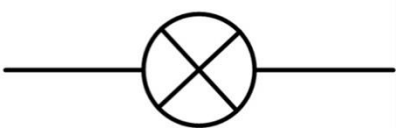
Your answer ☐

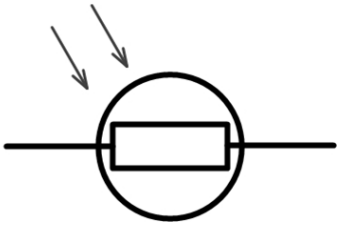
[1]

2 Which of these symbols is used to show an LDR?

A 

B 

C 

D 

Your answer ☐

[1]

3 A bus takes 1.8 hours to travel 24 km.

What is the average speed of the bus?

A 43.2 km/h

B 25.8 km/h

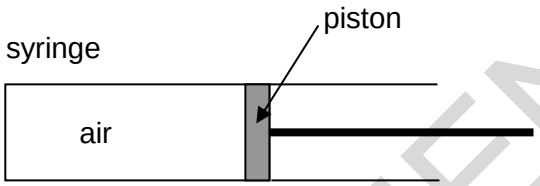
C 22.2 km/h

D 13.3 km/h

Your answer ☐

[1]

4 A syringe contains air.



The piston is pushed inwards.

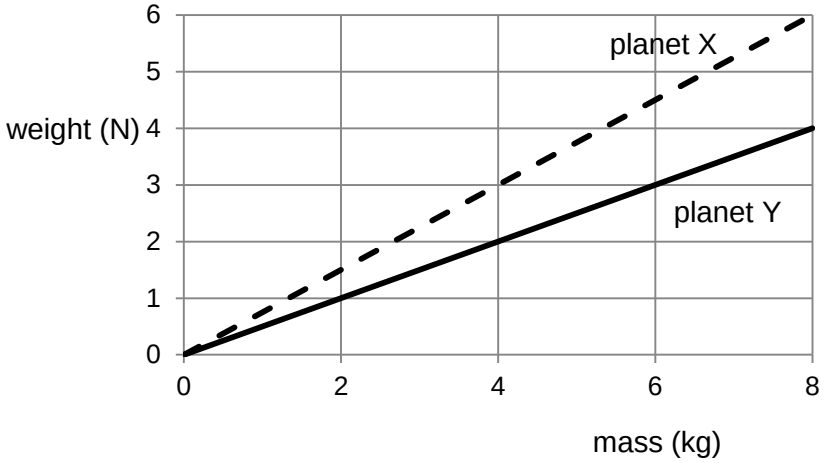
How do the pressure and volume of the air in the syringe change?

	Pressure	Volume
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

Your answer ☐

[1]

5 The graph shows the relationship between mass and weight on two different planets.



The weight of an object on planet **X** is 3 N.

What is the weight of the same object on planet **Y**?

A 1.5 N

B 2.0 N

C 4.0 N

D 6.0 N

Your answer ☐

[1]

6 The strength of the magnetic effect of a solenoid can be changed.

Which of the following rows correctly describes what happens to the strength when the current and number of turns are increased?

	Increased current	**Increased number of turns**
A	increases	decreases
B	increases	increases
C	decreases	increases
D	decreases	decreases

Your answer ☐

[1]

7 Why is an unmagnetised iron object attracted to a magnet?

A The iron has magnetism induced by the magnet.

B The iron has charged particles which attract the protons in the magnet.

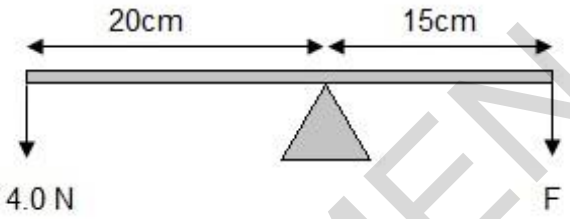
C The iron has charged particles which attract the electrons in the magnet.

D The iron is attracted by the Earth's magnetic field.

Your answer ☐

[1]

8 A see-saw is in equilibrium.



What force is needed for the see-saw to be in equilibrium?

A 3.0 N

B 3.5 N

C 5.0 N

D 5.3 N

Your answer ☐

[1]

9 Which sentence is the definition of the power of a machine?

A The amount of work done by the machine.

B The efficiency of the machine.

C The number of joules of energy the machine requires to work.

D The rate at which energy is transferred by the machine.

Your answer ☐

[1]

10 A sealed can contains gas.

The can is heated and the pressure of the gas increases.

How do the gas particles cause this increase in pressure?

A Their average distance apart increases.

B They expand.

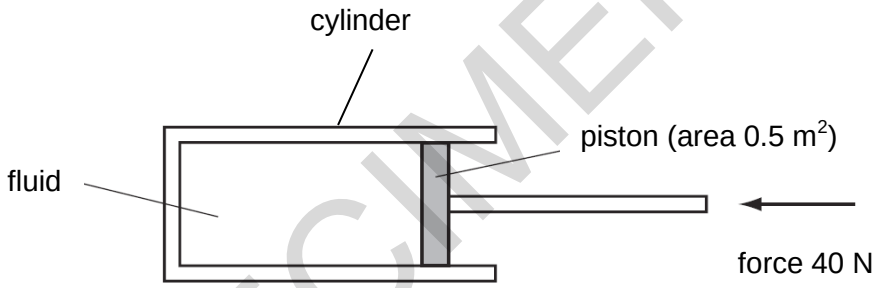
C They hit each other more frequently.

D They hit the can more frequently.

Your answer ☐

[1]

11 A piston is pushed in a cylinder containing a fluid.



If **pressure = force ÷ area**, what is the pressure exerted on the fluid?

A 20 Pa

B 80 Pa

C 160 Pa

D 200 Pa

Your answer ☐

[1]

12 A firework rocket has a resultant force of 2 N acting on it.

It has a mass of 0.1 kg.

What is the acceleration of the firework rocket?

A 0.2 m/s^2

B 0.5 m/s^2

C 20 m/s^2

D 200 m/s^2

Your answer ☐

[1]

13 What is the **minimum** number of forces that are required to compress a spring?

A 1

B 2

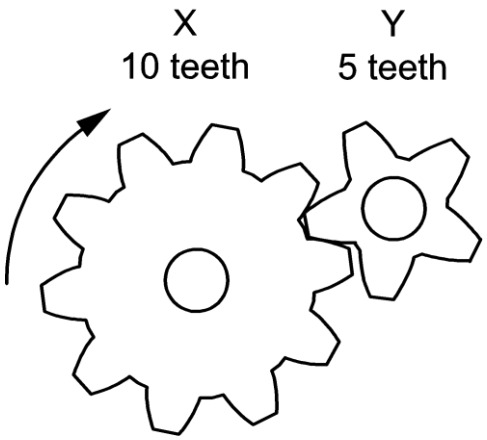
C 3

D 4

Your answer ☐

[1]

14 The diagram shows 2 gears.



Gear **X** is rotated clockwise at 1.0 rotation per second.

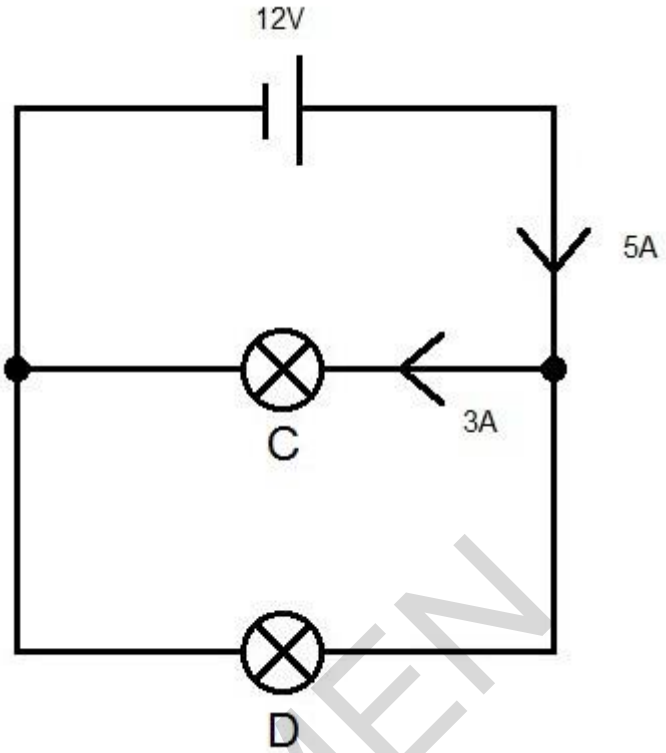
Which row is the correct description of the movement of gear **Y**?

	direction of rotation	rotations per second
A	anticlockwise	0.5
B	anticlockwise	2.0
C	clockwise	0.5
D	clockwise	2.0

Your answer ☐

[1]

15 Look at the circuit diagram.



Use the formula **resistance = potential difference ÷ current** to calculate the resistance of bulb **D**.

A 2 Ω

B 4 Ω

C 6 Ω

D 8 Ω

Your answer ☐

[1]

SECTION B

Answer **all** the questions.

16 Two students study the motion of a toy train on a track.

They need distance and time measurements to calculate speed.

(a) Write down an instrument they could use to measure:

(i) distance: …….. **[1]**

(ii) time: …… **[1]**

(b) The toy train travels for 45 seconds at 2 m/s.

Calculate the distance it travels.

Show your working.

…….....

…….....

…….....

answer: ……. m **[4]**

(c) The maximum speed of the train is 5 m/s. Its maximum velocity is also 5 m/s.

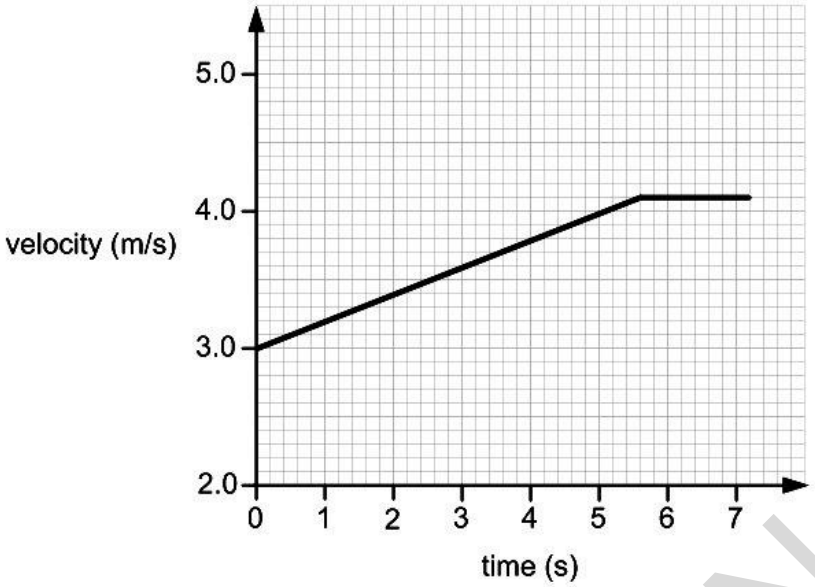
(i) What is the same about the maximum speed and velocity?

……... **[1]**

(ii) What may be different about the maximum speed and velocity?

……... **[1]**

(d) The train accelerates and its journey is shown in the graph below.



Use data from the graph to calculate the acceleration.

Show your working.

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answer: …… m/s^2 **[4]**

17 Two students, **A** and **B**, use different methods to see magnetic field patterns.

(a) (i) Describe how student **A** can use a compass to plot a magnetic field pattern.

You may draw a diagram to help you answer this question.

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..... **[3]**

(ii) Student **B** uses iron filings to show a magnetic field pattern.

Describe how student **B** uses iron filings to show a magnetic field pattern.

You may draw a diagram to help you answer this question.

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……...

……... **[2]**

(b) Their teacher prefers students to use the method proposed by student **A.**

Suggest **one** reason why.

……...

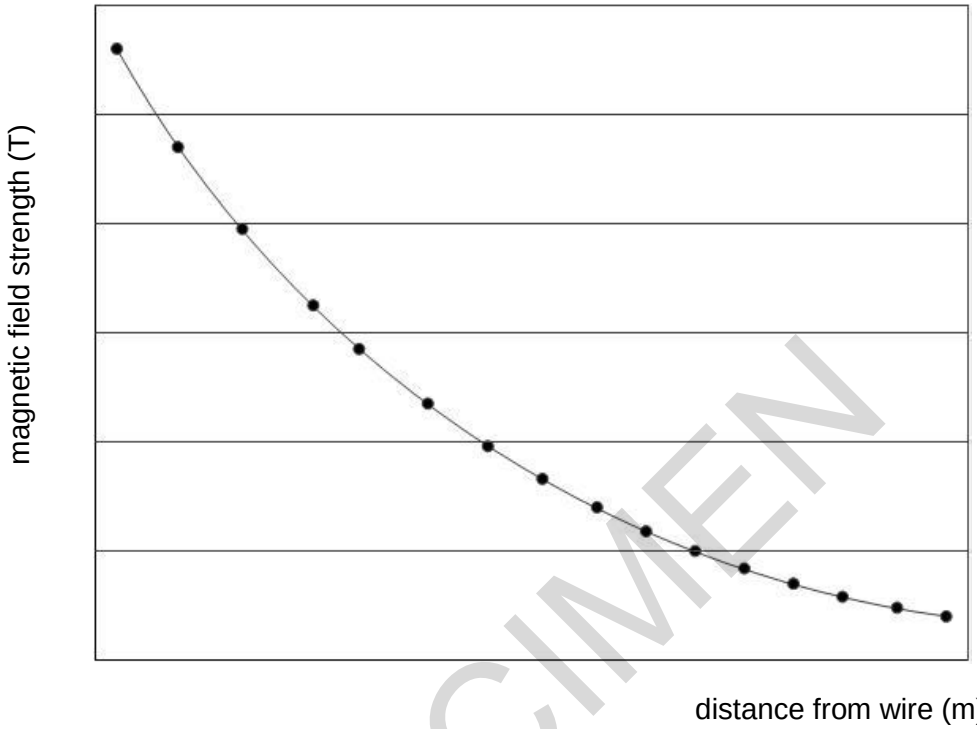
……... **[1]**

(c) Sketch the field pattern the students found around a bar magnet.

[2]

(d) The two students decide to investigate the magnetic effect of a current-carrying wire.

Look at the graph of their results.



What trend does the graph show?

……...

……...

……... **[2]**

18 Four students investigate the idea of work done.

work done = force x distance

Look at their results.

Student	Force (N)	Distance travelled (m)
A	100	5
B	50	10
C	120	12
D	40	4

(a) Use calculations to show which student does the most work.

……..

…….. **[2]**

(b) Which **two** students do the same amount of work?

…….. **[1]**

(c) State **two** reasons why it is important to repeat measurements in any experiment.

……..

…….. **[2]**

(d) Student **C** takes 0.5 minutes to push the trolley.

How much power do they use?

Show your working.

……..

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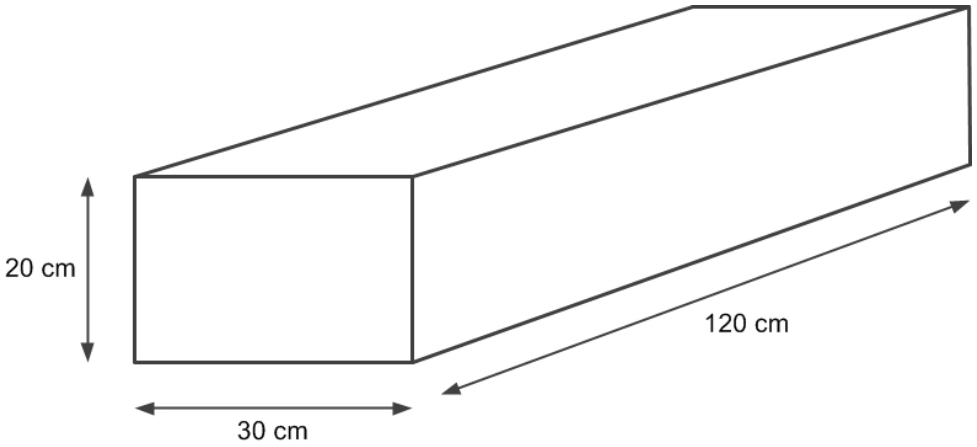
……..

answer: .....W **[4]**

19 Wood has a density of 180 kg/m^3.



Calculate the mass of this piece of wood.

Show your working and give the units.

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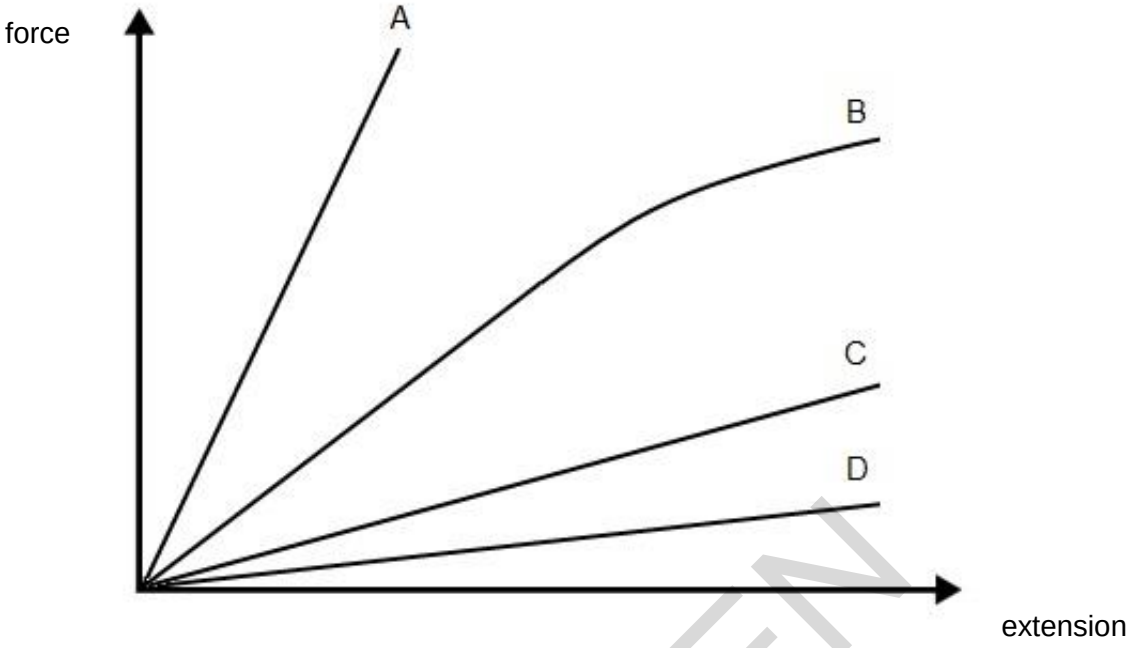
answer: …… **units:**…… **[6]**

20 The extension of four different springs is shown in the graph.



(a) Explain which of the springs **A**, **B**, **C** or **D** has the highest spring constant?

……

…… **[2]**

(b) Explain why the line for spring **B** has a different shape to the others.

……

…… **[2]**

(c) **(i)** A spring has a spring constant of 27 N/m.

For an extension of 25 cm, calculate the energy transferred in stretching.

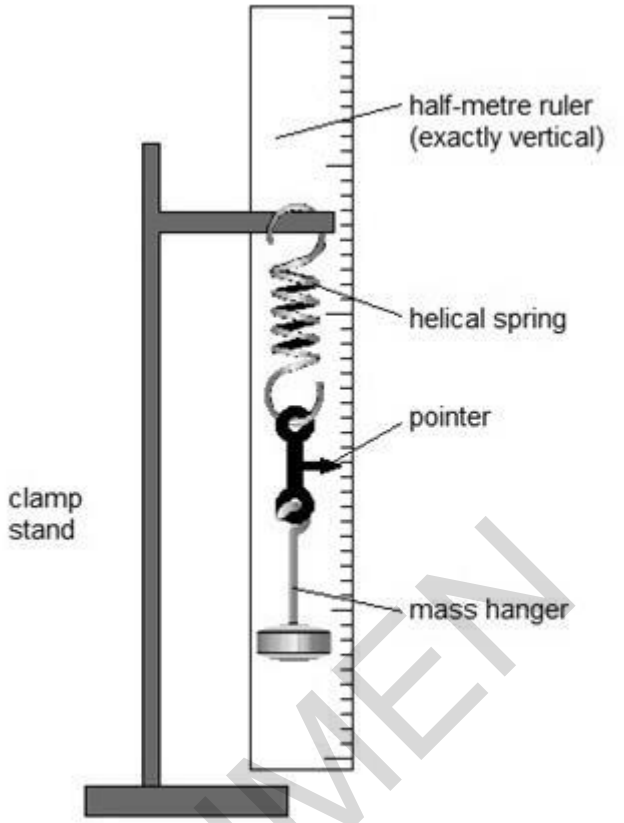
Use the formula: **energy transferred = 0.5 x spring constant x extension^2**.

……

……

answer: ..... J **[2]**

(ii) A student set up the apparatus shown in the diagram.



Describe how they could use this apparatus to collect data to draw a force/extension graph for this spring.

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…… **[4]**

(iii) The above spring has a spring constant of 30 N/m, this is replaced by a spring with a spring constant of 10 N/m.
What changes will the student have to make to this method to investigate this spring?

……

……

…… **[2]**

21 A student finds a resistor which has no markings on it.

The student uses a voltmeter, an ammeter and a cell to find the resistance of the resistor.

(a) Draw a circuit diagram the student could use to find the resistance of the resistor.

[3]

(b) In the experiment the current reading is 0.15 A and the potential difference is 2.0 V.

Use the formula: **potential difference = current x resistance**

to calculate the resistance of the unknown resistor.

Show your working.

Record your answer to **3** significant figures.

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answer: ..... Ω **[3]**

(c) The students repeat the experiment with different potential differences and currents.

Look at the results.

Potential difference (V)	Current (A) (Attempt 1)	Current (A) (Attempt 2)	Current (A) (Attempt 3)	Mean current (A)
2.0	0.15	0.14	0.16	0.15
4.0	0.31	0.31	0.31	0.31
6.0	0.44	0.44	0.38	0.44
8.0	0.60	0.62	0.58	0.60
10.0	0.74	0.75	0.73	0.74

There is an anomaly in the results.

(i) Write down the anomaly from the table.

……

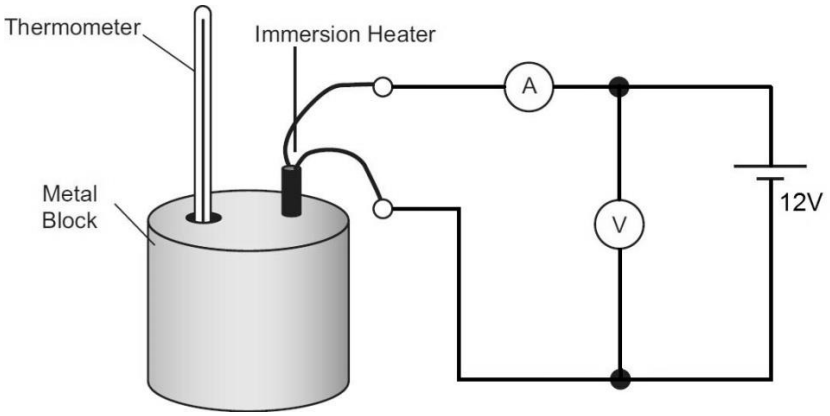
…… **[1]**

(ii) State how the students dealt with the anomaly?

……

…… **[1]**

22 A student completes an experiment to find the specific heat capacity of a metal.



(a) **(i)** The student takes voltage and current measurements.

Suggest **three** other measurements they need to take?

……

……

…… **[3]**

(ii) Describe how these measurements could be used to determine the specific heat capacity of the metal.

……

……

…… **[2]**

(b) The value obtained from the experiment is much higher than expected.

Suggest **two** reasons how this could have occurred and suggest **two** improvements to the experimental procedure.

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…… **[4]**

23 A student rubs a balloon against a scarf.

(a)* Describe how the balloon has become charged.

Suggest a way to show that the balloon is charged. What would you expect to see and why?

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…… **[6]**

(b) The rate of flow of electrical charge in a circuit is a current.

A current of 40 mA transfers a charge of 3.6 C.

Calculate how long this takes.

Show your working.

……

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……

answer: ..... seconds **[3]**

END OF QUESTION PAPER

OCR
Oxford Cambridge and RSA

F

…day June 20XX – Morning/Afternoon

GCSE (9–1) Physics A (Gateway Science)
J249/01 Paper 1 (Foundation Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK 90

DRAFT

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.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.
The communication statement determines the mark within a level.

11. **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

12. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Physics A:

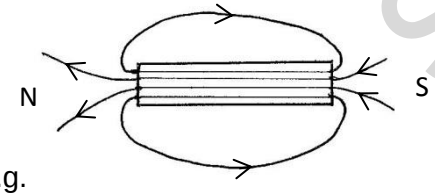
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge 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.

SECTION A

Question	Answer	Marks	AO element	Guidance
1	B	1	2.2	
2	D	1	1.2	
3	D	1	2.1	
4	C	1	2.1	
5	B	1	2.1	
6	B	1	1.1	
7	A	1	1.1	
8	D	1	2.1	
9	D	1	1.1	
10	D	1	1.1	
11	B	1	2.1	
12	C	1	2.1	
13	B	1	1.2	
14	B	1	2.1	
15	C	1	2.1	

SECTION B

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	Any one from: Tape measure (1) Ruler (1) Metre rule (1)	1	1.2	**ALLOW** trundle wheel
		(ii)	Any one from: Stop clock/watch (1) Timer (1)	1	1.2	
	(b)		Correct recall of formula: speed = distance / time (1) Re-arrangement of formula for distance (1) Substitution: 2 x 45 (1) Answer: 90 (m) (1)	4	1.1 2.2 2.1 2.2	
	(c)	(i)	They both have magnitude / size (1)	1	1.1	
		(ii)	The direction may not be the same (1)	1	1.1	
	(d)		Read correct values for time and velocity from graph (1) Change in velocity 4.1 – 3.0 = 1.1 m/s (1) Substitute in acceleration formula: 1.1 / 5.6 (1) Answer: 0.2 (m/s^2) (1)	4	2.2 2.2 2.1 2.1	

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	Any 3 from: Place magnet on a sheet of (plain) paper (1) Place the compass near the end of the magnet (1) Mark the position that the compass needle points to (1) Move the compass so the opposite end is at this position and mark the new position where the compass tip settles (1) Repeat above and below the magnet and then connect the marks together to construct a fieldline (1)	3	3 x 1.2	**ALLOW** full marks for a fully annotated diagram that demonstrates how the experiment would be undertaken
		(ii)	Place a clear/transparent/paper cover over the magnet (1) (Sprinkle) on iron filings (to show the field pattern) (1)	2	2 x 1.2	**DO NOT ALLOW** marks for diagram
	(b)		Any one from: Compass shows direction of field lines (1) Iron filings are easily spilt (1) Iron filings are difficult to remove from magnets (1) Iron filings carries a greater risk / **AW** (1) (Idea of) less accurate field pattern (1) Drawing provides a permanent record (1)	1	3.2a	
	(c)		Correct field pattern drawn, (1)  e.g. Correct direction of arrow heads (1)	2	2 x 1.1	Minimum of 4 field lines No field lines crossing
	(d)		As the distance from the wire increases the strength of the magnetic field falls / **AW** (1) (idea of) the non-linear nature of the relationship (1)	2	3.1b 3.2b	

Question			Answer	Marks	AO element	Guidance
18	(a)		C (1) The product of force x distance is the most / **AW** (1)	**2**	**2 x 3.1b**	
	(b)		A and B (1)	**1**	**3.1b**	Both needed for this mark Any order
	(c)		Reduce random errors/identify anomalies / **AW** (1) Allows a mean/average to be calculated (1)	**2**	**2 x 1.2**	
	(d)		Power = energy/time (1) Conversion of time into seconds (1) (120 x 12)/30 (1) 48 (W) (1)	**4**	**1.1** **1.2** **2.1** **2.1**	**ALLOW ECF** from **(a)**
19			Conversion of cm to m (1) Calculation of volume: 0.2 x 0.3 x 1.2 = 0.072 m^3 (1) Re-arrangement of formula for mass (1) Substitution: 180 x 0.072 (1) Answer: 13 (1) Units: kg (1)	**6**	**1.2** **1.2** **2.2** **2.1** **2.1** **1.1**	**ALLOW** 12.96

Question			Answer	Marks	AO element	Guidance
20	(a)		A (1) It is the steepest gradient (1)	2	3.1a 3.2b	
	(b)		It has passed its elastic limit **or** it no longer obeys Hooke's Law (1) (The spring is) permanently deformed/distorted **or** **(**the spring) has undergone plastic deformation (1)	2	2 x 3.2b	
	(c)	(i)	0.5 x 27 x (0.25^2) (1) 0.84 (J) (1)	2	2 x 2.1	**ALLOW** 0.25 (1) for conversion of cm to m.
		(ii)	Record the original length (1) Add a mass (1) Recorded the new length (1) Repeat for increasing masses (1)	4	4 x 2.2	
		(iii)	Use smaller weights (1) Use a ruler that can measure smaller intervals (1)	2	2 x 3.3b	
21	(a)		Correct circuit symbols used for ammeter and voltmeter (1) Correct circuit symbols used for the cell and resistor (1) Components connected correctly for current and voltage to be measured (1)	3	3 x 1.2	
	(b)		2.0/0.15 (1) 13.3 (ohms) (1) 3 sig. figs (1)	3	3 x 2.1	**ALLOW** 13 or 13.3333333333 (ohms) (2)
	(c)	(i)	Attempt 3 at 6.0 V (1)	1	3.2a	
		(ii)	They didn't include it in the mean (1)	1	3.1b	

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	Temperature rise **or** start and end temperatures (1) Time that the heater is switched on (1) Mass of the block (1)	**3**	**3 x 1.2**	
		(ii)	Reference to: energy = voltage x current x time (1) SHC = energy / (mass x temp rise) (1)	**2**	**2 x 1.2**	
	(b)		Any two reasons and any two improvements <u>Reasons</u> Heat escapes to the surroundings (1) Part of the immersion heater is outside of the block (1) Poor thermal contact between the immersion heater and block (1) It takes time for the thermometer to reach its maximum temperature (once the heater is turned off) (1) <u>Improvements</u> Lag/insulate the aluminium block (1) Make sure all of the heater is in the block/use a smaller heater (1) Use petroleum jelly to transfer heat between the immersion heater and the block (1) Wait until the maximum temperature is reached (1)	**4**	**2 x 3.2a** **2 x 3.3b**	Max 2 reasons and 2 improvements **ALLOW** (idea of) residual heat not reaching the block before the final temperature is recorded.

Question			Answer	Marks	AO element	Guidance
23	(a)*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** **Detailed description of charging the balloon AND an experiment linked appropriately with an explanation of the observations.** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** **Description of charging the balloon AND of an experiment to demonstrate.** *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** **Simple description of how the balloon may become charged OR a suggestion of an appropriate experiment.** *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** *No response or no response worthy of credit.*	**6**	**3 x 1.2** **3 x 2.2**	**AO2.2: Description of an experiment with explanation** • Holding a charged balloon by water/paper/wall/hair/gold leaf electroscope/another charged balloon • Use of a gold leaf electroscope. A charged balloon causing the gold leaf to rise when the plate is touched by the balloon • Caused by charge moving down the leaf and metal plate with the same charge repelling one another • Idea of induction if relevant to investigation **AO1.2: Description of charging an insulator** • Mention of electrostatic forces • Attraction of opposite charges • Repulsion of like charges • Electrons are rubbed on/off the balloon from/to the scarf / **ORA** • Idea of negative charge linking to electrons • Removal of electrons result in positive charge

Question			Answer	Marks	AO element	Guidance
	(b)		Conversion of mA to A (40 mA = 0.04 A) (1) Use of Q = I x t: t = 3.6 / 0.04 (1) t = 90 (seconds) (1)	**3**	**3 x 2.1**	

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