Rewarding Learning

General Certificate of Secondary Education

GCSE Physics

Unit 1
Higher Tier

[GPY12]

Assessment

MARK SCHEME

General Marking Instructions and Mark Grids

Introduction
Mark schemes are intended to ensure that the GCSE examination is marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

Quality of candidates' responses
In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking
Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, the examiners should seek the guidance of the Supervising Examiner.

Positive marking
Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate. Candidates can be awarded full marks for an answer if they have not shown a method. The advice to show clearly is to allow partial credit to be awarded.

Awarding zero marks
Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate. If the starting point for a response is clearly incorrect Physics then award 0.

Types of mark scheme
Mark schemes for questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

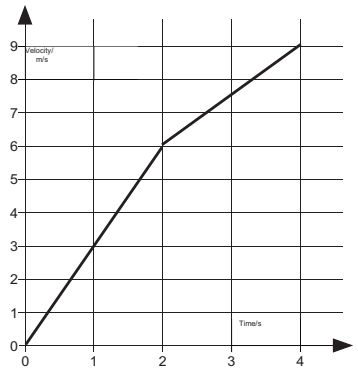
1 **(a)** **(i)** A vector has direction [1]

(ii) Acceleration – Vector [½]
Displacement – Vector [½]
Rate of change of speed – Scalar [½]
Speed – Scalar [½]
Velocity – Vector [½] [3]
Round up

(iii) m/s^2 **or** cm/s^2 [1]

(b) Straight line from (0,0) [1]
to (2,6) [1]
Straight line from (2,6) [1]
to (4,9) [1] [4]

If lines are freehand deduct 1 mark



(c) **(i)** 2 (s) [1]

(ii) Average velocity = $\frac{1}{2}$ (0 + 20) or $\frac{1}{2}$ (u + v) [1]
= 10 (m/s) [1] [2]

(iii) Height = area under graph [1]
= $\frac{1}{2}$ × 2 × 20 (m) [1]
= 20 (m) [1] [3]
or
Height = average velocity × time
= $\frac{1}{2}$ (0 + 20) × 2
= 20 (m)

(iv) −20 (m/s) the minus is required for both marks [2]

(d) Time = $\frac{\text{velocity change}}{\text{time taken}}$ [1]

= 30/3.8 [1]
Time = 7.9 s [1] [3]

(e) **(i)** Slowing/retardation/decelerating [1]
Time from line 1 to line 2 < time from line 2 to 3 [1] [2]
(or equivalent)

(ii) (Average) speed = distance/time
speed = 4/0.155 [1]
= 25.8 (m/s) [1] [2]

AVAILABLE MARKS

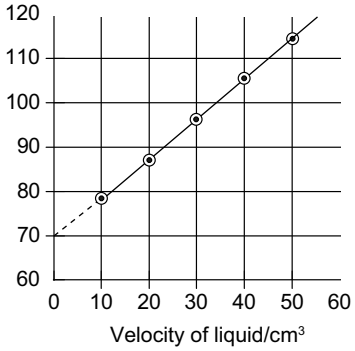
24

						AVAILABLE MARKS
2	**(a)**	**(i)**	$W = mg$ **or** $50 \times 10 = 500$ (N)		[1]	
		(ii)	$F = m \times a$ **or** $a = \frac{F}{m}$	[1]		
			$750 - 500 = 50 \times a$ **or** $250 = 50\ a$ **or** $a = \frac{250}{50}$	[2]		
			(possible ecf from **(i)**)			
			$a = 5$ (m/s^2)	[1]	[4]	
		(iii)	Fuel is burned off (used up)	[1]		
			so mass decreases	[1]	[2]	
		(iv)	Friction or Air Drag/Air resistance	[1]		
			Direction is Downwards	[1]	[2]	
		(v)	Thrust = Weight + other force		[1]	
	(b)	$P = \frac{F}{A}$	**or** P = 100/0.4 x 0.2 = 100/0.08	[1]		
			= 1250			
			Pa	[2]		
		P = 0.125		[1]		
		N/cm^2		[1]	[5]	
		The numerical answer and the unit must be consistent				
	(c)	**(i)**	CM = ACM			
			$W \times 20 = 2 \times 12$	[2]		
			$W = \frac{2 \times 12}{20}$	[1]		
			$W = 1.2$ (N)	[1]	[4]	
		(ii)	$F = 2 + 1.2$	[1]		
			Possible ecf for W from **(i)**			
			$F = 3.2$ (N)	[1]	[2]	
		(iii)	To the LEFT **or** in same direction as the pivot	[1]		22

3 **(a)** 1 cm^3 of gold [1]
has a mass of 19.3 g [1] [2]

AVAILABLE MARKS

(b) **(i)**



Volume axis labelled with unit [1]
Points plotted [2] [3]

(ii) Line extrapolated to y-axis [1]
Mass of measuring cylinder = 70 g ± 1g [1] [2]
Allow 69 g to 71 g

(iii) D = M/V [1]
any values from the table
e.g. (88 – 70)/20 or take the gradient [1]
D = 0.9 (g/cm^3) [1] [3]
Allowing for the uncertainty in the value of the mass of the cylinder the range of answers for the density are

Volume of liquid/cm^3	Range of Density values/g/cm^3
10	0.80 to 1.0
20	0.85 to 0.95
30	0.86 to 0.93
40	0.875 to 0.925
50	0.9 to 0.92

No ecf for the mass of liquid cylinder + liquid

(c) **(i)** Strong forces between the particles [1]

(ii) Vibrational [1] 12

AVAILABLE MARKS

4 **(a)** **(i)** KE at B = $\frac{1}{2}$ mv^2 [1]
= $\frac{1}{2}$ × 0.2 × 2^2 [1]
= 0.4 (J) [1]
Energy lost = 2 – 0.4 = 1.6 (J) [1] [4]

(ii) No circled [1]
C is half as high as A so needs 1 J of PE [1]
Car only has 0.4 J [1]
or
No circled [1]
Energy needed = 0.2 × 10 × 0.5 = 1.0 J [1]
Car only has 0.4 J [1] [3]

(b) **(i)** PE = mgh [1]
= 5 × 10 × 3 [2]
= 150 (J) [1] [4]
5000 × 10 × 3 = 150,000 award 3 marks

(ii) Efficiency = $\frac{\text{useful output energy}}{\text{Total input energy}}$ [1]
= 150/195 [1]
= 0.77 [1] [3]
Accept 77% but not 0.77%

(iii) Work done against friction = 45 (J) [1]
Work = 45 = 3 × F [2]
F = 15 N [1] [4]

(c) Indicative content
Method of heat transfer – conduction

Fair test – Rods same length, same cross section area
same amount of wax on the drawing pins
identical drawing pins
drawing pins equidistant from flame
Maximum of 2 points

Observation – Drawing pin on the copper rod falls first
Conclusion – Copper is the better conductor

Explanation – Copper has free electrons
Energy is transferred by collisions

Response	Mark
Candidate describes in detail using good spelling, punctuation and grammar **5 or more** points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidate describes in detail using good spelling, punctuation and grammar **3 or 4** points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[3]–[4]
Candidates make some reference to **1 or 2 of the main points** shown above using satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made some reference to specialist terms.	[1]–[2]
Response not worthy of credit	[0]

5 or more points award 6 marks, 3 or 4 points award 4 marks
1 or 2 points award 2 marks

		AVAILABLE MARKS
5	**(a)** Plum Pudding – negative electrons In a sphere of positive charge [2] Rutherford–Bohr – electrons in orbit Around a positively charged nucleus [2] [4]	
	(b) Indicative content **Vacuum** – *to prevent collision with air molecules* *Alphas have limited range in air* **Measurements –** *Move detector to different angles* *Measure the number of alphas detected* **Deflection** – *The positive particles repelled by nucleus* *The nucleus is positive or Like charges repel* **Small nucleus** – *Most alphas passed through without deflection* **Massive nucleus –** *Some alphas rebounded or were back scattered*	

Response	Mark
Candidate describes in detail using good spelling, punctuation and grammar **5 or more** points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidate describes in detail using good spelling, punctuation and grammar **3 or 4** points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[3]–[4]
Candidates make some reference to **1 or 2 of the main points** shown above using satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made some reference to specialist terms.	[1]–[2]
Response not worthy of credit	[0]

5 or more points award 6 marks, 3 or 4 points award 4 marks
1 or 2 points award 2 marks [6]

(c) **(i)** Number of protons = 92 – 88 = 4 [1]
Number of neutrons = (238 – 92) – (226 – 88)
= 146 – 138 = 8 [1] [2]

(ii) $^{222}_{86}Rn + {}^{4}_{2}\alpha$
[1] [1] [2]
Both the mass number and atomic number must be correct for the mark

(iii) 128/1024 = 1/8 i.e. 3 half lives [1]
11.4/3 = 3.8 days [1] [2]

(iv) Alpha radiation damages cells/DNA/ionising radiation [1]

(v) Ventilation to remove the gas
Radon barrier now included in new builds – acceptable answer [1] 18

Total **100**