Rewarding Learning

General Certificate of Secondary Education
2022

GCSE Physics

Unit 1
Higher Tier

[GPY12]

TUESDAY 7 JUNE, MORNING

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.

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.

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.

COVID-19 Context
Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

AVAILABLE MARKS

1 **(a)** **(i)** 20 (m) [1]

(ii) 20 (s) [1]

(iii) speed = distance/time or symbols [1]
80/(30 – 10) [2]
= 4 (m/s) [1] [4]

(b) **(i)** (Displacement) = area under graph [1]
$= 0.5 \times (3 \times 9) + 1 \times 9$ [2]
or
$= 0.5 \times (4 + 1) \times 9$ (worth 2 marks)
= 22.5 (cm) [1] [4]

(ii) a = (v – u)/t **or** a = gradient [1]
= (9 – 0)/3 **or** = (9 – 0)/(3 – 0) [1]
$= 3\ (cm/s^2)$ [1] [3]

(c) **(i)** Vectors have direction or
Scalars do not have direction [1]
Vector examples: force, displacement, velocity, acceleration [1]
Scalar examples: mass, length, area, volume, speed, energy, etc. [1] [3]

(ii) Displacement = 0 [1]

(d) **(i)** t = (v – u)/a (or equivalent) [1]
$= (0 – 6)/(–10)$ or $\frac{6}{10}$ [1]
= 0.6 s [1] [3]
(u, v confusion, deduct 1 mark, once only, if correct answer obtained)

(ii) Height = average speed × time [1]
Height = 3 × 0.6 (ecf for t from **(i)**) [2]
= 1.8 (m) [1] [4]
Sight of 3 is worth 1 mark
or
s = 0.5(u + v)t [1]
$= 0.5 \times 6 \times 0.6$ (ecf for t from **(i)**) [2]
= 1.8 (m) [1]
or
$s = ut + 0.5\ at^2$ [1]
$= 6 \times 0.6 – 0.5 \times 10 \times 0.6^2$ (ecf for t from **(i)**) [2]
= 1.8 (m) [1]
or
$s = (v^2 – u^2) / 2a$ [1]
$= (0^2 – 6^2) / (–20)$ [2]
= 1.8 m [1]
or

$$\left.\begin{aligned} mgh &= \tfrac{1}{2} mv^2 \\ gh &= \tfrac{1}{2} v^2 \end{aligned}\right\} \text{PE = KE [1]}$$

$10h = \frac{1}{2} \times 6^2$ [2]

$h = \frac{18}{10} = 1.8\,m$ [1]

24

					AVAILABLE MARKS
2	**(a)**	**(i)**	Straight line up to 8N curve beyond this point [1] Limit of proportionality is at 8N [1]	[2]	
		(ii)	F = ke or k = gradient [1] 8 = k × 16 or 2/4 etc [1] k = 0.5 [1] N/cm [1]	[4]	
		(iii)	Straight line from 0,0 [1] Through 32,8 [1]	[2]	

(b) The point
Where the weight of the bus acts
The lower the CoG the more stable the bus
The width of the base/distance across the bus wheel to wheel
This raises the CoG
The weight acts outside the base/wheel
This causes a turning effect

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]

[6]

(c) F = ma or F = ma [1]
F = 2000 × 0.4 1200 − F = 2000 × 0.4 [2]
F = 800 N F = 400 (N) [1]
Resistance = 1200 – 800 = 400 (N) [4]

(d) ACM = CM [1]
4 × 10 = 20 × W [2]
W = 40/20 = 2N [1] [4]

(e) P = F/A **or** A = F/P [1]
A = 5000/2.5 × 10^5 [1]
= 0.02 (m^2) [1] [3]

25

						AVAILABLE MARKS
3	**(a)**	**(i)**	Take the read from the bottom of the meniscus or avoid parallax error		[1]	
		(ii)	New measurement = 220 + 28 = 248		[1]	
		(iii)	Mass = density × volume or M = D × V	[1]		
			= 2.7 × 28	[1]		
			= 75.6(g)	[1]	[3]	
		(iv)	Mass on *x*-axis and volume on *y*-axis with units on correct axes gets [2] Mass and volume but without units on the correct axes gets [1] Mass and volume with units but on wrong axis gets [1]		[2]	
	(b)	**(i)**	Water molecules are further apart		[1]	
		(ii)	Gas	[1]		
			Liquid	[1]		
			Solid	[1]	[3]	11

4 **(a) (i)**

Energy resource	Renewable	Non-renewable
Coal		✓
Nuclear Fission		✓
Sunlight	✓	
Geothermal	✓	

[$\frac{1}{2}$] each round down [2]

(ii) Coal when burned releases carbon dioxide/sulfur dioxide [1]

(b) Efficiency = useful energy out/total energy in [1]
= 80/150 [1] for each correct value [2]
= 0.53 [1] [4]

(c) **(i)** $E_k = \frac{1}{2}\,mv^2$ [1]
$= \frac{1}{2} \times 500 \times 20^2$ [1]
= 100 000 (J) [1] [3]

(ii) 100 000 (ecf from **(i)**) [1]

(iii) Work = force × distance or W = F × D [1]
100 000 = F × 50 allow ecf from **(i)** [1]
F = 2000 (N) [1]
Force per brake = 500 (N) [1] [4]

(iv) Heat and Sound *both required* [1]

(d) **(i)** $E_p = mgh$ [1]
[1] [1]
$= (4.2 \times 10^5 \times 10) \times (400 \times 10^3)$ [2] [3]

(ii) Power = energy/time [1]

$$= \frac{(0.3 \times 10^{11} + 2.0 \times 10^{11})}{600}$$ [1]

$$= \frac{2.3 \times 10^{11}}{600}$$

$= 3.8 \times 10^8$ (W) [1] [3]

(e) Beaker A [1]
Temperature drop for beaker A = 100 – 55 = 45 °C [1]
Temperature drop for beaker B = 50 – 20 = 30 °C [2] 24

AVAILABLE MARKS

					AVAILABLE MARKS
5	**(a)**	**(i)**	$^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$ or β	[3]	
		(ii)	32 to 16 to 8 to 4 = 3 half lives [1] Age = 3 × 5730 [1] = 17 190 (years) [1]	[3]	
	(b)	**(i)**	Background (radiation)	[1]	
		(ii)	Named sources such as cosmic rays rocks	[1]	
		(iii)	Range (0) to 2.5 or 3 cm	[1]	
	(c)		Causes ionisation [1] May damage genes/DNA in cells or cause cancer [1]	[2]	
	(d)	**(i)**	Hydrogen [1] Deuterium [1] Tritium or Lithium [1]	[3]	
		(ii)	In the seas/oceans	[1]	
		(iii)	Helium	[1]	16
				Total	**100**