Rewarding Learning

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

THURSDAY 23 MAY 2013, MORNING

MARK SCHEME

Subject-specific Instructions

In numerical problems, the marks for the intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the final correct answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote correct units for intermediate numerical quantities.

Note that this “correct answer” rule does not apply for formal proofs and derivations, which must be valid in all stages to obtain full credit.

Do not reward wrong physics. No credit is given for consistent substitution of numerical data, or subsequent arithmetic, **in a physically incorrect equation**. However, answers to subsequent stages of questions that are consistent with an earlier incorrect numerical answer, and are based on physically correct equation, must gain full credit. Designate this by writing **ECF** (Error Carried Forward) by your text marks.

The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer marks, but 10^n errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer mark.

1 (a)
- Watch or timer (Stop) clock/tape (measure) or ruler or metre stick/ scales or newton meter or balance (1 each to max. of 2)
- Measure: height raised, time taken, weight to be lifted (1 each to a max. of 2)
- Power $= \frac{\text{work}}{\text{time}}$

Response	Mark
Candidates mention at least **5** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5–6]
Candidates explain at least **3** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3–4]
Candidates explain **1** of the above points. They use limited spelling, punctuation and grammar. The form and style is of a limited standard and they have made no use of specialist terms.	[1–2]
Response not worthy of credit.	[0]

[6]

(b) M = force × distance [1]
M = 20 × 45 [1] or M = 20 × 0.45 [1]
= 900 [1] = 9 [1]
= N cm [1] = Nm [1] [4]

AVAILABLE MARKS: 10

2 (a) 5 entries – [$\frac{1}{2}$] each round down:
0.0, 0.3, 1.0, 2.3, 6.3 [2]

(b) Choice of scale [1] and label [I^2 in A^2] [1]
Points plotted – 5 or 6 correct [2], 4 correct [1] ± 1 small square for points [4]

(c) Best fit line – curve can get ecf [1]

(d) k = grad [1] or equivalent
= 8/4 (or other) [1] or picks pair of co-ord's from table or graph
= 2 [1] Tolerance ±0.1
Unit: J/A^2 [1] [4]

AVAILABLE MARKS: 11

3 **(a)** **(i)** Friction/drag. Reject: resistance. Accept: water friction [1]

(ii) During AB – X less than W [1]
During BC – two forces are equal [1] [2]

(b) **(i)** Depth = area (under line) [1] or $A = \frac{1}{2}(a + b)\,h$ [1]
$= (2 \times 8)/2 + (8 \times 8)$ [1] $= \frac{1}{2}(8 + 10)\,8$ [1]
$= 72$ (cm) [1] [3]

(ii) Momentum $= m \times v$ [1]
$= 0.2 \times 8$ [1]
$= 1.6$ (g cm/s) [1] No ecf for v [3]

AVAILABLE MARKS

9

4 **(a)** **(i)** 1 000 000 (g) [1]

(ii) 1 000 (kg) ecf from (i) [1]

(iii) 1 000 (kg/m^3) ecf from (ii) [1]

(b) $M = D \times V$ [1] or equivalent formula
$= 0.18 \times 500$ [1]
$= 90$ (kg) [1]
Total mass = 240 (kg) [1] [4]

7

5 **(a)**

Physical Quantity	Centripetal force		
	Decreases	Increases	Unaffected
Mass		✓	
Radius		✓	
Speed		✓	
Direction of rotation			✓

[4]

(b) direction changes [1]
because there is an acceleration or velocity changes [1]
Force is perpendicular to velocity
Mark as independent points } Any 2 points from 3 for full marks
[2]

6

					AVAILABLE MARKS
6	**(a)**	**(i)**	Electrons are scattered Accept: Currants in a bun or Diagram Spread throughout the atom.	[1]	
		(ii)	(Electrons) orbit/in circles/shells. Reject: "round" on its own	[1]	
	(b)		Rate of decay cannot be changed	[1]	
	(c)	**(i)**	32 days = 4 half-lives [1] $\frac{1}{16}$ remaining [1] 6 (μg) [1] 96, 48 – 1st mark. 24, 12 – 2nd mark. 6 – 3rd mark	[3]	
		(ii)	90 (μg) [1] ecf from **(c)(i)**	[1]	7
7	**(a)**	**(i)**	(Same) atomic no. Or (same) no. of protons or both have 1 proton	[1]	
		(ii)	(Different) mass no. Or (different) no. of neutrons	[1]	
	(b)		A = 4 [1] Z = 2 [1]	[2]	
	(c)		(Very) high temperatures Or very high number densities Or extracting energy, keeping temperature high Or containment problems Any one [1] Accept: sustaining the reaction for long enough	[1]	5
8	**(a)**		a = (v − u)/t [1] or $a = \frac{\Delta v}{\Delta t}$ = (50 − 0)/25 [1] = 2 (m/s^2) [1]	[3]	
	(b)		(R)F = m × a [1] [1] 58 500 = 2 × m [1] allow ecf from **(a)** m = 29 250 (kg) [1]	[4]	7

			AVAILABLE MARKS
9	**(a)** PE = mgh [1] = 50 × 10 × 20 [1] = 10 000 (J) [1]	[3]	
	(b) **(i)** K.E. = $\frac{1}{2}$ m v^2 [1] 4900 [1] = $\frac{1}{2}$ × 50 × v^2 [1] v = 14 (m/s) [1] Allow ecf provided answer to part **(a)** > 5100	[4]	
	OR $v = \sqrt{\frac{2 \times KE}{m}}$ [1] $= \sqrt{\frac{2 \times 4900\,[1]}{50 \quad [1]}} = \sqrt{\frac{4900}{25}} = \sqrt{\frac{4900}{\frac{1}{2}x50}}$ v = 14 (m/s) [1]		
	(ii) Lost heat/sound or resistive forces/friction	[1]	8
		Total	**70**