General Certificate of Secondary Education
2013–2014

Double Award Science: Physics

Unit P1

Foundation Tier

[GSD31]

FRIDAY 15 NOVEMBER 2013, AFTERNOON

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 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.

				AVAILABLE MARKS
1	**(a)**	**(i)** Heat/thermal [1]	[1]	
		(ii) Strain/elastic [1]	[1]	
		(iii) Electrical [1] or electric	[1]	
	(b)	**(i)** 30 (J) [1] Heat/thermal [1]	[2]	

(ii) E = (useful) energy out/(total) energy in [1]
     = 80/200 [1]
     = 0.4 [1] or 40%   [3]   8

2   Advantages: Conserves fossil fuels [1]
                    No greenhouse gases [1]
       Disadvantages: Radioactive waste [1]
                    Decommissioning issue [1]   [4]   4

3   **(a)** (Av) speed = (total) distance/(total) time [1]
                    = 200/25 [1]
                    = 8 (m/s) [1]   [3]

   (b)   a = (v − u)/t [1] or a = $\dfrac{\Delta v}{t}$
           = 3/2 [2]
           = 1.5 (m/s^2) [1]   [4]   7

4   **(a)** **(i)**   ρ = m/v [1]
                    = 900/125 [1]
                    = 7.2 [1] g/cm^3 [1]   [4]

       (ii) Increase the volume reading [1]   [1]

   (b) Atoms/molecules (in a solid) are closer [1]   [1]   6

5   **(i)**   1400 (N) [1]   [1]

   (ii) W = F × d [1]
           = 1400 × 2.5 [1] e.c.f. from **(i)**
           = 3500 (J) [1]   [3]

   (iii) 0 (J) [1]
           Has not moved thro' any distance [1] } dep. marking   [2]

   (iv) ke = $\frac{1}{2}$ mv^2 [1]
           = $\frac{1}{2}$ 140 (7)^2 [1]
           = 3430 (J) [1]   [3]   9

					AVAILABLE MARKS

6 (i) Constant velocity [1]   [1]

(ii) Car ACCELERATES [1] to the left [1] – Depend. marking   [2]

(iii) 1600 (N) [1]   [1]

(iv) a = 1600/800 [1] e.c.f. from **(iii)**
    = 2 (m/s^2) [1]   [2]   6

7 "Plum-pudding" [1] and Rutherford-Bohr [1]
Positive charge spread throughout atom [1] and electrons are plums scattered or dotted [1]
Positive charge in nucleus [1] and electrons orbit nucleus [1]

Response	Mark
Candidates explain **5 or 6** 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 **3 or 4** 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 or 2** of the 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

8 (a) (i) 92 [1]   [1]

(ii) Atomic number [1]   [1]

(iii) 143 [1]   [1]

(iv) Mass number [1]   [1]

(b) 5 correct arrows, award [1] each   [5]

(c) (i) (slow) neutron [1] is absorbed [1]   [2]

(ii) • Fragments are formed or U235 splits or nucleus splits
    • (2/3) (fast) neutrons are emitted (per fission)
    • Energy is released/produced/given out
Any two points for [1] each   [2]

(iii) Neutron [1]   [1]   14

9 **(a)** Horizontal axis labelled – with unit [1], scale more than half [1]
Plotting points: 3 or 4 correct answers [1]
All correct [2]   [4]

(b) Best fit line [1]   [1]

(c) **(i)** $k = $ grad or $k = \dfrac{\Delta y}{\Delta x}$ [1]
= 6/200 e.g. [1] or any other values from graph
= 0.03 [1] mm/g [1]   [4]

(ii) 3.7 ± 0.2 [1]   [1]   10

Total   **70**