**PHYSICS 2**

**HIGHER TIER**

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 1. | *(a)* | | Indicative content:<br><br>The absorption of slow neutrons can induce fission of Uranium-235 nuclei, releasing energy and the emission of neutrons from such fission can lead to a sustainable chain reaction. The moderator slows down the neutrons for fission to occur. The control rods control the rate of fission by absorbing a proportion of the neutrons<br><br>**5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit. | 6 |
| | *(b)* | | 97 added to Kr, 56 added to Ba | 2 |
| | | | **Question total** | **[8]** |
| 2. | *(a)* | (i) | [High energy] / [fast moving] electron | 1 |
| | | (ii) | $_{-1}^{0}\beta$ or $_{-1}^{0}e$ | 1 |
| | *(b)* | (i) | Beta absorbed / can't get out of the body (1) so damages / ionises cells (1) **The 2nd mark must be linked to the 1st mark.** | 2 |
| | | (ii) | Both nuclei contain the same number of (53) protons / proton number (1) different numbers of neutrons / mass number / nucleon number (1) 78 neutrons in I-131 & 74 in I-127 / difference of 4 neutrons (1) | 3 |
| | *(c)* | | Calculation of number of half lives -5 (1) x 8 (1) | 2 |
| | | | **Question total** | **[9]** |

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 3. | *(a)* | | 0.2 [s] | 1 |
| | *(b)* | (i) | Line is steepest | 1 |
| | | (ii) | $a = \frac{8(1)}{(2-0.2)(1)}$ allow **ecf** from (a) = [4.44] m/s$^2$ (1) | 3 |
| | | (iii) | Subs 4.44 x 94 (1) = 417.36 ( accept 417 - 418) [N] (1)<br>Allow **ecf** from (b)(ii) | 2 |
| | *(c)* | (i) | C to D | 1 |
| | | (ii) | because longest time (1) at highest velocity (1) OR area under graph (1) with the term "is greatest" or equivalent (1)<br>**The 2nd mark must be linked to the 1st mark.** | 2 |
| | *(d)* | | Straight line from D to axis (1) final coordinate (12.5, 0) (1)<br>Allow ± ½ square. | 2 |
| | *(e)* | (i) | Calculation of area under BC – 30.75/30.8 [m] (1); calculation of area under CD – 62.5 [m]; (1) total = 93.3 [m] (1) OR area under AB = 7.2 (1) and 100 (1) – 7.2 = 92.8 [m] (1) Any attempt at area calculation = 1 mark only. | 3 |
| | | (ii) | $\frac{(d)(i)(ecf)}{8}$ (1) = 11.66 - 11.8 [m/s] (1) | 2 |
| | | | **Question Total** | **[17]** |
| 4. | *(a)* | (i) | 750 [N] | 1 |
| | | (ii) | Calculation of resultant force: 750 (**ecf**) – 300 = 450 [N] (1)<br>$\frac{450}{75}$ = 6 [m/s$^2$] (1) | 2 |
| | *(b)* | | **Indicative content:**<br>During free fall, sky diver acted on by 2 forces; these are weight and air resistance; the weight remains constant throughout the fall; the air resistance increase with speed; eventually the air resistance becomes equal to the weight; the resultant force is zero; the skydiver stops accelerating.<br>**5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br>**3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. | 6 |

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 4. | | | **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.<br><br>**Question total** | **[9]** |
| 5. | *(a)* | | Calculation of braking distance: Calculation of KE: use of $\frac{1}{2}mv^2$; (1)<br>subs ½ x 1000 x $18^2$; (1)<br>answer of 162 000 [J]; use of W*D* = *F* x *s*; (1)<br>answer for *s* of 24 [m]; (1)<br>Alternatively, accept this method:<br>First step find deceleration: use of $a = \frac{F}{m}$ (1),<br>subs $\frac{6750}{1000} = 6.75[\ m/s^2\ ]$; (1)<br>Now braking time: braking time = $\frac{18.6}{6.75}$ = 2.67/2.7 [s]; (1)<br>braking distance = mean speed x time = 9 x 2.67 = 24 [m]; (1)<br>So overall stopping distance = 24 (**ecf**) + 12 = 36 [m] (1) | 5 |
| | *(b)* | | Thinking distance halves / 6 [m]; (1) braking distance decreases to a quarter / 6 [m]; (1) overall stopping distance of 12 [m] is less than 15 [m] view of the school (1)<br><br>**Question total** | 3<br><br>**[8]** |

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 6. | *(a)* | | Same voltage across each (Accept can be switched separately) | 1 |
| | *(b)* | (i) | Use of $P=VI$; (1)<br>Method 1 : calculation of current through quantity of each type of lamp: 0.05 x 20, 0.08 x 6, 0.22 x 6 (1) for currents and (1) for multiples; Answer of 2.8 [A] gains 3 marks.<br>Alternatively: total power = ((20 x 11) + (6 x 50 ) +(6 x 18))= 628 [W] (1);<br>Current = $\frac{628}{230}$ = 2.73 or 2.80 [A] (1) | 3 |
| | | (ii) | Use of $P=I^2R$; (1) $19 = 2.7^2$ x $R$; (1 mark – substitution, 1 mark – manipulation) $R$ = [2.6 Ω] (answer of 83 Ω = 2 marks) | 3 |
| | *(c)* | | Use of $P=I^2R$ (no credit);<br>50=0.048 (**ecf**) x $R$ (1) so $R$ = 1040 [Ω ](1) | 2 |
| | | | **Question total** | **[9]** |
| | | | **Higher Paper Total** | **60** |