

## Science (Physics) – Set V

### Marking Scheme

Secondary 4 Express / 4 Normal Academic (SBB)

#### Paper 1 – Multiple Choice

| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
|----|----|----|----|----|----|----|----|----|----|
| C  | A  | C  | C  | C  | D  | B  | B  | D  | B  |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| B  | A  | C  | C  | B  | C  | B  | C  | B  | A  |

Read from the Paper 1 mark scheme printed with the source, which the seller had faded and watermarked; the letters were recovered from the scan.

#### Paper 2 – Section A (55 marks)

|   |     |                                                                                                                                                                                                                                                                                                                                                                                   |                 |
|---|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1 | (a) | 1 kg = 1000 g<br>= 1000/10 <sup>-6</sup> µg<br>= 1.0 x 10 <sup>9</sup> µg                                                                                                                                                                                                                                                                                                         | 1               |
|   | (b) | Charge<br>kg ms <sup>-2</sup>                                                                                                                                                                                                                                                                                                                                                     | 1<br>1          |
|   |     |                                                                                                                                                                                                                                                                                                                                                                                   | <b>Total 3</b>  |
| 2 | (a) | Weight: Since <b>weight = mass × gravitational field strength</b> and the gravitational field strength on moon is smaller, the <b>weight on the moon will decrease</b> .<br><br>Density: Density is <b>mass per unit volume</b> .<br>Since the <b>mass is independent of gravitational field strength/location</b> , it does not change. Hence, <b>density remains the same</b> . | 1<br><br>1<br>1 |
|   | (b) | Pressure = F / A<br>= (0.200)(10) / (25.0 x 4.5)<br>= 0.0178 N/cm <sup>2</sup>                                                                                                                                                                                                                                                                                                    | 1<br>1          |
|   |     |                                                                                                                                                                                                                                                                                                                                                                                   | <b>Total 5</b>  |
| 3 | (a) | Principle of moments stated that when <b>in equilibrium</b> ,<br><br>the sum of anticlockwise moments is equal to the sum of clockwise moments about the same pivot.                                                                                                                                                                                                              | 1<br><br>1      |
|   | (b) | C is labelled in the middle of the bar with indication that it is 1.50 m from either ends.                                                                                                                                                                                                                                                                                        | 1               |
|   | (c) | Based on Principle of Moments,<br><br>ACW moments = CW moments<br>W x 0.25 = 4.0 x 1.00 + 300 x 2.00<br>W = 2420 N                                                                                                                                                                                                                                                                | 1<br><br>1      |
|   |     |                                                                                                                                                                                                                                                                                                                                                                                   | <b>Total 5</b>  |
| 4 | (a) | X: Solid<br>Y: Solid and liquid                                                                                                                                                                                                                                                                                                                                                   | 1<br>1          |
|   | (b) | Energy transferred to P results in <b>work done against the attractive intermolecular force</b> . This results in the average separation of the particles and potential energy of the particles increasing. However, the <b>average kinetic energy remains constant</b> and so the temperature remains constant.                                                                  | 1<br><br>1      |



|    |          |                                                                                                                                                                                                                                                                                                                                                                                                                    |                          |
|----|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|    | (d)      | The <b>effective resistance of the circuit will increase</b> . Since the emf is still at 12 V and $I = V/R$ , the <b>current flowing in the circuit will decrease</b> . The ammeter reading will decrease.                                                                                                                                                                                                         | 1<br>1                   |
|    |          |                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Total 8</b>           |
| 9  | (a)      | Current going into                                                                                                                                                                                                                                                                                                                                                                                                 | 1                        |
|    | (b)      | Increase the strength of magnet.<br>Increase the current.                                                                                                                                                                                                                                                                                                                                                          | 1<br>1                   |
|    | (c)      | Concentric circles (min 4)<br>Gaps between circles increases as distance from conductor increases<br>Clockwise arrows                                                                                                                                                                                                                                                                                              | 1                        |
|    |          |                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Total 4</b>           |
| 10 | (a)(i)   | Point plotted correctly<br>Smooth curve                                                                                                                                                                                                                                                                                                                                                                            | 1<br>1                   |
|    | (a)(ii)  | $\approx 2.5$ min<br>Correct working shown on graph                                                                                                                                                                                                                                                                                                                                                                | 1<br>1                   |
|    | (a)(iii) | Background radiation should be subtracted off.<br>Another half-life can be determined and the average taken.<br>Any one.                                                                                                                                                                                                                                                                                           | 1                        |
|    | (b)(i)   | The $\alpha$ -particles would have been stopped by the aluminium sheet before reaching the detector.                                                                                                                                                                                                                                                                                                               | 1                        |
|    | (b)(ii)  | $\beta$ -particles are stopped by a few millimetres of aluminium.<br>The large drop in count rate as the thickness of aluminium is increased shows that $\beta$ -particles are emitted from the source.<br><br>Because there is still a high count rate (about 1000 count per sec), $\gamma$ -radiation is emitted from the source.<br><br>Otherwise, the reading should be low and close to the background count. | 1<br>1<br><br>1<br><br>1 |
|    |          |                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Total 10</b>          |

### **Section B (10 marks)**

|    |     |                                                                                                                             |        |
|----|-----|-----------------------------------------------------------------------------------------------------------------------------|--------|
| 11 | (a) | $a = (v - u) / t$<br>$= (25.0 - 0) / 6.0$<br>$= 4.17 \text{ m/s}^2$                                                         | 1<br>1 |
|    | (b) | Distance = Area under velocity-time graph<br>$= \frac{1}{2} (6.0) (25.0)$<br>$= 75.0 \text{ m}$                             | 1<br>1 |
|    | (c) | $F = ma$<br>$= 1250 \times 4.17$<br>$= 5210 \text{ N}$                                                                      | 1<br>1 |
|    | (d) | $F = \text{engine force} - \text{resistive forces}$<br>$5210 = 8000 - \text{resistive forces}$<br>resistive forces = 2790 N | 1      |

|    |          |                                                                                                                                                                                                                              |                 |
|----|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|    | (e)      | As the resistive forces increase, the acceleration decreases/velocity increases at a decreasing rate.<br>When the engine force = resistive forces, the velocity stops increasing and the car moves with a constant velocity. | 1<br>1          |
|    | (f)      | Velocity is a vector and speed is scalar.                                                                                                                                                                                    | 1               |
|    |          |                                                                                                                                                                                                                              | Total 10        |
| 12 | (a)      | The fuse prevents excessive current flow.<br>$P = VI$<br>$1250 = 240(I)$<br>$I = 5.21 \text{ A}$<br>Fuse rating = 10 A                                                                                                       | 1<br><br>1<br>1 |
|    | (b)      | No of kWh = $1250/1000 \times 30$<br>= 37.5<br>Cost = $37.5 \times \$0.26$<br>= \$9.75                                                                                                                                       | 1<br><br>1      |
|    | (c)(i)   | Live and neutral                                                                                                                                                                                                             | 1               |
|    | (c)(ii)  | <b>Yes</b> it will still work because the <b>current is still flowing into the motor</b> from the supply through the live wire and back to the supply through the neutral wire.                                              | 1<br>1          |
|    | (c)(iii) | The vacuum cleaner is made of a <b>plastic casing</b> .<br>The vacuum cleaner must be <b>double insulated</b> in which there are <b>two layers of insulation</b> to enclose all exposed metal parts and "live" parts.        | 1<br>1          |
|    |          |                                                                                                                                                                                                                              | Total 10        |