

# **ASSESSMENT SCHEDULE**

**Physics Level 2**

91173 Demonstrate understanding of electricity and electromagnetism

Note: Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

* the last written step before the answer is given has no unexpanded brackets or terms and does not require rearranging.
* the power of any number that is multiplied by a power of 10 is correct.

Correct units and significant figures are required only in the questions that specifically ask for them.

**Evidence Statement**

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| **Question One** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (a) | E = V/d = 21/0.65 = 32.30769… = 32 V m-1 | Working shown including showing formula used |  |  |
| (b) | F=Eq = 32.30769 x 7.4 x 10-3 = 0.2391… = 0.24 N | Correct working with incorrect or missing transformation of prefix | Correct working and answer |  |
| (c) | I=q/t = (1.4 x 104 x 7.4 x 10-3)/60 = 1.72666.. = 1.7 A | Correct use of current definition/equation of current but with minor error (e.g. prefix, min vs. sec) | Correct working and answer |  |
| (d) | Effect on force:  The force will INCREASE. As the distance decreases with a constant voltage, the electric field strength will increase. Since the force is proportional to the charge (unchanged) F=Eq and the electric field strength, the force will also increase.  The energy lost will be UNCHANGED. The electric energy lost by the paint particle is proportional to the Voltage V=ΔE/q and the charge on the particle. Since neither are changing, the energy lost will remain the same. | ONE of  Force INCREASES  OR  Energy SAME  OR  One correct statement of proportionality | Effect on EITHER force OR ENERGY correctly described AND explained | Complete correct description and explanation for BOTH force and energy |
| (e) | EK(gained) = Eelectric (lost) = Eqd = Vq  EK(gained) = 21 x 7.4 x 10-3 = 0.1554J  EK = ½ mv2 🡪 v=√(2Ek/m) = √(2 x 0.1554/0.57 x 10-3)  v = 23.35 … = 23 ms-1  OR  F = Eq = Vq/d =21 x 7.4 x 10-3/0.95 = 0.1635…  Newtons 2nd Law so F=ma = 0.1635  🡪 a = 0.1635/0.57 x 10-3 = 286.98…  Using kinematic equations:  vf2 = vi2 = 2ad 🡪 vf = √(2ad) = √(2 x 286.98… x 0.95)  v = 23.35… = 23ms-1 | Calculates electric field  OR  Calculates energy or force using incorrect prefix conversion  OR  Calculates any velocity using any Ek or acc  OR  Implies EK(gained) = Eelectric (lost) | Clearly states EK(gained) = Eelectric (lost)  OR  Correct value for kinetic energy  OR  Correct working for velocity with minor error | Correct working and answer using appropriate method |
| (f) | The gravitational force will not affect the motion very much as the gravitational force is very small compared to the electric force. The electric force is 0.24 N, and the gravitational force is Fg=mg=0.57×10-3×9.8=5.6×10-3 N.  OR  Gravitational potential energy is proportional to the distance and mass of the paint particle from the car. Since both are very small (0.95m and 0.00057kg), the gravitational energy will be much smaller (5x10-3) than the electric energy of 0.1554J, and so would not change my answer in 1e) | No  OR  Attempts calculation using Eg=mgh  OR  Calculates gravitational force | No  AND ONE OF  Shows correct calculation of Eg or Fg  OR  States that Eg or Fg is negligible compared to Eelectric or Felectric | Full and complete explanation using EITHER full calculations or proportionality statements AND a clear indication that Eg or Fg is negligible compared to Eelectric or Felectric |

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| **NØ** | **N1** | **N2** | **A3** | **A4** | **M5** | **M6** | **E7** | **E8** |
| No evidence | 1A | 2A | 3A | 4A | 2M + 1A | 4M | 1E + 3M | 2E + 2M |

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| **Question** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| Two  (a) | V = IR 🡪 R= V/I = 5.4/1.1 = 4.9090… = 4.9Ω (2sf) | Working shown including showing formula used |  |  |
| (b) | Current through bottom branch is 1.1A  Voltage across top branch is 5.4V as in parallel, so  Rtotal, branch = 2.1 +4.8 = 6.9Ω  V = IR 🡪 I = 5.4/6.9 = 0.7826…A  Currents in branches add to total current so  I = 1.1 + 0.7826 … = 1.8826 … = 1.9 A (2sf)  OR  Calculate resistance of branches combined: 2.8652 …Ω  So total resistance is 6.3652 …Ω and using Ohm’s law total current is 1.8852 …= 1.9A (2sf) | Total resistance in upper branch calculated correctly  OR  Total current calculated using correct method with incorrect total resistance | Correct total resistance calculated  OR  Correct resistance for combination of parallel branches | Correct method and working |
| (c) | The power dissipated through the 3.5Ω resistor will INCREASE.  Adding another parallel branch allows current to flow easier and so the total resistance will decrease. This will increase the total current since the supply voltage is unchanged. Since the total current flows through he 3.5Ω resistor, this current is increased. Using Ohm’s Law V = IR over the resistor, the voltage over the resistor is also increased. Since the power dissipated is directly proportional to both V and I, and both these values are increasing, the power dissipated will increase. | Increase  OR  Implies power depends on voltage and current  OR  Adding branch lowers total resistance | Total resistance decreases as resistor added in parallel/additional branch  OR  Current through 3.5Ω increases because total resistance is decreased | Correct and complete explanation linking the added resistance to the current through and voltage over the 3.5Ω resistor and then to power dissipated |
| (d) | P =VI and V = IR 🡪 P = V2/R  So R = V2/P = 122/24 = 6.0Ω (2sf) | Attempt to combine P=VI and V=IR | Correct answer and working |  |
| (e) | Bulb B would have the most power output, and the power output of Bulb A and C are equal to each other and lower than B.  P=IV. Both A and C are in parallel to each other, so they have the same voltage, and since the bulbs are identical, their current is therefore also the same, and V=IR so their voltage and power are the same.  The current from the two branches will add together to make the total current through Bulb B, so Bulb B will therefore will use more voltage, and more power. | States B has the most power, and A and C have the same power as each other. | Explains why B has more power due to increased current  OR  Explains why A and C have the same power due to the same current and voltage | Complete explanation including relationship stated between voltage, current and power. |

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| **NØ** | **N1** | **N2** | **A3** | **A4** | **M5** | **M6** | **E7** | **E8** |
| No evidence | 1A | 2A | 3A | 4A | 2M | 3M | 1E + 1M | 2E + 1M |

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| **Question** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| Three  (a) | The force is zero.  Magnetic fields only act on magnetic or magnetisable objects (which the Sr–90 nucleus isn’t as stated in the question) or on MOVING charged particles. Since the Sr-90 nucleus is stationary there is no force acting on it from the magnetic field. | Zero  OR  States one correct condition under which magnetic field exerts a force | Correct answer and explanation |  |
| (b) |  | One correct direction indicated | Both directions correctly indicated |  |
| (c) | EK = ½mv2 🡪 v = √(2 x 1.7 x 10-15/9.1 x 10-31)  v = 6.11…x 107 ms-1  F = Bqv = 4.8 x 1.6 x 10-19 x 6.11…x 10-7  F = 4.694… x 10-11= 4.7 x 10-11 N (2sf) | Uses F = Bqv correctly with incorrect v  OR  Uses E =½ mv2 to find any speed | Correct working with minor error | Correct working and answer |
| (d) | From right to left (North to South) | Correctly labelled arrow indicating direction |  |  |
| (e) | From A to B | Correctly labelled arrow indicating direction |  |  |
| (f) | Ohm’s Law: V = IR 🡪 V = 5 x 8.9 = 44.5V max  V = BvL 🡪 v = V/(BL)  v = 44.5/(1.8 x 2 x 0.28 x35) = 1.26… = 1.3ms-1 (2sf) | Correct max voltage  OR  Correct inductive length per loop (0.28m x 2) | Correct working for velocity with correct max voltage and any length related to 0.28m  OR  Correct working without correct transformation of length in to m) | Correct working and answer |

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| **NØ** | **N1** | **N2** | **A3** | **A4** | **M5** | **M6** | **E7** | **E8** |
| No evidence | 1A | 2A | 3A | 4A | 1M + 2A | 2M +1A | 1E + 1M | 1E + 2M |

**Judgement Statement**

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|  | **Not Achieved** | **Achievement** | **Achievement  with Merit** | **Achievement  with Excellence** |
| **Score range** | 0 – 6 | 7 – 12 | 13 – 18 | 19 – 24 |