Assessment Schedule – 2021

Physics: Demonstrate understanding of aspects of electricity and magnetism (90937)

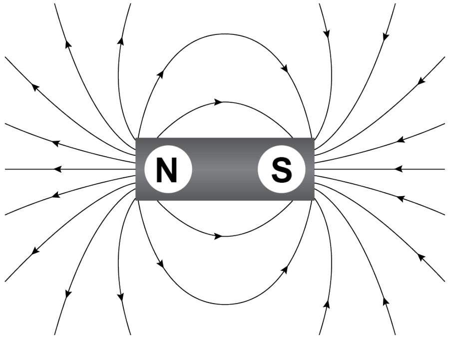
Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Needle needs to be made of a conducting material so electrons can easily flow on and off the needle to charge the air particles.	• Correct answer.		
(b)	The neutral dust particles are attracted to the negatively charged needle. Once the particles come into contact with the needle, they gain the negative charge and then are repelled, as both the needle and the particles now have the same charge (like charges repel). The negatively charged particles are now attracted to the positive plate, as opposite charges attract.	• States how the dust particles gain a negative charge. OR Indicates motion is due to same charges repel, and / or opposite charges attract.	• Complete answer. (Two points with reason e.g. like charges repel.)	
(c)	Average power of discharge = $\frac{E}{t} = \frac{4\times10^{-4}}{0.008} = 0.05$ W Voltage between dust particle and metal plate = $V = \frac{P}{I} = \frac{0.5}{2\times10^{-6}} = 25\,000 \text{ V} \left(30\,000 \text{ V 1 sf}\right)$ OR $Q = It = 2.0\times10^{-6}\times0.08 = 1.6\times10^{-8}$ $V = \frac{E}{Q} = \frac{4\times10^{-4}}{1.6\times10^{-8}} = 25\,000 \text{ V} \left(30\,000 \text{ V 1 sf}\right)$	• Calculates 0.05 W correctly. OR Calculates voltage correctly from incorrect power. OR Charge calculated(1.6×10^{-8} C). OR V from incorrect charge.	• Calculates 25 000 V correctly.	
(d)	Reasons why the plate needs to be cleaned periodically: • The dust particle is an insulator. • Its electrons cannot move about it freely in an insulator. • Therefore, the attraction due to the positively charged metal plate is limited to where they touch. The electrons at the far end of the dust particle remains unaffected. • This reduced electrostatic attraction for newly charged particles, so less dust is collected. • Distance from positive plate is increased, therefore reduced force of attraction.	• Identifies the dust particles as insulators. OR Electrons cannot move freely in an insulator. OR Attraction is only at the place where they touch, and doesn't affect the far end of the dust particle.	• Links dust as insulators to electrons' movement in the dust particles. OR Links insulators to a reduction in electrostatic attraction.	• Complete answer. • Distance from positive plate is increased therefore reduced force of attraction.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence.	1A	2A OR 1M / E	3A OR 1A + 1M	4A OR 2A + 1M	1A + 2M OR 1M + 1E	2A + 2M OR 3M	1A + 1M + 1E	2M + 1E

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	24 volts due to lamps being in parallel.	• States 24 V.		
(b)(i) (ii)	Current through lamp $= I = \frac{V}{R} = \frac{24}{20} = 1.2\text{ A}$ The three lamps are identical and receive the same voltage, so the current through each is the same, 1.2 A. The power supply provides 3 × 1.2 = 3.6 A. OR $R_t = 6.6\,\Omega \quad I = \frac{V}{R} = \frac{24}{6} = 3.36\text{ A}$	• Calculates 1.2 A correctly with work clearly shown. OR States / calculates 3.6 A for the current provided by the power supply.	• Calculates 1.2 A correctly with work clearly shown. AND States / calculates 3.6 A for the current provided by the power supply.	
(c)	As the resistance of the thermostat decreases, the combined resistance of the two components in series (= $R_{\text{thermostat}} + R_{\text{AC unit}}$) decreases. Therefore, from $I = V/R_{\text{combined}}$ and with the voltage of 240 V being constant, the current through the heat pump increases.	• States / implies that the combined resistance of the two components in series decreases. OR States / implies that the current through the heat pump increases.	• Links the decreased combined resistance of the two components in series to the increase of the current through the heat pump.	
(d)	The combined resistance of the two components = $R_{\text{combined}} = 1.9 + 24.2 = 26.1\ \Omega$. Therefore, the current through either of the components $= I = \frac{240}{26.1} = 9.195\text{ A}$. Therefore, voltage received by AC unit $= V = RI = 24.2 \times 9.195 = 222.5$ V. Hence its power $= P = IV = 9.195 \times 222.5 = 2046$ W = 2000 W (2sf). Alternatively, power of AC unit $= P = R_{\text{AC unit}} I^2 = 24.2 \times 9.195^2 = 2046$ W = 2000 W (2sf)	• Calculates 9.195 A correctly from correct combined resistance, with work clearly shown (show question). OR Calculates voltage received by AC unit correctly from incorrect current. OR Calculates power of AC unit correctly from given current (9.195 A) and incorrect voltage (e.g. 240 V, so that $P = 9.195 \times 240 = 2207$ W). OR Calculates power of AC unit correctly from given current (9.195 A) and incorrect resistance (e.g. 26.1 Ω, so that $P = 24.2 \times 9.195^2 = 2207$ W).	• Calculates 9.195 A correctly from correct combined resistance, with work clearly shown. AND Calculates 222.5 V correctly. OR Calculates 9.195 A correctly from correct combined resistance, with work clearly shown. AND Calculates power of AC unit correctly from incorrect voltage (e.g. 240 V, so $P = 2207$ W).	• Calculates 2046 W correctly.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence.	1A	2A OR 1M / E	3A OR 1A + 1M	4A OR 2A + 1M OR 2M	1A + 2M OR 1M + 1E	2A + 2M OR 3M	1A + 1M + 1E	2M + 1E

Q	Evidence	Achievement	Merit	Excellence
THREE (a)		• Correct labelling of poles.		
(b)(i) (ii)	Right-to-left. $I = \frac{Bd}{k} = 3.36\times10^{-6}\times\frac{0.50}{2\times10^{-7}} = 8.4$ A	• Draws arrow from right to left into wire and / or implies correct direction otherwise. OR Draws arrow from right to left into wire and / or implies correct direction otherwise, and calculates 84 A (with $d = 50$). OR Attempted calculation with 1 minor error . Calculates 8.4 A correctly.	• Draws arrow from right to left into wire and / or implies correct direction otherwise. AND Calculates 8.4 A correctly.	
(c)	Point A has a stronger magnetic field than Point B. Point A is in the opposite direction of the magnetic field in Point B or counter clockwise.	Either point correct.	Both correct.	
(d)	The north pole of the permanent magnet faces to the right. In diagram, the solenoid must pull the vehicle to be able to move it to the right. It must have a south pole facing left; by the RHGR, the current must go counter-clockwise. Then, the force between the two is attractive.	• Labels the poles in diagram correctly: S-N. OR States / implies the directions of the current diagrams correctly: counter-clockwise. OR States / implies the forces between the permanent magnet and the solenoid in diagram: attractive.	• TWO out of three points correct.	• Complete answer.

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No evidence.	1A	2A OR 1M / E	3A OR 1A + 1M	4A OR 2A + 1M OR 2M	1A + 2M OR 1M + 1E	2A + 2M OR 3M	1A + 1M + 1E	2M + 1E

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 18	19 – 24