Assessment Schedule – 2022

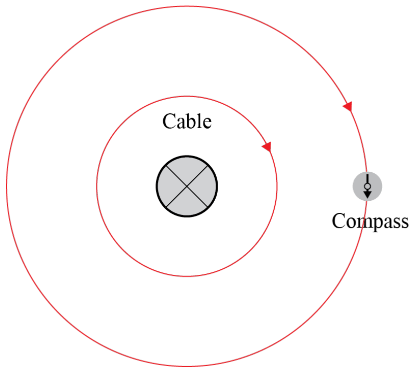
Physics: Demonstrate understanding of aspects of electricity and magnetism (90937)

Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Thomas gained his charge by charging / charge separation by friction. (Accept rubbing) (not just contact)	• States 'charging / charge separation by friction' correctly.		
(b)	Thomas's charge is distributed all over him so that his hairs carry like charges. As like charges repel, so do his individual hairs and his hair stands up. (2 things)	• States / implies that Thomas's hairs carry like charges. OR Stated / implied that like charges repel so that his hair stands up.	• Links Thomas's hairs carrying like charges to his hair standing up because like charges repel.	
(c)(i)	$\Delta t = \frac{\Delta E}{P} = \frac{0.040}{0.5} = 0.08 \text{ s}$	• Calculates $\Delta t = 0.08$ s OR 80s $\left(\frac{40}{0.5}\right)$	• Calculates $\Delta t = 0.08$ s. AND	
(ii)	Electrons move from Thomas to his dad.	• States / implies that electrons move from Thomas to his dad.	States / implies that electrons move from Thomas to his dad.	

(d)	Plastic is an insulator, and its electrons are bound to its atom. When Thomas goes down the plastic slide, friction between him and the slide causes him to acquire / gain excess electrons from the slide. The resulting positive charges on the slide remain in place so that charge on Thomas and the slide builds up. The metal is a conductor and its electrons can move relatively freely. Any charge will redistribute promptly, and no charge on Thomas or the slide can build up.	• States / implies that plastic is an insulator and that the metal is a conductor. OR Describes separation of charges by friction in terms of electrons moving onto Thomas, off the slide. OR States / implies that the slide acquires a positive charge. OR States / implies that electrons are immobile in insulators and relatively mobile in conductors.	• Links electrons moving onto Thomas, off the slide, with the slide acquiring a positive charge. OR Links charges remaining in place to insulating property of the plastic slide. OR Links charges not remaining in place / redistributing to conducting property of the metal slide.	• Links electrons moving onto Thomas, off the slide, with the slide acquiring a positive charge. AND Links charges remaining in place and building up to insulating property of the plastic slide. OR Links charges not remaining in place / redistributing and not building up to conducting property of the metal slide.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No relevant evidence.	Very little evidence at the Achievement level. Most evidence is at the Not Achieved level.	Some evidence at the Achievement level; partial explanations.	Most evidence provided is at the Achievement level, while some is at the Not Achieved level.	Nearly all evidence provided is at the Achievement level.	Some evidence is at the Merit level with some at the Achievement level.	Most evidence is at the Merit level, with some at the Achievement level.	Evidence is provided for most tasks, with evidence at the Excellence level weak or with minor errors / omissions.	Evidence provided for all tasks. Evidence at the Excellence level accurate and full.
0	1A	2A	3A	4A	1A + 2M	2A + 2M	1A + 1M + 1E	2M + 1E

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	$V = \frac{P}{I} = \frac{8.05 \times 10^7}{700} = 115000 \text{ V}$	• Uses correct formula and substitution.		
(b)(i)		• Indicated field line direction correctly. OR	• Indicates field line direction correctly. AND	
(ii)		Draws the direction of the compass correctly. OR States / implies that the compass needle will point in the direction of the field lines.	Draws the direction of the compass correctly. AND States / implies that the compass needle will point in the direction of the field lines.	
(c)(i)	$B = \frac{kI}{d}$ $d = \frac{kI}{B}$ $d = \frac{2 \times 10^{-7} \times 700}{0.040}$ $d = 0.0035 \text{ m}$	• Calculates distance correctly. OR • Correct substitution in rearranged formula.	• Calculates distance correctly.	
(ii)	Since the distance is small, there is no significant health hazard by the magnetic field if living near a transmission cable.	OR Indicates that there is no health hazard.	AND Links distance away from wire as too close to warrant a health hazard.	

(d)	The total resistance of the entire (100 km) length is 0.035 + 0.035 + ... + 0.035 = 100 × 0.035 = 3.5 Ω. Therefore, the current is: $I = \frac{V}{R} = \frac{660}{3.5} = 188.6\text{ A}$ The power lost in the cable is $P = VI$ = 660 × 188.6 = 124457 W ≅ 120 kW. P = 120 kW (1sf) OR $P = \frac{V^2}{R} = \frac{660^2}{3.5} = 124457\text{ W} = 120\text{ kW}$	• Calculates 3.5 Ω for entire cable length correctly. OR Calculates I for R = 0.035 Ω (i.e. 18 857 A) OR Calculates $P = \frac{V^2}{R}$ for R = 0.035 Ω (i.e. 12445714 W).	• Calculates 3.5 Ω for entire cable length correctly AND Calculates 188.6 A correctly.	• Calculates 124457 ≅ 120 kW correctly.

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0	1A	2A	3A	4A	1A + 2M	2A + 2M	1A + 1M + 1E	2M + 1E

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	Voltage across solenoid = $R_L I = 2.90 \times 0.348 = 1.0092 \cong 1.01$ V.	• Calculates 1.01 V correctly.		
(b)	The total resistance of the circuit is $\frac{V}{I} = \frac{10.5}{0.348} = 30.17\ \Omega$ But 30.17 Ω = 1.6 + R_{var} + 2.90 so that R_{var} = 30.17 –1.60 – 2.90 = 25.7 Ω. **Alternatively**, the voltage across the 1.60 Ω resistor is 1.60 × 0.348 = 0.557, leaving 10.5 – 1.01 – 0.557 = 8.93 V for the variable resistor. Its resistance is then $\frac{8.93}{0.348} = 25.7\ \Omega$.	• Calculates total resistance of 30.17 Ω correctly. OR Calculates voltage of variable resistor, 8.93 V, correctly.	• Calculates 25.7 Ω correctly.	
(c)	When the resistance of the variable resistor is decreased, the total resistance of the circuit decreases accordingly, because it is a series circuit. As the supply voltage is a constant 10.5 V, the current from the supply increases.	• States / implies that the total resistance decreases. OR States / implies that the current increases.	• Linked decrease of total resistance to increase in current because the supply voltage is constant.	
(d)	When a current runs through the circuit, the current through the solenoid builds up a magnetic field around it. For the electromagnetic balance to work, the magnetic field must be opposite to the permanent magnet above, and thus needs to have north facing up. For north to be up, the current must be counter-clockwise by using RHGR. The solenoid's north pole is then facing the south pole of the permanent magnet on the right-hand side balance arm. This will pull it down, balancing the down force due to the object on the left-hand side.	• States / implies that a current in the solenoid builds up a magnetic field OR Describes the magnetic field of the solenoid with the north pole at the top. OR States / implies that the arms can be levelled by the solenoid pulling down the permanent magnet.	• Links the direction of the current in the circuit and / or in the solenoid to the polarity of the magnetic field of the solenoid. OR Links the polarity of the magnetic field of the solenoid (i.e. N up) to an attraction of the permanent magnet and levelling of the balance arms. OR Misconception (wrong idea) Links polarity of the magnetic field of the solenoid (S up) to a repulsion of the permanent magnet and levelling of	• Links the direction of the current in the circuit and / or in the solenoid to the polarity of the magnetic field of the solenoid. AND Links the polarity of the magnetic field of the solenoid (i.e. N up) to an attraction of the permanent magnet and levelling of the balance arms.

			the balance arms	

NØ	N1	N2	A3	A4	M5	M6	E7	E8
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0	1A	2A	3A	4A	1A + 2M	2A + 2M	1A + 1M + 1E	2M + 1E

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 13	14 – 18	19 – 24