

Name of the Student: _____

Max. Marks : 19 Marks

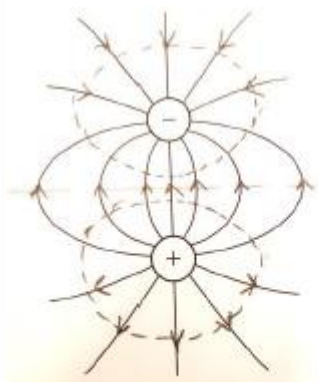
Time : 19 Minutes

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	<ul style="list-style-type: none"> • Use of $\Delta E = mc\Delta\theta$ (1) • Use of $\Delta E = L\Delta m$ (1) • Apply 5% to calculate energy saved (1) • Use of $P = VI$ or (1) Use of $Q = It$ • Use of $P = \frac{W}{t}$ or (1) Use of $E = QV$ • 2.69×10^5 J compared with 1.93×10^5 J (1) for energy saved, and concludes claim invalid. Or a phone could run for 5 days compared to 7 days and conclusion claim invalid Or a phone could run for 433 900 s compared to 604 800 s and conclusion claim invalid 	<p><u>Example of calculation:</u></p> <p>For aluminium when being heated up to m.pt.: $\Delta E = 14 \times 10^{-3} \text{ kg} \times 902 \text{ J kg}^{-1}\text{K}^{-1} \times (660 - 293)\text{K}$ $\Delta E = 4.63 \times 10^3 \text{ J}$</p> <p>For aluminium when melting: $\Delta E = 14 \times 10^{-3} \text{ kg} \times 396 \times 10^3 \text{ J kg}^{-1} = 5.54 \times 10^3 \text{ J}$</p> <p>Energy saved = $\frac{0.95}{0.05} \times (4630 + 5540)\text{J}$</p> <p>Energy saved = $1.93 \times 10^5 \text{ J}$ $P = 3.7 \text{ V} \times 120 \times 10^{-3} \text{ A} = 0.444 \text{ W}$ $\Delta E = 0.444 \text{ W} \times 7 \times 24 \times (60 \times 60)\text{s} = 2.69 \times 10^5 \text{ J}$</p>	6

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
(a)	<ul style="list-style-type: none"> Replace Work W by force \times distance (1) Replace distance \div time by velocity v (1) Use $v = r \times$ Angular velocity (1) Recognise $F \times r$ is the moment of F (1) 	Alternative method: Consider one revolution of axle, Load rises $2\pi r$ Work done = $2\pi r F$ Time taken = $2\pi \div \omega$ Power = Work \div time = $2\pi r F \div 2\pi/\omega$ to give reqd eq	4
(b)(i)	<ul style="list-style-type: none"> Arrow away from + charge Or arrow towards - charge (1) At least 3 Equipotential lines, perpendicular to field lines (1) Symmetrical about vertical/horizontal axis and not touching/crossing (1) 	MP3 dependent on lines being perpendicular in MP2 	3
(b)(ii)	<ul style="list-style-type: none"> Use of $F = \frac{Q_1 Q_2}{4\pi\epsilon_0 r^2}$ (1) $F = 0.036$ (N) (1) 	<u>Example of calculation:</u> $F = 8.99 \times 10^9 \text{ Nm}^2\text{C}^{-2} \frac{(0.1 \times 10^{-6} \text{ C})^2}{(0.05\text{m})^2}$ $F = 0.036\text{N}$	2

Question Number	Acceptable answers	Additional guidance	Mark
(c)	<ul style="list-style-type: none"> • Use of moment = $F x$ (1) • Expression for correct moment (1) • Use of power = moment of force x angular velocity (1) • Only realistic possibility is pond pump and $P = 0.6W$ (calculated answer could also be force and then comparison with b(i)) (1) 	<p>Show that value gives $3.2 \times 10^{-3} \text{ Nm}$ and 0.64 W</p> <p><u>Example of calculation:</u> Moment $= 0.036\text{N} \times 0.04\text{m} \times 2 = 2.89 \times 10^{-3} \text{ Nm}$</p> <p>Power = $2.89 \times 10^{-3} \text{ N m} \times 200\text{s}^{-1} = 0.58\text{W}$</p>	4