

①

Paper 1 Multi-Step Calculators MS.

Q1.) $h = 0.4m$
 $Reps. = 12$
 $g = 9.8N/kg$
 $t = 60s$
 $P = ?$
 $m = 65kg$

$$P = \frac{E}{t} \rightarrow E = mgh$$

$$= 65 \times 9.8 \times (0.4 \times 12)$$

$$= 3057.6J$$

$$P = \frac{E}{t} = \frac{3057.6}{60} = \underline{\underline{51W}}$$

Q2.) $E = 18,000,000J$
 $t = 1 \text{ hour} = 3600s$
 $V = 230V$

$$(P) = IV \rightarrow P = \frac{E}{t} = \frac{18,000,000}{3600}$$

$$= 5000W$$

$$P = IV, 5000 = I \times 230$$

$$\frac{5000}{230} = I = \underline{\underline{22A}}$$

Q3.) $V = 12m/s$
 $m = 0.05kg$
 $h = ?$
 $g = 9.8N/kg$

$$KE = GPE \text{ at highest point}$$

$$KE = \frac{1}{2}mv^2 \quad GPE = mgh$$

$$KE = 0.5 \times 0.05 \times 12^2 = 3.6J$$

$$3.6 = GPE = mgh.$$

$$3.6 = 0.05 \times 9.8 \times h, 3.6 = 0.49h$$

$$3.6 / 0.49 = h = \underline{\underline{7.3m}}$$

Q4.) $m = 2kg$
 $\Delta T = 20^\circ C$
 $t = S_{min} = 300s$
 $V = 12V$
 $SHC = 385 J/kg^\circ C$

a.) $E = m \times SHC \times \Delta T$
 $= 2 \times 385 \times 20 = \underline{\underline{15400J}}$

b.) $0.7 \times 15400J = \underline{\underline{10780J}}$

$$0.7 = \frac{\text{used out}}{\text{Total in}}$$

$$0.7 = \frac{15400}{\text{Total in}} \quad \text{Total in} = \frac{15400}{0.7}$$

$$= \underline{\underline{22,000J}}$$

c.) Find R. Need I!! Need P!!!

$$P = \frac{E}{t} = \frac{22,000}{300} = \underline{\underline{73W}}$$

$$P = IV \quad 73 = I \times 12, I = \frac{73}{12} = 6.1A.$$

$$V = IR \quad 12 = 6.1 \times R \quad R = \frac{12}{6.1} = \underline{\underline{1.96\Omega}}$$

(2)

Multistep Pl Qs

Q5.) $P = 1.4 \times 10^3 \text{ W}$ (from cells)
 $E = 168,000 \text{ J}$

a.) $P = \frac{E}{t}$ $1.4 \times 10^3 = \frac{168,000}{t}$, $t = \frac{168,000}{1.4 \times 10^3} = 120 \text{ s}$
2 MWS

b.) $\text{Cost} = £6000$
 $\text{time} = 6.5 \text{ hours at } 1.4 \text{ kW so } 1.4 \times 6.5 \text{ kWh}$
 $= 9.1 \text{ kWh per day.}$
 $\text{Cost Saving per day} = 40 \text{ p} \times 9.1 = 364 \text{ p} = £3.64$

$\text{Total days to pay back } £6000 = \frac{6000}{3.64} = 1648 \text{ DAYS}$

$1648 \div 365 = \underline{\underline{4.5 \text{ YEARS}}}$

Q6.) Air mass per second = 15,000 kg
Velocity = 12 m/s
Output = 450 kW.
Efficiency = ??

Input = KE of Wind = $\frac{1}{2}mv^2 = 0.5 \times 15000 \times 12^2$
 $= 1,080,000 \text{ J per second}$
 $= 1,080,000 \text{ W}$

$E = \frac{\text{Useful out}}{\text{Total in}} = \frac{450,000}{1,080,000} = \underline{\underline{0.42 \text{ or } 42\%}}$

Q7.) $V = 120 \text{ V}$
 $I = 2.4 \text{ A}$
 $m = 100 \text{ kg}$
 $h = 0.8 \text{ m}$

$\text{Total in} = E = P \times t$, $P = IV$
 $= 288$ $P = 2.4 \times 120$
 $= 288 \text{ W}$

$E = P \times t = 288 \times 12 = 3456 \text{ J}$
INPUT = 3456 J

$t = 12 \text{ s}$ OUTPUT = GPE = $mgh = 100 \times 9.8 \times 0.8 = 784 \text{ J}$
 $E = ?$

$E = \frac{\text{Useful out}}{\text{Total in}} = \frac{784}{3456} = \underline{\underline{0.23 \text{ or } 23\%}}$

③

Mult Step Pl Qs

Q8.) $m = 75 \text{ kg}$

Original $L = 25 \text{ m}$

New $L = 92.2 \text{ m}$

Extension $= 92.2 - 25 = \underline{67.2 \text{ m}}$

a) Energy loss $= \text{GPE} = mgh = 75 \times 9.8 \times 92.2$
 $\underline{67767 \text{ J}}$

b) Energy in Cord $= \frac{1}{2}ke^2$

$67767 = \frac{1}{2}ke^2$

$67767 = 0.5 \times k \times 67.2^2$

$67767 = 0.5 \times k \times 4515.84$

$67767 = 2257.92 k$

$\frac{67767}{2257.92} = k = \underline{30 \text{ N/m}}$

Q9.) $m = 90 \text{ kg}$

$h = 15 \text{ m}$

$g = 9.8$

Initial GPE $= mgh = 90 \times 9.8 \times 15$
 $= 13230 \text{ J}$

When Slide GPE = KE

So $13230 = \frac{1}{2}mv^2$

$13230 = 0.5 \times 90 \times v^2$

$13230 = 45 \times v^2$

$\sqrt{\frac{13230}{45}} = v = \underline{17 \text{ m/s}}$

Q10.) $V = 230 \text{ v}$

$I = 10.5 \text{ A}$

$m = 1.2 \text{ kg}$

$\Delta T = 80^\circ \text{C}$

time = ?

$\text{suc} = 4200 \text{ J/kg}^\circ \text{C}$



Missing from Q
 Sorry.

$E = m \times \text{suc} \times \Delta T$

$= 1.2 \times 4200 \times 80$

$= 403200 \text{ J}$

$P = IV = 230 \times 10.5$

$= 2415 \text{ W}$

$P = \frac{E}{t}$ $2415 = \frac{403200}{t}$

$t = \frac{403200}{2415} = \underline{166.5} \div 60 = \underline{3 \text{ mins}}$