1	**(a)**	**(i)**	KE = $\frac{1}{2}mv^2$ in any form **OR** $\frac{1}{2}mv^2$	C1
			(KE = 24.5 × 6.7 =) 164 J **OR** 160 J	A1
		(ii)	efficiency = output (power) ÷ input (power) **OR** <u>useful power</u> ÷ input (power)	C1
			0.08 × candidate's **(a)(i)** correctly evaluated	A1
	(b)		use of $\rho = m \div V$ in any form **OR** $m \div V$	C1
			(ρ = 6.72÷5.6 =) 1.2 kg / m^3	A1
	(c)		rotation/movement of <u>wire</u>/coil **OR** rotation/movement of <u>magnet</u>	B1
			<u>consistent with above mark</u>: in magnetic field / between magnetic poles / cutting magnetic field **OR** in coil / near wire	B1
				[Total: 8]

2	**(a)**	**(i)**	(g.p.e. =) *mgh* **OR** 0.15 × 10 × 1.8	C1
			2.7 J ignore minus sign	A1
		(ii)	(k.e. **OR** 2.7 =) $\frac{1}{2}mv^2$ **OR** $\frac{1}{2} \times 0.15v^2$	C1
			(v^2 =) 36	C1
			6.0 m / s	A1
	(b)	**(i)**	<u>initial</u> temperature (of metal) **OR** <u>final</u> temperature (of metal) **OR** temperature change (of metal)	B1
		(ii)	thermal energy transferred to something specific e.g. air / tube / stopper / thermometer / surroundings / environment **OR** small spheres lost before / after weighing **OR** not all the spheres fall the same distance	B1
		(iii)	higher temperature increase **OR** calculate mean of (100) readings	M1
			small measurements less accurate owtte	A1
				[Total: 9]

3 **(a)** **(i)** **1.** (loss of P.E. =) mgh OR $92 \times 10 \times 1500$ C1
1.38×10^6 J A1
correct use of mgh with h = 500 or 2000 gains 1 mark only

(ii) **2.** (K.E. =) $\frac{1}{2} mv^2$ OR $\frac{1}{2} \times 92 \times 52^2$ C1
1.244×10^5 J at least 2 sig. figs A1

(a) **(** difference is due to:
(work done in overcoming) air resistance/drag
OR energy converted to/lost as heat (by air resistance/drag) B1

(b) increases B1

(ii) 920 N B1

[Total 7]

4 **(a)** **(i)** $(m =) \rho V$ OR $1000 \times 1.8 \times 10^6$ C1
1.8×10^9 kg

(ii) (g.p.e. =)mgh OR $1.8 \times 10^9 \times 10 \times 350$ (e.c.f. from **(a)(i)**) C
6.3×10^{12} J (e.c.f. from **(a)(i)**) A

(iii) (P =)E/t OR $6.3 \times 10^{12}/7$ OR $6.3 \times 10^{12}/(7 \times 60)$ OR $6.3 \times 10^{12}/(7 \times 3600)$ C1
(ecf from **(a)(i)(ii)**)
2.5×10^8 W (e.c.f. from **(a)(i)(ii)**) A

(b) continuously regenerated / not used up / everlasting supply
IGNORE used again / recycled / can be renewed B1

(ii) any **two** of: biomass/geothermal/solar/ tidal/wave/wind energy/wood
(NOT nuclear/light) [9]

5 **(a (i)** (gravitational) potential energy to kinetic energy B1

(ii) chemical energy to (gravitational) potential energy B1

reference in **(i)** or **(ii)** to heat / thermal / internal energy produced OR work done against air resistance or friction B1

(b) (i) (K.E. =) $\frac{1}{2}mv^2$ OR $0.5 \times 940 \times 16^2$ C1
1.2×10^5 J A

(ii) in words or symbols $Q = mc\theta$ OR $\theta = Q/mc$ C1
$1.203 \times 10^5 = 4.5 \times 520 \times \theta$ OR $\theta = 1.203 \times 10^5 / (4.5 \times 520)$ C1
51 °C or K A1

[Total: 8]

6 **(a** (W.D. =) $F \times d$ **or** 640×3.5 C1
2240 J to 2 or more sig. figs. A1 [2]

(b) (E =) VIt **or** $75 \times 25 \times 4.0$ **or** 75×100 (accept (E =) VQ and $Q = It$) C
7500 J A1 [

(ii) (efficiency =) $\frac{\text{(useful) energy output}}{\text{energy input}}$ (× 100%) **or** 2240/7500

(accept power for energy) (e.c.f. from **3(a)(i)** or **3(b)(i)**) C1
0.3 or 0.30 or 0.299 or 30 % or 29.9 % (e.c.f. from **3(a)(i)** or **3(b)(i)**) A1

(c) any **two** from:
electrical heating
friction
W.D. lifting suppor
sound B2 [2]

[Total: 8]