1 **(a) (i)** (power =) work (done) / time (taken) OR energy (supplied) / time (taken) OR rate of doing work OR rate of supplying energy B1

(ii) box 2 (force acting on the object) AND box 5 (distance moved by the object) B1

(b) (i) multiplies mass of <u>all passengers</u> by h C1
(increase in gpe =) mgh OR uses $12 \times 650 \times 150$ C1
(power = increase in) gpe / time C1
1.8×10^4 W OR 18 kW A1

(ii) energy to raise the lift OR weight / load / mass of lift OR more weight / load / mass

[Total: 7]

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

(ii) kinetic (energy) to elastic / strain (potential energy) B1

(iii) elastic / strain (potential energy) to kinetic (energy) B1

(b) mgh OR $0.15 \times 10 \times 2.0$ OR 3(.0 J) C1
$\frac{1}{2} mv^2$ OR $v^2 = 2gh$ C1
$v^2 = 2 \times 3.0 / 0.15$ OR 40 C1
6.3(24555) m / s A1

(c) heat / thermal / internal energy lost OR ball / surface gains heat / thermal / internal energy B1

[Total: 8]

3 **(a) (i)** kinetic B1

(ii) (GPE =) mgh OR $1.0 \times 10 \times 300$ C1
3000 J A1

(iii) $Q = mc\Delta\theta$ in any form OR $Q \div mc$ OR $3000 \div [(1.0 \times) 4200]$ C1
0.71 °C A1

(iv) Energy used to heat air (via air resistance) / Heat lost to surroundings B1
OR Energy retained as KE of water (at bottom of waterfall)
OR Sound (energy) produced

(b) Temperature change/difference is (very) small B1

[Total: 7]

4 **(a** Fd OR weight × d OR mgh OR 30 000 × 10 × 140 OR 4.2×10^7 seen anywhere C1

(P =) E / t OR W / t OR mgh / t symbols or words C1

$4.2 \times 10^7 / 60$ C1

7.0×10^5 W / 700 kW / 0.7 MW A1

(b) efficiency = output / input OR (P_{in} =) 100 × P_{out} / efficiency

(P_{in} =) $100 \times 7 \times 10^5 / 70$

1.0×10^6 W OR 1 000 000 W OR 1.0 MW A1

(c) (horizontal) wind has no effect on P.E gained / vertical force on water
OR same upward / vertical force acts on water
OR force from wind is horizontal B1

[Total: 8]

5 **(a) (i)** $\frac{1}{2}mv^2$ in words, symbols or numbers C1

$(v = \sqrt{(2 \times \frac{1}{2} \times 16.2)} =) 4.0\,\text{m/s}$ accept 4 A1

(ii) mgh or KE / mg or $v = \sqrt{(2gh)}$ or $v^2 = u^2 + 2as$ words, symbols or numbers C1

correct substitution e.g. $h = 16.2 / 2 \times 10$ C1

0.81 m allow e.c.f. from **3(a)(i)** A1

(iii) heating of <u>water</u> o.w.t.t.e. B2
compensation mark: award B1 for one of heat, internal energy, sound, KE of water
ignore intermediate states throughout **3(a)(iii)** e.g. KE / PE of splashed water

(b) same height M1

m affects both KE and GPE (in same way) / $v^2 = u^2 + 2as$ applies in both cases
ignore "height doesn't depend on mass" A1
special case : M1 for logical argument about not all KE becoming GPE
A1 for consequent statement about height gained

[Total: 9]

6 **(a) (i)** (increase in g.p.e. = mgh **OR** $65 \times 10 \times 8 =$) 5200 J B

(ii) **EITHER**
k.e. gained = g.p.e. lost C1
$\frac{1}{2}\ mv^2 = 5200$ in any form C1
$v^2 = 5200 / (0.5 \times 65)$ **OR** 160 C1
$v = 12.6\,\text{m/s}$ e.c.f. **(a)(i)** A1
OR
$v^2 = u^2 + 2as / v^2 = 2gh$ (C1)
$v^2 = 2 \times 10 \times 8$ (C1)
$v^2 = 160$ (C1)
$v = 12.6\,\text{m/s}$ e.c.f. **(a)(i)** (A1)

(b) speed is the same B1
EITHER
loss in g.p.e. is the same B1
k.e. gained is the sa B1
OR
acceleration is the same (B1)
distance fallen is the same (B1)

[Total: 8]