**1** **(a** Coal, hydroelectric and wind boxes ticked B2

**(b) (i)** Copper is a good conductor of thermal energy / heat
Black surface is a good / the best absorber of radiation / infra red B1

**(ii)** (Temp rise = ) 72 – 20 = 52 (°C)
(Q =) $mc\Delta\theta$ OR $0.019 \times 4200 \times 52$ C1
4100 J A1

**(iii)** Efficiency = (power) output / (power) input (× 100)
OR 70 $\frac{(4100/5)\times 100}{\text{power input}}$ OR $\frac{(4100\times 100)}{\text{power input}}$ OR rearranged C1
Power input = 1200 W A1

**[Total: 9]**

**2** **(a (i)** $v = u + at$ OR $(a =) (v - u)/t$ OR $24 = a \times 60$ OR $24/60$
$0.4(0)\,m/s^2$ A1

**(ii)** $(F =) ma$ OR $7.5 \times 10^5 \times 0.40$ C1
300 000 N OR 300 kN

**(b) (i)** in words or symbols $(P =) W/t$ OR F x d / t OR $Fv$
OR $7.2 \times 10^4 \times 24 / 1$ OR OR $7.2 \times 10^4 \times 24$ C1
$1.7 \times 10^6$ W A1

**(ii)** gravitational/potential energy of train has to be increased
OR force acts down the slope / backward force acts (on train) B1

(for the same distance moved) more work done has to be done OR energy has to be provided (by the engine) B1
in the same time (so needs more power) B1

**[Total: 9]**

**3** **(a (i)** work done = force x dist or 600 x 3 or 60 x 3 or fd or mgh — C1

work = 1800 J c.a.o. accept j or Nm for unit — A1 [2]

**(ii)** power = work/time or 1800/12 e.c.f. — C1

power = 150 W e.c.f. accept J/s or NM/s for unit — A1 [2]

**(b)** P.E. decreases/transformed (ignore mention of KE) — C1

all the decrease becomes heat (ignore mention of sound) — A1 [2]

**[Total: 6]**

4 **(a (i)** down to R and up towards Q/S, then reverse OR equivalent
OR back towards Q, then reverse — B1
continues backward and forward until stops (at R) — B1

**(ii)** idea of energy loss OR because of friction NOT PE/KE — B1

**(b)** (PE lost =) 1.2 × 0.5 OR 0.6 (J) OR 0.12 × 10 × 0.5 OR mgh OR wt × dist — C1
i.e. evidence of m

$0.5 \times 0.12 \times v^2 = mgh$ OR 0.6 etc. e.c.f. — C1
i.e. evidence of $\frac{1}{2}mv^2$

3.16 OR 3.2 m/s c.a.o. — A1

**[Total: 6]**

| | | | | | |
|---|---|---|---|---|---|
| 5 | **(a)** | work = force x distance<br>= force of gravity/weight x (vertical) distance/height | C1<br>A1 | **2** | |
| | **(b)** **(i)** | work = (100 x 8) = 800 J | A1 | | |
| | **(ii)** | power = (800/5) = 160 W | A1 | **2** | |
| | **(iii)** | increases the k.e. of the water (ignore heat/sound) | B1 | **1** | |
| | | | | **[5]** | |

| | | | | |
|---|---|---|---|---|
| 6 | **(a** | p.e. lost = mgh or 1 x 10 x 7<br>= 70 J | C1<br>A1 | [2] |
| | **(b)** | 70 = 0.5 x $m$ x $v^2$ or ecf<br>$v^2$ = 140 or 2 x p.e.<br>$v$ = 12 m/s | C1<br>C1<br>A1 | [3] |
| | **(c)** | some p.e. changed to heat/sound/either one/work done against air resistance air/resistance acts against the motion | B1 | [1] |
| | | | | **[Total: 6]** |

| | | | | |
|---|---|---|---|---|
| 7 | **(a)** | time a number of swings (if number stated, >5)<br>time divided by [2 x number of swings] | M1<br>A1 | **2** |
| | **(b)** | weight of gravity and tension | B1 | |
| | **(ii)** | force towards centre of circular motion or towards support point | B1 | **2** |
| | **(c)** | p.e. = mgh or 0.2 x 10 x 0.<br>= 0.1 J | C1<br>A1 | **2**<br>**[6]** |