1 **(a** two processes from:
vapour rising
condensation
rain falling
water falling from lake / through pipes
water turns turbine / generator
electricity generated. max B2

energy changes:
PE to KE matched to a process B1
KE to electricity energy for turbine / power station B1

**(b) (i)** (PE =) $mgh$ OR $2 \times 10^5 \times 10 \times 120$ allow $g$ = 9.8 or 9.81 C1
$2.4 \times 10^8$ J A

**(ii)** (KE of water =) $\frac{1}{2}mv^2$ OR $\frac{1}{2} \times 2 \times 10^5 \times 14^2$ C1
$1.96 \times 10^7$ J OR $2.0 \times 10^7$ J A [8]

2 **(a** $\Delta h$ = 0.068 m C1
<u>use of</u> $mgh$ C1
0.054 J/Nm A1 [3]

**(b)** $\frac{1}{2}mv^2$ = candidate's **(a)** C1
1.2 m/s ecf from **(a)** A1 [2]

**(c) (i)** <u>use of</u> distance ÷ time C1
= 1.1 m/s A1

**(ii)** air or wind resistance / friction / heat / thermal energy
OR correct mention of experimental error e.g. width of cylinder B1 [3]

3 (a) (i) <u>use of</u> $a = \Delta v/t$ in any form      C1
         $23.3\,\text{m/s}^2$   ignore sign      A1    [2]

     (b) (i) 336 000 J      B    [1]

         (ii) <u>use of</u> power × time      C1
             = 180 000 J      A    [2]

         (iii) 54% OR   0.54
              ecf from **(i)** and **(ii)**      B1    [1]
              accept (= 180 000/840 000) 21%   OR   0.21

     **(c)** anything sensible for a moving vehicle, e.g. flywheel / capacitor / battery      M1
         appropriate change <u>for this device</u>, for example:
         flywheel: speed or kinetic energy
         capacitor: voltage or charge or electrical energy
         battery: voltage or charge or electrical or chemical energy      A1    [2]

4 (a) (i) *mgh* in any form   OR   2.0 × 10 × 4.8      C1
         96 J      A1

         (ii) GPE $\rightarrow$ KE (+ heat and/or sound)
             $\rightarrow$ heat and/or sound
             −1 e.e.o.o.      B2

     **(b)** force × distance/time   OR   520 × 3/5      C1
         312 W      A1

         (ii) 2600 W   ecf **(i)**      B1    [7]

5   **(a**    $\frac{1}{2}mv^2$   OR   $\frac{1}{2} \times 900 \times 30^2$          C1
           405 000 J          A1

    **(b)**   force x distance   OR   2000 x 30          C1
          60 000 J   OR   60 kJ          A1

    **(c)**   60 000 W   OR   60 000 J/s   OR   60kW   OR   60 kJ/s   ecf from (b)          B1

    **(d)**   chemical          B1

    **(e)**   idea of energy loss / heat / sound / inefficiency / energy used within car /
         possibility of increase in P.E.   Ignore work done against against friction          B1      [7]