M1. (a) (i) 720

allow 1 mark for correct substitution,

ie $72 \times 10$ provided no subsequent step shown

(ii) 720 or their (a)(i)

(b) (i) gravitational potential

allow gravitational potential

(ii) 432

allow 1 mark for correct substitution, ie $\frac{21600}{50}$ provided no subsequent step shown

watt / W
M2. (a) (i) gravitational potential

- accept gravitational
- accept potential

(ii) 2250 (N)

forces must be balanced
or
forces are equal and opposite

do not accept because it is not moving
do not accept ‘equilibrium’ by itself
do not accept ‘it is not balanced’
do not accept ‘forces are equal’
do not accept ‘forces are the same’

(b) 1500

1 mark for correct substitution
M3.  (a)  (i)  50 (N) 
    *ignore any units*  
    1

(ii) resultant force  
    1 

(iii) 4000 
    *accept their (a)(i) × 80 correctly calculated for 2 marks* 
    *allow 1 mark for correct substitution i.e. 50 × 80 or their (a)(i) × 80* 
    *ignore any units*  
    2

(b) (i) joule  
    1 

(ii) heat  
    1  

[6]
M4. (a) (i) horizontal arrow pointing to the left
judge by eye
drawn anywhere on the diagram

(ii) 60 (N)

(at steady speed) resultant force must be zero
accept forces must balance/are equal
accept no acceleration
do not accept constant speed

(b) 1680
allow 1 mark for correct substitution, ie 60 x 28 provided no
subsequent step shown

joule
accept J
do not accept j

[6]
M5.  

(a) potential

(b) (i) 13 200

allow 1 mark for correct substitution, ie $660 \times 20$ provided no subsequent step shown

(ii) 16.5

allow 1 mark for correct

or

\[
\frac{\text{their (b)(i)}}{800} \text{ correctly calculated } \frac{13 200}{800} \frac{\text{their (b)(i)}}{800}
\]

substitution, ie or provided no subsequent step shown

[5]
M6. (a) (i) 24

allow 1 mark for converting time to 600 seconds or showing method ie 14400/10

\[
\frac{14400}{10} \times 60
\]

provided no further steps shown

(ii) 24

ignore any unit or their (a)(i)

(b) (i) 20 45

both required – either order

(ii) the block transfers energy to the surroundings

[5]
M7. (a) 1800 (N)

allow 1 mark for correct substitution ie 180 \times 10 provided no further steps shown

(b) 3780 or their (a) \times 2.1 correctly calculated

allow 1 mark for correct substitution

ie 1800 or their (a) \times 2.1 provided no further steps shown

joule

accept J

accept any clear indication of correct answer

(c) 0

reason does not score if 0 not chosen

work is only done when a force makes an object move

accept distance moved is zero

accept no energy transfer (to the bar)

accept the bar is not moving/is stationary

'it' refers to the bar/weights
M8. (a) D

(b) C

(c) \[ W = 300 \times 45 \]

\[ W = 13500 \]

*allow 13 500 with no working shown for 2 marks*

(d) straight line drawn from 13 m/s to 0 m/s

finishing on x-axis at 65 s

[6]