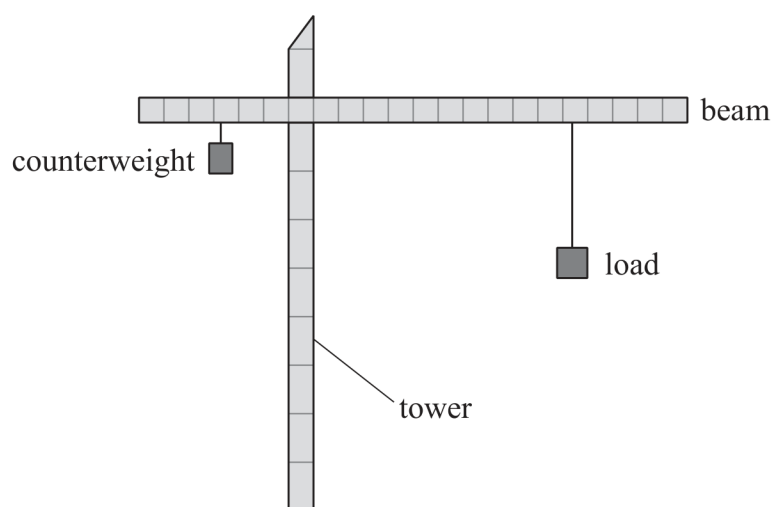


- 19 The diagram shows a crane lifting a load. There is a large mass called a counterweight attached to the crane, on the opposite side of the tower to the load.



- (a) The crane has an electric motor with an efficiency of 47%.

The crane lifts a load of  $4.4 \times 10^4 \text{ N}$ . The load moves through a vertical distance of 15 m in a time of 70 seconds.

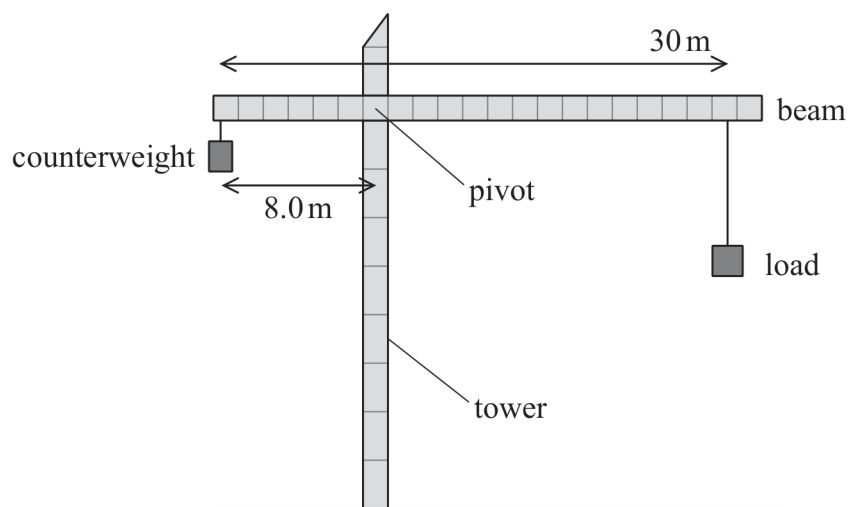
Determine the average power input to the electric motor.

(4)

Average power input = .....



- (b) The horizontal distance from the load to the tower can be changed. The horizontal distance from the counterweight to the tower can also be changed.



- (i) Explain how the counterweight needs to move when the load is moved away from the tower.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) The beam is uniform with a weight of  $3.0 \times 10^4 \text{ N}$ .  
The counterweight has a weight of  $1.1 \times 10^5 \text{ N}$ .  
The load has a weight of  $4.4 \times 10^4 \text{ N}$ .

Deduce whether the load can be moved to the end of the beam without the crane toppling.

(5)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS

(Total for Question 19 = 13 marks)