

(NI)

Work Energy and Power

1. How much work is done when a packing case (box) is dragged 4m across the floor against a frictional force of 45N? How much energy is needed.
2. A crane does 1200J of useful work when it lifts a load vertically by 60cm. find the weight of the load.
3. How much work is done by an electric motor pulling a 130N load 6.5m up the slope shown in the diagram if the constant tension in the string is 60N.
4. A battery stores 15kJ of energy. If the battery is used to drive an electric motor, how high could it raise a 750kg load if it was lifted vertically?
5. An electric motor is used to raise a load of 105N. The load rises vertically 2m in a time of 6s. Find the work done and the power of the motor.
6. A crane has a power of 2000W. How much work can it do in an hour?
7. A small wind generator has an average output power of 350W. How long does it take to generate 70kJ of electrical energy?
8. A nail gun fires a nail with KE of 1.8J into a piece of wood. The average resistive force on the nail is 45N and it stops 0.3s after entering the wood.
calculate:- a) the distance the nail penetrates into the wood
b) the average power of the resistive forces in stopping the nail.
9. A space shuttle takes off:
 - a) The work done by the engines of the space shuttle during lift - off is 9.4MJ. This takes the space shuttle 5s. Calculate the average power generated by the engines during lift off.
 - b) one of the engines in the space shuttle exerts a force of 11.75kN. In this time interval of 5s, the space shuttle rises to a height of 200m. Calculate the work done by this engine.

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Efficiency

1. An electric kettle is rated 2.5kW it produces 2.5kJ of heat energy every second. The kettle takes 160 seconds to boil some water, and during this time 360kJ of heat energy pass into the water. Calculate the kettles efficiency.
2. A motor rate 40W lifts a load of 80N to a height of 90cm in 4s. Find its efficiency.
3. A rotary engine, which has an efficiency of 0.3.
 - a) Calculate the amount of useful energy it produces when the input chemical energy is 2000J.
 - b) 90% of the wasted energy is heat. What percentage of the input energy is lost as heat?

Gravitation Potential Energy GPE ($g = 10\text{N/kg}$)

1. Find the GPE of a mass of 500g when raised to a height of 240cm.
2. How much heat and sound energy is produced when a mass of 1.2kg falls to the ground, without any deformation, from a height of 5m?
3. How much gravitational potential energy is stored in the reservoir of a hydroelectric power station if it holds 5 000 000kg water at an average height of 80m above the turbines?
4. A marble of mass 50g falls to earth. At the moment of impact its kinetic energy is 1J. From what height did it fall?
5. A book of mass 50g has a GPE of 3.2J when at a height of 4m above the surface of the Moon. Find the gravitational field strength on the Moon.

Kinetic Energy KE

1. A car of mass 80kg is travelling at 15m/s. Find its KE.
2. A bullet has a mass of 20g and is travelling at 300m/s. Find its KE.
3. Find the speed of a boat if its mass 1200kg and it has a kinetic energy of 9600J.
4. A car of mass 800kg is travelling at a steady speed. The kinetic energy of the car is 160kJ. Show that the speed of the car is 72km/hr.
5. The input power of a small hydroelectric power station is 1MW. If 18 000 000kg of water flows past the turbines every hour, find the average speed of the water.

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Work Energy and Power

1. 180J
2. 2000N
3. 390J
4. 2m
5. 35W
6. 7.2MJ
7. 200s
8. a) 0.04m or 4cm b) 6W
9. a) 1.88MW b) 2.35MJ

Efficiency

1. 0.9 or 90%
2. 0.45
3. a) 600J b) 63%

Gravitation Potential Energy GPE ($g = 10\text{N/kg}$)

1. 12J
2. 60J
3. 4 000 000 000J
4. 2m
5. 1.6N/kg

Kinetic Energy KE

1. 90 000J
2. 900J
3. 4m/s
4. 20m/s \rightarrow 72km/hr
5. 20m/s