UNIT-5 WORK ENERGY AND POWER

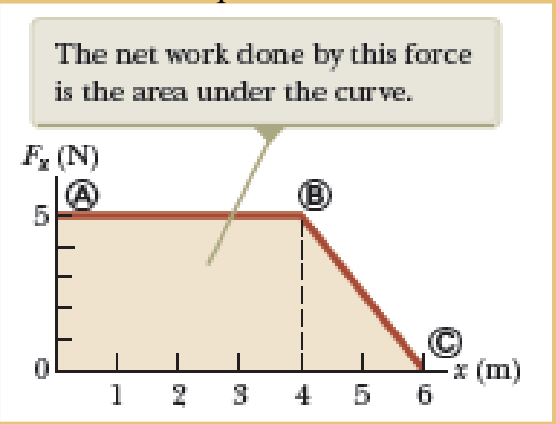
1 A boy pushes an 87-kg patient on an 18-kg gurney (wheeled stretcher), producing an acceleration of 0.55 m/s^2. (a) How much work does the boy do in pushing the patient and gurney through a distance of 1.9 m? Assume the gurney moves without friction. (b) How far must the boy push the gurney to do 140 J work?

[110 J, 2.4 m]

2 A person pulls a 50-kg crate 40 m along a horizontal floor by a constant force of 100N which acts at 30° with the horizontal. Calculate the work done by the force.

[3.46 x 10^3 J]

3 A force acting on a particle varies with displacement x as shown in Figure Calculate the work done by the force on the particle as it moves from $x = 0$ to $x = 6.0\ m$.



[25 J]

4 Sadaf has just arrived at the airport and is dragging her suitcase to the luggage check-in desk. She pulls on the strap with a force of 190 N at an angle of 35° to the horizontal to displace it 45 m from the desk. Determine the work done by Sheila on the suitcase.

[7.0 x10^3 J]

5 Calculate the work done by a boy lifting a load of 7.5 kg to a height of 3.2 m from the ground level. (g = 9.8 ms^{-2})

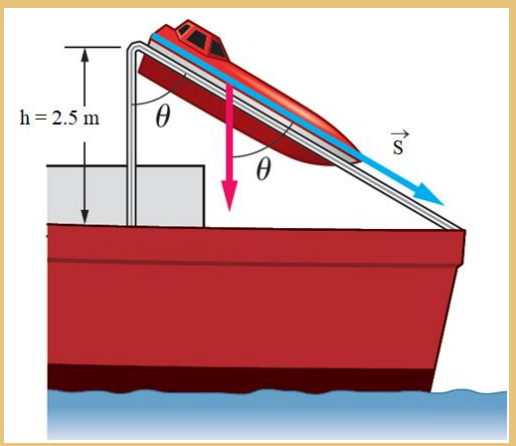
[235.2 J]

6 A body of mass 10kg at rest is subjected to a force of 16N. Find the kinetic energy at the end of 10 s.

[1280 J]

7 In a gravity escape system (GES), an enclosed lifeboat on a large ship is deployed by letting it slide down a ramp and then continue in free fall to the water below. Suppose a 4970-kg lifeboat slides a distance of 5.00 m on a ramp, dropping through a vertical height of 2.50 m. How much work does gravity do on the boat?

[1.22 x 10^5]



8 A small airplane moving along the runway during takeoff has a mass of 690 kg and kinetic energy of 25,000 J. What is the speed of the plane?
[8.5 m/s]

9 A 10.0 kg mass is dropped from a tall building. During the first second of the fall, what was the average power exerted by gravity? What was the average power exerted by gravity during the first 5.00 seconds of the fall?
[480 W, 2400 W]

10 A 220-kg motorcycle is cruising at 14 m/s. What is the total work that must be done on the motorcycle to increase its speed to 19 m/s? [1.81×10^4 J]

11 A 4.10-kg box of books is lifted vertically from rest at a distance of 1.60 m with a constant, upward applied force of 52.7 N. Find (a) the work done by the applied force, (b) the work done by gravity, and (c) the final speed of the box.
[84.3 J, - 64.3 J, $W_{total} = 19.9$ J , 3.12 m/s]

12 To pass a slow-moving truck, you want your fancy 1.30×10^3 kg car to accelerate from 13.4 m/s to 17.9 m/s in 3.00 s. What is the minimum power required for this pass? [w = 9.16×10^4 J, 40.9 hp

13 It takes a force of 1450 N to keep a 1300-kg car moving with constant speed up a slope of 5.25°. If the engine delivers 4.10×10^4 W to the drive wheels, what is the maximum speed of the car? [28.3 m/s]

14 How much work is needed for a 73-kg runner to accelerate from rest to 7.7 m/s?
[2.16×10^3 J]

15 The energy required to increase the speed of a certain car from 18 m/s to 24 m/s is 190 kJ. What is the mass of the car? [1.5×10^3 kg]

16 An ice cube is placed in a microwave oven. Suppose the oven delivers 105 W of power to the ice cube and that it takes 32,200 J to melt it. How much time does it take for the ice cube to melt? [5.11 min]

17 A new record for running the stairs of the Empire State Building was set on February 4, 2024. The total of 1576 steps, was run in 9 minutes and 33 seconds. If the height gain of each step was 0.20 m, and the mass of the runner was 70.0 kg, what was his average power output during the climb? [3.77 KW, or 5.05 hp]

18 Your car produces about 34 kW of power to maintain a constant speed of 31 m/s on the highway. What average force does the engine exert? [1.09×10^3 N]

19 A motor pumps the water at the rate of 600 grams/min to the height of 95 m If the motor is 50% efficient then how much input electric power is needed?
[18.62 W]

20 The mass of the earth is 5.98×10^{24} kg and the mass of the sun is 1.99×10^{30} kg, and the earth is 160 million km away from the sun, Calculate the GPE of the earth.
[$\mathbf{U = -\ 4.96 \times 10^{33}\ J}$]