Ph 11
Apr 94

Name: KEY

More to Work On

g = 9.80 N/kg

PART A: Short Questions:

Give an equation, show substitution, use correct units in answer

1. How much work is done when a 200 N force is used to slide a 30 kg trunk 6.0 m across a room?

$200 \times 6 =$

1. 1200 J

2. A person on a bicycle produces a forward force of 200 N and is travelling 3.0 m/s. What power is being produced?

$P = \frac{W}{t} = \frac{F \cdot d}{t} = F \cdot v = 200 \times 3$

2. 600 W

3. What power is needed to lift a 1000 kg load 20 m to the top of a construction site in 1.0 minute?

$P = \frac{1000(9.8)20}{60}$

3. 3.27×10^3 W

4. A 1500 kg car accelerates from rest at 2.0 m/s^2 for a distance of 250 m. Neglecting friction, how much work was done in accelerating the car?

$W_{NET} = \Delta E_K$

OR $W_{NET} = F_{NET} d = mad = 1500(2)(250) =$ 4. 7.50×10^5 J

5. When the acceleration is over, what is the kinetic energy of the car in the previous question?

5. 7.50×10^5 J

6. A 150 W motor is used to raise a garage door. If the average force needed to lift the door is 600 N, how much time will it take to raise the door 2.5 m?

$P = \frac{W}{t} = \frac{Fd}{t}$

6. 10 s

$t = \frac{Fd}{P} = \frac{600(2.5)}{150} =$

7. What is the potential energy stored in a cubic meter of water (=1000 kg) that is in a reservoir behind a dam at a height of 60 m above the elevation of the turbines the water will be used to turn?

$mgh = 1000(9.8)(60)$

7. 5.88×10^5 J

8. In an experiment, a small 20 W motor is used to lift a 100 g mass through a vertical distance. If the motor runs for 40 s, how much potential energy does the mass gain?

$E = Pt$

$= 20(40) =$

8. 800 J

9. What is conserved during an elastic collision?

9. $E_T, \vec{P}_T, E_K$

10. Mr. W's home with electric heating uses an average of 4000 kWh of electricity per month. How many joules of energy is this?

$4000(1000)3600 =$

10. 1.44×10^{10} J

11. A 200 g mass rests on a table 2.0 m above the floor. If the mass slips off the table what is its kinetic energy just as it reaches the floor?

~~$mgh = \frac{1}{2}mv^2$~~

v

$E_K' = E_P$

$= mgh$

11. 3.92 J

12. What is the kinetic energy of a 1200 kg car travelling 90 km/h?

$25 \frac{m}{s}$

$\frac{1}{2}(1200)(25)^2 =$

12. 3.75×10^5 J

13. What unit is equivalent to a J/s?.

13. WATT

PART B: Problems.

14. A 200 W motor runs a pump to move water from a stream into a storage tank 10 m above the elevation of the stream. How many litres of water can the pump move in 1.0 hour? (recall that 1.0 L of water = 1.0 kg)

$$P = \frac{W_{LIFT}}{t} = \frac{\Delta E_p}{t} = \frac{mgh}{t}$$

$$m = \frac{P \cdot t}{gh} = \frac{200(3600)}{9.8(10)} = \boxed{7.35 \times 10^3 \text{ L}}$$

15. A pendulum bob is raised in an arc to a position 20 cm higher than its lowest point. The bob is released. What is the speed of the bob as it passes through its lowest point?

$$E_T = E_T'$$
$$E_p = E_K'$$
$$mgh = \frac{1}{2}mv'^2$$
$$v' = \sqrt{2gh}$$
$$v' = \sqrt{2(9.8)(.2)} = \boxed{1.98 \frac{m}{s}}$$

16. A 10 g bullet travelling at 300 m/s imbeds itself into a stationary 1000 g block of wood. After impact the block has a speed of 3.0 m/s. How many joules of heat and sound energy was produced?

$$\Delta E_{H+S} = -\Delta E_K$$
$$= -(E_K' - E_K)$$
$$= E_K - E_K'$$
$$= \frac{1}{2}mv^2 - \frac{1}{2}mv'^2$$
$$= \frac{1}{2}(0.010)(300)^2 - \frac{1}{2}(1.010)(3)^2$$
$$= 450 - 4.545$$
$$\boxed{\Delta E_{H+S} = 445 \text{ J}}$$

17. Car travelling at 10 m/s rolls down a steep driveway that has a vertical drop of 5.0 m. Ignoring friction, what is the car's speed at the bottom of the incline?

$$E_K + E_P = E_K'$$

$$\frac{1}{2}mv^2 + mgh = \frac{1}{2}mv'^2$$

$$v^2 + 2gh = v'^2$$

$$v' = \sqrt{v^2 + 2gh}$$

$$= \sqrt{10^2 + 2(9.8)(5.0)}$$

$$= \sqrt{198}$$

$$\boxed{v' = 14\ \frac{m}{s}}$$

18. A 500 g piece of copper is heated to 200 °C and dropped into 250 g of water at 20 °C. To what temperature is the water heated, ignoring heat lost to the surroundings?
Specific heat of copper = 390 J/kg°C
Specific heat of water = 4200 J/kg°C

$$T' = \frac{m_c c_c T_c + m_w c_w T_w}{m_c c_c + m_w c_w}$$

$$= \frac{(.5)(390)(200) + (.25)(4200)(20)}{.5(390) + .25(4200)}$$

$$\boxed{T' = 48^\circ C}$$