Power Practice Name:_____

1. What is the power of a motor that does 65 000 J of work in 120 seconds?

$$P = \frac{W}{t} = \frac{65000}{120}$$

$$= 541.67$$

$$\approx \boxed{540\ W}$$

2. How long does it take 2.5 kW (kilowatt) electric motor to do 75 000 J of work?

* 2.5 kW = 2500 W

$$P = \frac{W}{t} \quad \text{so} \quad t = \frac{W}{P}$$

$$= \frac{75000}{2500}$$

$$= 30\ sec$$

$$= \boxed{3.0 \times 10^{1}\ sec}$$

3. How much work can a 520 W electric mixer do in 2.5 **minutes**?

$$2.5\ min \times \frac{60\ sec}{1\ min} = 150\ sec$$

$$P = \frac{W}{t} \quad \text{so} \quad P \times t = W$$

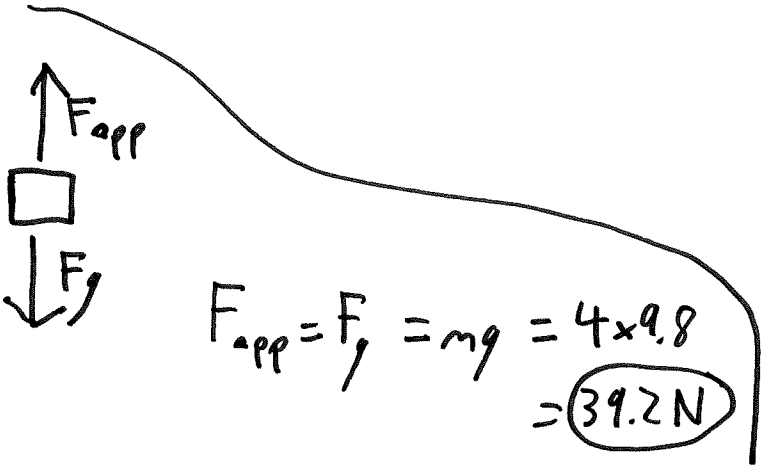
$$520 \times 150 = \boxed{78\,000\ J}$$

Power Practice

Name:_____

4. What velocity can a 12.0 W motor lift a 4.0 kg object at?

$P = F\bar{v} \rightarrow \frac{P}{F} = \bar{v}$



$F_{app} = F_g = mg = 4 \times 9.8 = 39.2\,N$

$\frac{12.0}{39.2} = 0.31\,m/s$

5. If a 100.0 W light bulb is left on for 1.0 **hours**, how much energy is consumed?

$1\,hr \times \frac{3600\,sec}{1\,hr} = 3600\,sec$

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

so $P \times t = W \rightarrow 100 \times 3600 = 360\,000\,J$

6. A kilowatt hour is a measure of energy. Determine how many joules a kilowatt hour is.

$1\,kW \cdot hr = 1000\,W \times 3600\,sec$

$= 3\,600\,000\,J$

$= 3.6 \times 10^6\,J$

Power Practice Name:_____

7. A force of 5.0 N moves a 6.0 kg object along a floor at a constant speed of 2.5 m/s for 22 seconds. What power is being used?

$$P = F\bar{v} = 5 \times 2.5$$
$$= 12.5\,W$$
$$\approx \boxed{13\,W}$$

8. What power in needed to heat 1.0 litres of water from 22°C to 98°C in 3.5 seconds?

$\Delta T = 98 - 22 = 76$

$$E_h = mc\Delta T$$
$$= 1 \times 4200 \times 76$$
$$= 319200$$

$$P = \frac{W}{t} = \frac{319200}{3.5} = 91200\,W \approx \boxed{91\,kW}$$

9. 350 mL of water is placed on a 1200 W heating plate. How hot will the water be after one minute?

350 mL has mass 0.35 kg

(1) How much work does the heating plate do?

$P = \frac{W}{t} \rightarrow P \times t = W \rightarrow 1200 \times 60 = 72000$

(2) How hot does that make the water?

$E_h = mc\Delta T \rightarrow \frac{E_h}{mc} = \Delta T$

$\frac{72000}{0.35 \times 4200} = 49°$

(3) What is final temp $22 + 49 = \boxed{71°C}$

Power Practice Name:_____

10. A car's engine accelerates the 1200 kg car from rest to 100.0 **km/hr** in 5.0 seconds. What is the power output of the engine during this time? (answer in both watts and horsepower)

① How much work was done?

$E_K = \frac{1}{2}(1200)(27.78)^2$ $\quad 100\ km/hr = 27.78\ m/s$

$= 463037.04\ J$

② How much power in watts $P = \frac{W}{t} = \frac{463037}{5} = 92607\ W \approx 93000\ W$

③ in Hp? $92607\ W \times \frac{1}{746\ W} = 124 \approx 120\ HP$

11. A 72 kg person runs up a staircase 3.0 m high in 3.5 seconds. What is her power in hp?

① How much work was done $E_p = mgh$

$= 72 \times 9.8 \times 3$

$= 2116.8\ J$

② Power? $P = \frac{W}{t} = \frac{2116.8}{3.5} = 604.8\ W$

③ in horse power $604.8\ W \times \frac{1\ HP}{746\ W} = 0.81$ horsepower

12. An elevator is powered by a 10.0 hp motor. What is the maximum mass it can raise at a constant speed through a vertical distance of 40.0 m in 18 seconds?

$10\ hp \times \frac{746\ W}{1\ hp} = 7460\ W$

$\bar{v} = \frac{d}{t} = \frac{40}{18} = 2.22\ m/s$

$P = F\bar{v} \rightarrow \frac{P}{\bar{v}} = F \rightarrow \frac{7460}{2.22} = 3361\ N$

$F = F_g = mg \rightarrow \frac{F_g}{g} = m \rightarrow \frac{3361}{9.8} = 340\ kg$

Power Practice Name:_____

13. A machine pulls a 450 kg block along a surface with $\mu = 0.24$ at 5.3 m/s. What power is the machine outputting?

$P = F\bar{v}$

↖ need to find

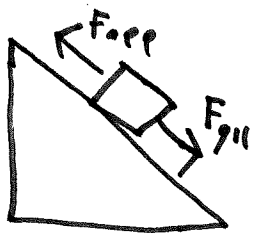
$F = F_{Fric} = \mu F_N \leftarrow F_N = F_g = mg = 450 \times 9.8 = 4410\,N$

$= 0.24 \times 4410 = 1058.4\,N$

$P = 1058.4 \times 5.3 = 5609.52\,W \approx 5600\,W$

$\approx$ (5.6 kW)

14. A 56 kg block is pushed up a 26° frictionless incline at a constant velocity using 450 watts of power. How fast is the block moving up the ramp?



$F_{g||} = \sin\theta F_g$

$= \sin\theta mg$

$= \sin 26 \times 56 \times 9.8$

$= 240.58\,N$

$P = F\bar{v} \rightarrow \frac{P}{F} = \bar{v} \rightarrow \frac{450}{240.58} =$ (1.9 m/s)

Power Practice Name:_____

15. A 2.3 kg model car is accelerated by a 6.4 watt engine for 12.0 seconds from rest. Then it coasts over a surface with $\mu = 0.44$. How far will the car travel before it stops?

① Need to find velocity it is accelerated to

a) Find amount of energy generated

$P = \frac{W}{t} \rightarrow Pxt = W$

$6.4 \times 12 = 76.8$ J

b) Find velocity if it has 76.8 J of kinetic energy

$E_K = \frac{1}{2}mv^2 \rightarrow v = \sqrt{\frac{2E_K}{m}}$

$= \sqrt{\frac{2(76.8)}{2.3}}$

$= 8.172 m/s$

② Find how far it travells

$F_{fric} = \mu F_N = 0.44 \times 2.3 \times 9.8 = 9.92 N$

← □ F_{fric}

$a = \frac{F_{net}}{m} = \frac{9.92}{2.3} = 4.31 m/s^2$ ← make negative since it is slowing

$a = -4.31 m/s^2$

$V_0 = 8.172 m/s$

$V_f = 0$

$d = ?$

Use $V_f^2 = V_0^2 + 2ad$

$d = 7.7 m$