1. Basic Concept and formula
    a. Express power in term of energy and change in time
    b. Expression in term of force and velocity

$$P = \frac{\Delta E}{\Delta T} = \frac{\Delta W}{\Delta T} = \frac{Fd}{\Delta T} = Fv$$

2. A 50-kg person runs up the stairs 10 meters high in 2 minutes. Acceleration due to gravity (g) is $10\frac{m}{s^2}$. Determine the power.

W = m g h = (50)(10)(10) = 5000 Joule.
P = W / t = 5000 / 120 = 41.7 Joule/second.

3. You're riding a toboggan down an icy run to a frozen lake, and you accelerate the 80.0-kg combination of you and the toboggan from 1.0 m/s to 2.0 m/s in 2.0 s. How much power does that require?

$$\begin{aligned} W &= \frac{1}{2}mv_2^{\,2} - \frac{1}{2}mv_1^{\,2} \\ &= \frac{1}{2}(80.0\ \text{kg})(2.0\ \text{m/s})^2 \\ &\quad - \frac{1}{2}(80.0\ \text{kg})(1.0\ \text{m/s})^2 \\ &= 120\ \text{J} \end{aligned}$$

$$P = \frac{120\ \text{J}}{2.0\ \text{s}} = 60\ \text{W}$$

4. A 1,000-kg car accelerates from 88 m/s to 100 m/s in 30 s. How much power does that require?

$$\begin{aligned} P &= \frac{W}{t} = \frac{m}{2t}\left(v_2^{\,2} - v_1^{\,2}\right) \\ &= \frac{1{,}000.0\ \text{kg}}{2(30\ \text{s})}\left([100\ \text{m/s}]^2 - [88\ \text{m/s}]^2\right) \\ &= 3.8\times10^4\ \text{W} \end{aligned}$$

5. A 60.0-kg person is running and accelerates from 5.0 m/s to 7.0 m/s in 2.0 s. How much power does that require?

$$P = \frac{W}{t} = \frac{m}{2t}\left(v_2{}^2 - v_1{}^2\right)$$
$$= \frac{60.0\ \text{kg}}{2(2.0\ \text{s})}\left([7.0\ \text{m/s}]^2 - [5.0\ \text{m/s}]^2\right)$$
$$= 360\ \text{W}$$

6. A 120-kg linebacker accelerates from 5.0 m/s to 10.0 m/s in 1.0 s. How much power does that require?

$$P = \frac{W}{t} = \frac{m}{2t}\left(v_2{}^2 - v_1{}^2\right)$$
$$= \frac{120\ \text{kg}}{2(1.0\ \text{s})}\left([10.0\ \text{m/s}]^2 - [5.0\ \text{m/s}]^2\right)$$
$$= 4{,}500\ \text{W}$$

7. 4.You're driving a snowmobile that accelerates from 10 m/s to 20 m/s over a time interval of 10.0 s. If you and the snowmobile together have a mass of 500 kg, how much power is used?

$$P = \frac{W}{t} = \frac{m}{2t}\left(v_2{}^2 - v_1{}^2\right)$$
$$= \frac{500\ \text{kg}}{2(10.0\ \text{s})}\left([20\ \text{m/s}]^2 - [10\ \text{m/s}]^2\right)$$
$$= 7.5\times10^3\ \text{W}$$

- Sources for problems: https://scienceknowledge.webador.com/physics-content/ib-physics/mechanics/work-energy-and-power/power
- Provided by: https://scienceknowledge.webador.com/