For each problem below:

- Write the formula you will use to solve the problem
- Substitute know values with units into the formula
- Complete the calculation and give the answer with the correct unit
- Check that your answer has the correct number of significant figures

1. What is the power output of an engine that does 60,000 J of work in 10 sec?

$$P = W/t = \frac{60{,}000\ J}{10\ sec} = 6000\ J/sec = 6000\ W$$

2. How much power is needed to lift a 200 N object to a height of 4 m in 4 sec?

$$W = f \times d = 200\ N \cdot 4\ m = 800\ J$$

$$P = W/t = 800\ J/4\ sec = 200\ J/sec = 200\ W$$

3. A set of pulleys is used to lift a piano weighing 1,000 N. The piano is lifted 3 m in 60 sec. How much power is used?

$$W = f \cdot d = 1000\ N \cdot 3\ m = 3000\ J$$

$$P = W/t = \frac{3000\ J}{60\ sec} = 50\ J/sec = 50\ W$$

4. How much power is used if a force of 35 N is used to push a box a distance of 10 m in 5 sec?

$$W = f \cdot d = 35\ N \cdot 10\ m = 350\ J$$

$$P = W/t = 350\ J/5\ sec = 70\ J/sec$$

5. What is the power of a kitchen blender if it can perform 3,750 J of work in 15 sec?

$$P = W/t = 3{,}750\ J/15\ sec = 250\ J/sec = 250\ W$$

6. How much work is done using a 500. watt microwave oven for 5.0 min?

$$W = P \cdot t$$

$$= 500.\ W \cdot 300\ sec$$

$$= 150{,}000\ W$$

$$\frac{60\ sec}{1\ min} \cdot 5\ min = 300\ sec$$

7. How much work is done using a 60. watt light bulb for 1.0 hour?

$W = P \cdot t = 60.\text{J/sec} \cdot 3600\,\text{sec} = 216{,}000\,\text{J}$

$\frac{60\,\text{min}}{1\,\text{hr}} \cdot \frac{60\,\text{sec}}{1\,\text{min}} = 3600\,\text{sec}$

$\rightarrow 220{,}000\,\text{J}$

8. What is the efficiency of a simple machine that produces 1,500 J of useful work from 4000. J of work input?

$\text{eff} = \frac{\text{work output}}{\text{work input}} \times 100 = \frac{1500\,\text{J}}{4000.\,\text{J}} \times 100 = 37.5\%$

$= 38\%$

9. Using a lever, a person applies 60. N of force and moves the lever 1.0 m. This moves a 200. N rock at the other end by 0.20 m. What is the efficiency of this simple machine?

$W = f \cdot d = 60.\text{N} \cdot 1.0\,\text{m} = 60\,\text{J}$

$W = f \cdot d = 200.\text{N} \cdot 0.20\,\text{m} = 40\,\text{J}$

$\text{eff} = \frac{40\,\text{J}}{60\,\text{J}} \times 100 = 66.66\ldots\% = 67\%$

10. A pulley system is pulled downward with a force of 300. N for a distance of 4.0 m. This results in an 1100 N object moving upward a distance of 0.40 m. What is the efficiency of this pulley system?

$W = f \cdot d = 300.\text{N} \cdot 4.0\,\text{m} = 1200\,\text{J}$

$W = f \cdot d = 1100\,\text{N} \cdot 0.40\,\text{m} = 440\,\text{J}$

$\text{eff} = \frac{\text{work output}}{\text{work input}} \times 100 = \frac{440\,\text{J}}{1200\,\text{J}} \times 100 = 36.666\ldots\%$

$= 37\%$