

Lesson 11.1: Work and Power

Work – transforming or converting energy. This change in energy is measured in joules (J)

$$\text{Work} = \Delta \text{Energy}$$

Energy – An object has energy if it has the ability to do work.

Refer students to pg. 337 for the different types of energy

Orally:

Q: Describe an energy transformation using the energy types listed on pg. 337 Table 1.

A: Will vary.

Law of conservation of energy – When energy is converted from one type to another, there is no energy created or lost. (i.e., the energy in = the energy out.)

e.g., 100J of electrical energy run into a light bulb --> 15J of light energy are produced and 85J of heat energy are produced.

Power: - The rate at which work (energy transformation) is done.

$$P(\text{Watts}) = \text{Work}(\text{Joules})/\text{time}(\text{seconds}) \quad * \text{Work} = \Delta E$$

$$1.0 \text{ watt (W)} = 1.0 \text{ J/s}$$

Problem 1: Calculate the power of a hair dryer that uses 20 000J of energy every 16s

$$P = \text{Work}/\text{time}$$

$$P = 20\,000\text{J}/16\text{s}$$

$$P = 1\,250\text{J/s} = \mathbf{1\,250W}$$

Problem 2: Calculate the work done by a 100W light bulb over the course of an hour?

$$P = \text{Work}/\text{time}$$

$$100\text{W} = \text{Work}/(1\text{hr} \times 60\text{min}/\text{hr} \times 60\text{s}/\text{min})$$

$$100\text{W} = \text{Work}/3600\text{s}$$

$$360000\text{J} = \text{Work done (The energy change } \Delta E)$$

Problem 3: Calculate the time in minutes that elapse when a refrigerator rated at 450W converts 35 000J of energy.

$$P = \text{Work}/\text{time}$$

$$450\text{W} = 35000\text{J}/\text{time}$$

$$77.8\text{s} = \text{time}$$

$$77.8\text{s} \div 60\text{s}/\text{min} = 1.3\text{min}$$

Problem 4: A clock operates on 2 W of power. If the battery of the clock has 15 kJ of stored energy, how many hours can the clock operate for?

$$15\text{kJ} \times 1000\text{J}/\text{kJ} = 15000\text{J}$$

$$P = \text{Work}/\text{time}$$

$$2\text{W} = 15000\text{J}/\text{time}$$

$$7500\text{s} = \text{time}$$

$$7500\text{s} \div 60\text{s}/\text{min} \div 60\text{min}/\text{hr} = 2.1\text{hr}$$

Assign: CYU 11.1 #1, 2, 4 – 7, 8b, 9

Pg 339.