Pg. 241

#1 a) $E_g \rightarrow E_k, E_g \rightarrow E_k$

#4. $F_{NET} = ma$

$V_i = 0$

$V_f = ?$

$V_f = V_i + a\Delta t$

$V_f^2 = V_i^2 + 2a\Delta d$ ($V_i^2 = 0$)

a) $\therefore V_f^2 = 2a\Delta d$

b) $E_k = \frac{mv^2}{2}$

$E_k = \frac{m 2a\Delta d}{2}$

$E_k = ma\Delta d$

$a\Delta d$

$\frac{m}{s^2}\ m$

$= \frac{kgm^2}{s^2}$ J

$g = 9.8 \frac{m}{s^2}$ $\quad g = 9.8 \frac{N}{kg}$

$$g = 9.8 \frac{\cancel{kg}\ \frac{m}{s^2}}{\cancel{kg}}$$

EFFICIENCY, TYPES OF ENERGY, AND POWER

SPH3U – Unit 3

EFFICIENCY

- Efficiency:
  - the amount of useful energy produced in an energy transformation expressed as a percentage of the total amount of energy used

$$efficiency = \frac{E_{out}}{E_{in}} \times 100\%$$

OR $\text{efficiency} = \frac{W_{OUT}}{W_{IN}} \times 100\%$

OR $\text{efficiency} = \frac{P_{OUT}}{P_{IN}} \times 100\%$

SOURCES OF ENERGY

- Energy Resource
  - energy rich substance

- Non-Renewable Energy Resource
  - a substance that cannot be replenished as it is used in energy-transforming processes

- Renewable Energy Resource
  - a substance with an unlimited supply or a supply that can be replenished as the substance is used in energy transforming processes

NON-RENEWABLE ENERGY RESOURCES

- Fossil Fuels
  - fuel produced by the decayed and compressed remains of plants that lived hundreds of millions of years ago eg. coal, oil

- Nuclear Energy
  - form of potential energy produced by interactions in the nucleus of atoms
    - Nuclear fission – the decomposition of large, unstable nuclei into smaller, more stable nuclei
    - Nuclear fusion – a nuclear reaction in which two atoms fuse together to form a larger nucleus

RENEWABLE ENERGY RESOURCES

- Solar Energy
  - Energy from the sun
    - Passive solar design – building design that uses the sun's radiant energy directly for heating
    - Photovoltaic cell – a device that transforms radiant energy into electrical energy

- Hydroelectricity
  - electricity produced by transforming the kinetic energy of rushing water into electrical energy

POWER

- Power (P)
  - the rate of transforming energy or doing work

$$P = \frac{\Delta E}{\Delta t} \quad \text{or} \quad P = \frac{W_{net}}{\Delta t}$$

UNITS OF POWER

- Power is measured in watts (James Watt)
- 1 watt (W) = 1 Joule / second
- scalar quantity

Pg. 243 Practice #1.

Given: $E_{IN} = 5200\,J$

$m = 50.0\,kg$

$\Delta d = 4.0\,m$

Required: Efficiency

Analysis: $Eff = \frac{E_{out}}{E_W} \times 100\%$

$E_{OUT} = E_g = mgh$

Steps $E_{OUT} = (50.0\,kg)\left(9.8\frac{m}{s^2}\right)(4.0\,m)$

$E_{OUT} = 1960\,J$

$Eff = \frac{1960\,J}{5200\,J} \times 100\%$

$Eff = 38\%$

Pg 251

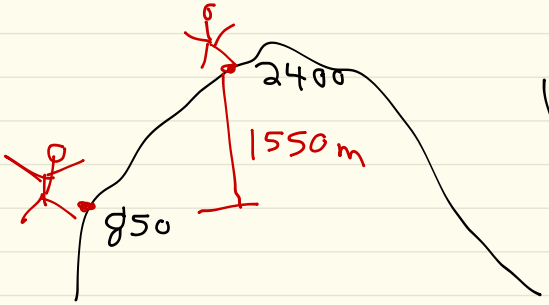
#2.

$$P = \frac{W_{NET}}{\Delta t}$$

Given: $m = 55\,kg$

$h_1 = 850\,m$ $\quad t_1 = 9\,am$

$h_2 = 2400\,m$ $\quad t_2 = 12\,Noon$ $\quad > 3\,hrs$



$$W = \Delta E_g$$

$$W = mg\Delta h$$

$$W = (55\,kg)\left(9.8\,\frac{m}{s^2}\right)(1550\,m)$$

$$W = 835\,450\,J$$

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

$$3\,hrs \times \frac{60\,min}{1\,hr} \times \frac{60\,s}{1\,min}$$

$$\Delta t = 10\,800\,s$$

$$P = \frac{835\,450\,J}{10\,800\,s}$$

$$P = 77\,W$$

Pg. 251 #3

Given: $m = 60.0\ kg$

$v_1 = 0\ m/s$

$v_2 = 12\ m/s$

$\Delta t = 6.0\ s$

Required: Power $= P$

Analysis:

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

$$W = \Delta E_k = \frac{mv_2^2}{2}$$

Steps:

$$W = \frac{mv_2^2}{2}$$

$$= \frac{(60\ kg)(12\ m/s)^2}{2}$$

$$W = 4320\ J$$

$$P = \frac{4320\ J}{6.0\ s}$$

$$P = 720\ W$$

QUESTIONS

- Pg. 249 # 1-3
- Pg. 254 #1-5