Energy 11/12/2022

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Energy cannot be created or destroyed, only transferred, what is this principle called?
Law of Conservation of Energy

What is the difference between an energy store and an energy transfer?
Store - Where energy is kept
Transfer - Movement of energy between stores

What is the equation for kinetic energy?
$$\boldsymbol{E_k = \frac{1}{2}mv^2}$$

What is the name for energy held by particles?
Internal Energy (Thermal)
$$\boldsymbol{Internal\ energy = Potential\ energy + Kinetic\ energy}$$

Required to Remember

Energy Stores:

- **Chemical Energy, Bond Energy**
- **Kinetic Energy,** $\boldsymbol{E_k = \frac{1}{2}mv^2}$
- **Gravitational Potential Energy,** $\boldsymbol{E_p = mgh}$
- **Elastic Potential Energy,** $\boldsymbol{E_e = \frac{1}{2}ke^2}$
- **Internal (Thermal) Energy, Potential + Kinetic**

Internal Energy:

- **For potential use specific latent heat:** $\boldsymbol{E = mL}$
- **For kinetic use specific heat capacity:** $\boldsymbol{\Delta E = mc\Delta\theta}$

Energy Transfers:

- **Work Done, $W = Fs$**
- **Waves: Sound, Light, Electrical Current**

Exam Questions:

A condenser transfers energy from a coolant to the air in a building.

When the total energy input to the heat pump system is 1560 kJ the temperature of the air in the building increases from 11.6 °C to 22.1 °C.

The efficiency of the heat pump system is 87.5%.

The mass of the air inside the building is 125 kg.

Calculate the specific heat capacity of the air in the building.

Give your answer in standard form.

(6)

$$1\,560\,000\,J \times 0.875 = 1365000\,J$$
$$22.1\,°C - 11.6\,°C = 10.5\,°C$$
$$\Delta E = mc\Delta\theta$$
$$c = \frac{\Delta E}{m\Delta\theta}$$
$$c = \frac{1365000}{125 \times 10.5} = 1040\,J/kg\,°C$$
$$c = 1.04 \times 10^3\,J/kg\,°C$$

The initial temperature of an ice cream mixture was +20 °C. The mixture froze at -1.5 °C.

A total of 165 kJ of internal energy was transferred from the mixture to cool and freeze it.

Specific heat capacity of the mixture = 3500 J/kg °C.

Specific latent heat of fusion of the mixture = 255 000 J/kg.

Calculate the mass of the mixture.

Give your answer to 2 significant figures.

(6)

$$\boldsymbol{E = mL}$$
$$\boldsymbol{\Delta E = mc\Delta\theta}$$
$$\boldsymbol{20 - (-1.5) = 21.5\ ^{\circ}C}$$
$$\boldsymbol{E = m(L + (c\Delta\theta))}$$
$$\boldsymbol{m = \frac{E}{L + (c\Delta\theta)}}$$
$$\boldsymbol{m = \frac{165000}{(3500 \times 21.5) + 255000} = \frac{660}{1321}}$$
$$\boldsymbol{m = 0.50\ kg}$$