

Name: _____ Date: _____ Period: _____

Objectives:

3.1 Thermal concepts

3.2 Thermal properties of matter

3.1.1 State that temperature determines the direction of thermal energy transfer between two objects.

Students should be familiar with the concept of thermal equilibrium.

3.1.2 State the relation between the Kelvin and Celsius scales of temperature.

$T \text{ (K)} = T \text{ (}^\circ\text{C)} + 273$ is sufficient.

3.1.3 State that the internal energy of a substance is the total potential energy and random kinetic energy of the molecules of the substance.

Students should know that the kinetic energy of the molecules arises from their random/translational/rotational motion and that the potential energy of the molecules arises from the forces between the molecules.

3.1.4 Explain and distinguish between the macroscopic concepts of temperature, internal energy and thermal energy (heat).

Students should understand that the term thermal energy refers to the non-mechanical transfer of energy between a system and its surroundings. In this respect it is just as incorrect to refer to the “thermal energy in a body” as it would be to refer to the “work in a body”.

3.1.5 Define the mole and molar mass.

3.1.6 Define the Avogadro constant.

3.2.1 Define specific heat capacity and thermal capacity.

3.2.2 Solve problems involving specific heat capacities and thermal capacities.

3.2.3 Explain the physical differences between the solid, liquid and gaseous phases in terms of molecular structure and particle motion.

Only a simple model is required.

3.2.4 Describe and explain the process of phase changes in terms of molecular behavior.

Students should be familiar with the terms melting, freezing, evaporating, boiling and condensing, and should be able to describe each in terms of the changes in molecular potential and random kinetic energies of molecules.

3.2.5 Explain in terms of molecular behavior why temperature does not change during a phase change.

3.2.6 Distinguish between evaporation and boiling.

3.2.7 Define specific latent heat.

3.2.8 Solve problems involving specific latent heats.
Problems may include specific heat calculations.

3.2.9 Define pressure.

3.2.10 State the assumptions of the kinetic model of an ideal gas.

3.2.11 State that temperature is a measure of the average random kinetic energy of the molecules of an ideal gas.

3.2.12 Explain the macroscopic behavior of an ideal gas in terms of a molecular model.

Only qualitative explanations are required. Students should, for example, be able to explain how a change in volume results in a change in the frequency of particle collisions with the container and how this relates to a change in pressure and/or temperature.

Formula Sheet:

$P = \frac{F}{A}$ P: pressure (N m^{-2} or Pascals, Pa); F: net force (N); A: area (m^2)

$Q = mc\Delta T$ Q: thermal energy (J); m: mass (kg); c: specific heat capacity ($\text{J kg}^{-1} \text{K}^{-1}$); ΔT : temperature change (K)

$Q = mL$ L: specific latent heat (J kg^{-1})

Unit Conversions:

$1 \text{ atm} = 1.01 \times 10^5 \text{ N m}^{-2} = 101 \text{ kPa} = 760 \text{ mm Hg}$