

ENGG201 Summary Notes 1

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1. States of Matter: gas, liquid, solid (multiple), plasma
2. Possible for material to co-exist simultaneously in 3 states (triple point).
3. Engineer needs to know properties of materials and how properties change with pressure, temperature, composition, so as to design or create processes or equipment.
4. Fundamental quantity = mass, length, time, temperature, electric current, luminous intensity.
5. Derived (or compound) quantities = combinations of fundamental quantities, e.g. density, velocity, acceleration, force, pressure.
6. Can represent dimensions of a quantity A by: $[A] = [M]^{\alpha} [L]^{\beta} [t]^{\gamma}$.
7. Dimensions must match throughout an equation, that is, all additive terms on both sides of an equation must match.
8. Some quantities are dimensionless, that is, they have no units. Exponents (such as the 2 in x^2), transcendental functions (e.g. log, exp, sin, cos, etc.) and arguments of transcendental functions are dimensionless.
9. Units are attached to most quantities that represent physical measurements of the properties of matter. Eg. 1 m/s, 20 km/h, 40 kg, 9.81 m/s².
10. Base units of SI:

Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Temperature	Kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd
11. Density = mass / volume.
12. Pressure = force / area.
13. Speed = distance traveled / time.
14. $T(K) = T(^{\circ}C) + 273.15$
 $T(^{\circ}F) = 1.8 T(^{\circ}C) + 32$
 $T(^{\circ}R) = 1.8 T(K)$ $^{\circ}R$, Rankine temperature scale.

1. Conservation principles:

Mass

Energy

Momentum (product of mass and velocity, rate of change of momentum is the net force acting on an object).

2. Conservation of Mass:

Mass In + Mass Generated = Mass Out + Mass Accumulated

3. Conservation of Energy, Energy balance on closed system:

Final		Initial		Net Energy
System	-	System	=	Transferred to
Energy		Energy		the System

System Energy consists of internal, kinetic, potential energy.

Transferred Energy consists of work and heat.

4. Conservation of Momentum, Newton's laws:

a. body at rest or in motion will remain in the corresponding state until acted on by a force

b. $a = F/m$; $F = ma$

c. net force exerted by the surroundings on a body is equal to and opposite the force the body exerts on the surroundings.

1. Temperature:
Attribute that provides a measure of how hot or cold a material is.
2. Temperature is determined relative to a reference state.
3. Energy can be converted between different forms.
4. Two categories of energy:
State = depend on the current state of the system (are a property of the system)
Path = transferred energy, not a property of the system.
5. State = internal, potential, kinetic energies.
6. Path = work and heat.
7. Internal Energy = is the energy stored in the system and it depends on nature and thermal state of material.
8. Potential Energy = is the energy needed to lift a material from a datum point to an elevated point ($PE = mgh$). Other form is the energy stored in a compressed or extended spring.
9. Kinetic Energy = is the energy that would be recovered if the body was brought to rest ($KE = mu^2/2$).
10. Work = force acting through a distance.
11. Heat = thermal energy transferred between bodies that have different temperatures.
12. Heat capacity = quantity of heat required to raise the temperature of a material by one degree. If amount of material is 1 kg, then it is called the specific heat capacity.