

Some important terms and concepts for exam 1

Here is a list compiled from all the lectures (through Feb.22). Of course not all of these will be tested, but some familiarity with these helps understand what has been discussed.

"Fermi problems" (Piano tuners, oil consumption, water usage, electricity usage)

Avogadro's Number: $N_o = 6.0 \times 10^{23}$

1 Mole (of substance with atomic mass number [or atomic weight] A)

= A grams, which contains N_o units

speed or velocity = $v = \text{distance}/\text{time}$ or $v = d/t$

acceleration = change of velocity over time = $\Delta v / \Delta t$

acceleration due to gravity = $g = 9.8 \text{ m/s}^2$ $d = (1/2)gt^2$

Force = mass \times acceleration Work = force \times distance

Power = Energy/time

waves: disturbances of a medium that propagate due to elasticity of the medium

Electromagnetic waves

$c = 3.0 \times 10^8 \text{ m/sec}$

EM spectrum

Energy units: Amount of work required to lift 1 Kg a distance of about 10 cm

(0.1 m) is

$\approx 1 \text{ Joule of energy (MKS)} = 10^7 \text{ erg} \approx 0.7 \text{ ft-lb}$

$\approx 9 \times 10^{-4} \text{ BTU} \approx 6 \times 10^{18} \text{ eV} \approx 3 \times 10^{-7} \text{ KWh}$

$\approx 0.2 \text{ cal (1/1000 food Cal)}$ different units for different sizes of phenomena

1 kiloton = $4.2 \times 10^{12} \text{ J}$

— 1 Kg *weighs* 2.2 lbs (force) Work = $F \cdot d$

Classical Kinetic Energy = $1/2 mv^2$

Classical Momentum = $p = mv$

Relativity:

Inertial frame

Einstein's two Postulates of Special Relativity

Light clock, Proper time, proper length

Synchronization, simultaneity

Keep track of Frames of Reference in following relations:

$$\text{time dilation: } t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}} \quad \text{length contraction: } L = L_0 \sqrt{1 - \frac{v^2}{c^2}}$$

$$\text{velocity addition } u = \frac{u' + V}{1 + \frac{Vu'}{c^2}}$$

$$\text{momentum: } p = \frac{m_0 u}{\sqrt{1 - \frac{u^2}{c^2}}} \quad \text{energy: } E = \frac{m_0 c^2}{\sqrt{1 - \frac{u^2}{c^2}}} = \text{Kinetic Energy} + m_0 c^2$$

Twin paradox, rest mass, relativistic mass, rest energy or mass-energy

Nucleus, atomic number, atomic mass or mass number, isotope, A & Z
Mass defect, binding energy, binding energy per nucleon, fusion, fission
curve of binding energy

Equivalence Principle, accelerating frames, bending of light by gravity, curvature of space-time, solar eclipse, cosmology