# Topic 8 – Heat

Specific heat capacity (c) - E required to raise t of 1 kg substance by 1 K

Specific latent heat (L) - E required to change state of 1 kg substance at constant t

## Molecule speeds

mean of sum of squares of speeds of individual molecules

## Ideal gas equation

**Conditions: molecules**

1. Negligible size
2. Identical
3. Exert no force on each other except during collisions
4. Random motion

# Topic 9 – Nuclear physics

## Particle interactions

|  |  |  |
| --- | --- | --- |
| **Particle** | **General equation** | **Dangers / effects** |
| Alpha |  | High ionization (outside ok inside dead) |
| Beta |  | Moderate ionization (slight damage) |
| Gamma |  | Minimal ionization |

## Fusion & fission

### Binding energy

Higher more stable as it requires more E to pull the nucleus apart

### Binding energy per nucleon graph

Low N Lowless stableweaker electrostatic force ∴ Fusion

Fe is the most stable element as highest

High N less stable ∴ Fission

Nuclear fusion - Small nuclides that combine together to make larger nuclei, releasing E

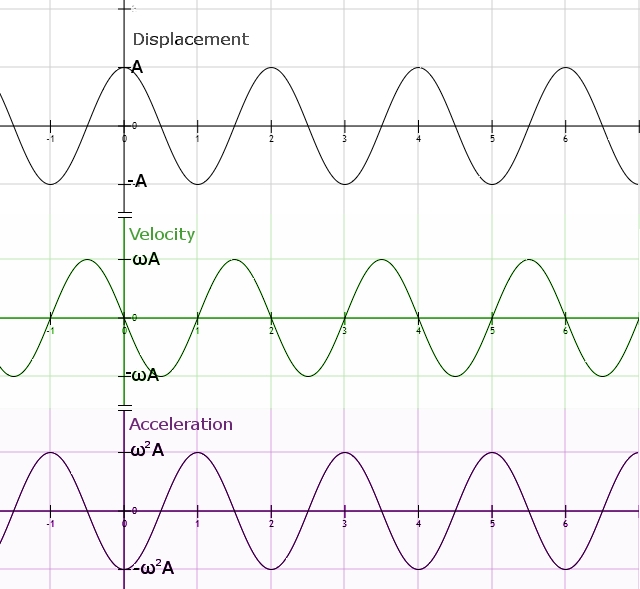
**Fusion facts:**

1. High KE and density required to fuse two nuclei, to overcome the electrostatic repulsion between protons
2. Fusion product mass less than sum of reactants as E released

# Topic 10 – Simple harmonic motion (SHM)

**Conditions:**

1. A force continually trying to return object to center position
2. Fdisplacement from center position

Assuming :

### Graphs

## Conservation of energy

Free oscillations have all E conserved.

## Terminologies

### Resonance

When the frequency of the applied force to an oscillating system is equal to its natural frequency , the amplitude of the resulting oscillations increases significantly

### Damping

Reduction in energy and amplitude of oscillations due to resistive forces on the oscillating system

**Types of damping:**

1. Light / under:
2. Critical:
3. Heavy / over:

# Topic 11 – Gravity and space

## Gravitational forces

Gravity is always attractive

## Starshine

Black body radiation - Object that completely absorbs all radiation that lands on it

Wien’s law:

## Star classifications

H-R diagram

### Star formation

* Dust & gas clump together by gravityprotostar
* Star undergoes nuclear fusion
* Binding E diffrelease E as EM radiationheat star
* Gravitational collapse prevented by pressure of vibration of particles

### Life cycles

**Low-mass stars (~1x Sun)**

**Massive stars (>4x Sun, blue supergiant)**

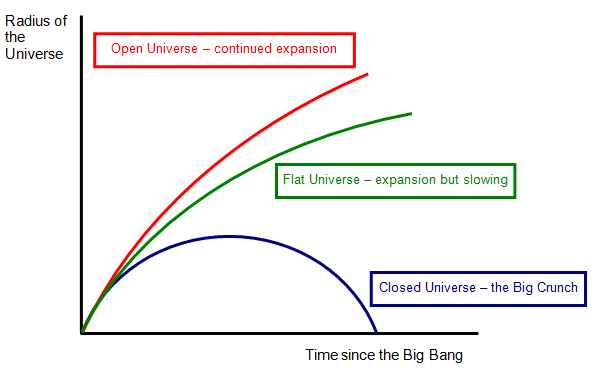
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## Distance to stars

## Calculation of the age of the universe

## Theories of the fate of everything

Critical density - Density of matter in the Universe, below which universe will expand forever



* Dark matter can’t be seen and that does not emit or absorb electromagnetic radiation.
* It explains why stars orbit galaxies even if the centripetal force by the mass of stars is lower than needed.
* Gravitational lenses verify existence of dark matter, as masses deform space-time which bends light. This bending effect is observed in photographs of deep space.