# 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

Why does increasing temperature increase the pressure?

1. Atoms moves faster
2. More frequent collisions
3. Rate of change of momentum is greater
4. Larger force

## 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 |

Show half-life equals…

* Read from graph at least 2 half-lives

Why can’t use activity to determine age

* Time scale too long
* Activity

## 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

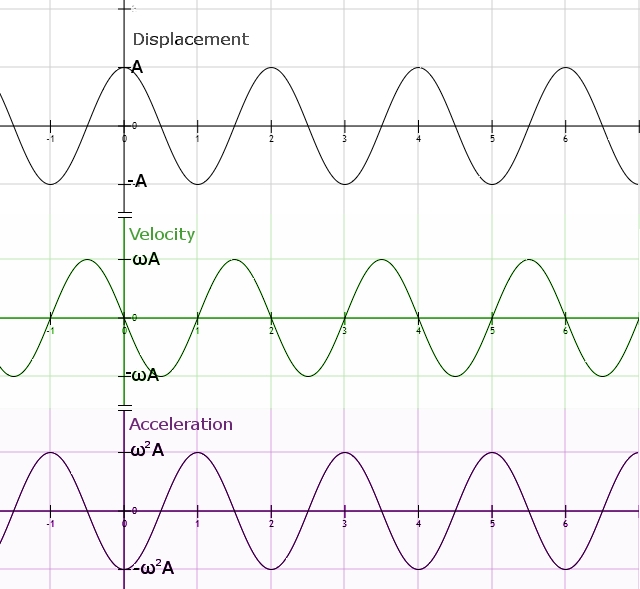
**Fusion facts:**

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

Standard candle - Object with known luminosity

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)**

<Check according to past papers for marking>

## Distance to stars

Parallax - Change in position relative to background

Inverse square law:

Determine distance by standard candle

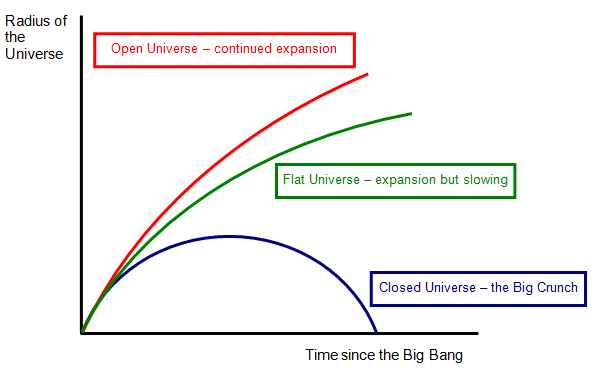
1. Standard candle – object of known luminosity
2. Identify object standard candle and measured
3. Inverse square law used

## Calculation of the age of the universe

Approaching Distancing

## 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.