Fusion & Stars

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Course	HL IB Physics
Section	Nuclear & Quantum Physics
Topic	Fusion & Stars
Difficulty	Easy

To be used by all students preparing for HL IB Physics
Students of other boards may also find this useful

1

The incorrect answer is **B** because:

- The process of nuclear fusion **releases** energy, rather than absorbing it
- All the other statements are **true**
- Option **B** is the only false statement

A is correct as for fusion to occur both nuclei must have high kinetic energy.

C is correct as fusion is the combining of two smaller nuclei into a larger nucleus.

D is correct as fusion is the process that powers stars.

2

The correct answer is **C** because:

- The **temperature** must be **very high** for the nuclei to come close enough for fusion to occur
- The **density** must also be **very high** for the rate of collision of nuclei to be sufficient to sustain fusion

3

The correct answer is **D** because:

- This is the Hertzsprung-Russel diagram
- The points are:
  - W = main sequence (very hot) stars
  - X = white dwarfs
  - Y = main sequence (cooler) stars
  - Z = red giants
- An ordinary star will either be at W or Y and then move to X (at the very end of its life) or Z (just after it has run out of fuel)
- Therefore, the only path in the options that works is Y → Z

A & C are incorrect as stars do not move **along** the sections where all the main sequence stars are plotted in the middle of the diagram.

B is incorrect as X is where the white dwarfs are, which a star turns into at the end of its lifecycle (long after being a main sequence star).

4

The correct answer is **D** because:

- A star of 10 solar masses is classed as a high-mass star
- The evolution of a star much more massive than the Sun is:
  - nebula → protostar → main sequence star → red supergiant → supernova → neutron star

A is incorrect because the supernova stage always follows the red supergiant stage

B is incorrect because this includes stages in the wrong order (e.g. nebula → planetary nebula) as well as mixing up low-mass and high-mass evolution sequences (e.g. a supernova would never occur before a white dwarf)

C is incorrect because this shows the correct sequence for a low-mass star (i.e. a star similar to the Sun), but this is not correct for a high-mass star

5

The correct answer is **A** because:

- The angle of stellar parallax is $p(arc\text{-}second) = \frac{1}{d\ (parsec)}$
- This tells us
  - The greater the parallax angle, the closer the star is to Earth
  - The smaller the parallax angle, the further the star is from Earth
- Star X has a larger parallax angle than Star Y
- Hence, Star X is closer to Earth than Star Y