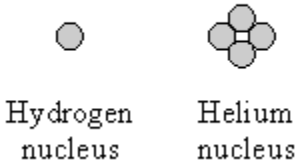
Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

At the very high temperatures in the sun, hydrogen is converted into helium. It takes four hydrogen nuclei to produce one helium nucleus.

The table shows the relative masses of hydrogen and helium nuclei.



Nucleus	Relative Mass
hydrogen	1.007825
helium	4.0037

(a) Use these figures to calculate what happens to the mass of the sun as hydrogen is converted to helium.

_____

_____

_____

_____

(3)

(b) Use your answer to part (a) to explain how the sun has been able to radiate huge amounts of energy for billions of years.

_____

_____

_____

(2)

(Total 5 marks)

Q2.

The energy radiated by a **main sequence** star like the Sun is released by a nuclear fusion reaction in its core.

Read the following information about this reaction then use it to answer the questions below.

- The net result of the nuclear fusion reaction is that four hydrogen nuclei produce one helium nucleus. There is a loss of mass of 0.7%.

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- For nuclear fusion to occur nuclei must collide at very high speeds.
- The energy released during the reaction can be calculated as shown:

energy released [J] = loss of mass [kg] × (speed of light [m/s^2])

(The speed of light is 3×10^8 m/s)

(a) Calculate the energy released when 1g of hydrogen fuses to form helium.

(*Show your working*.)

_____

_____

_____

_____

_____

_____

(4)

(b) The table shows the lifetimes and surface temperatures of main sequence stars with different masses.

MASS OF STAR [SUN = 1]	LIFETIME ON MAIN SEQUENCE [MILLION OF YEARS]	SURFACE TEMPERATURE * [KELVIN]
0.5	200 000	4000
1	10 000	6000
3	500	11 000
15	15	30 000

[* The higher the surface temperature of a star, the higher the temperature and pressure in its core.]

(i) Describe the relationship between the lifetime of a main sequence star and its mass.

_____

_____

_____

(2)

(ii) Suggest an explanation for this relationship.

_____

_____

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_____

(3)

(Total 9 marks)

Q3.

Explain, in as much detail as you can, the scientific evidence for the “big bang” theory of the origin of the Universe.

_____

_____

_____

_____

_____

_____

_____

(Total 5 marks)

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