AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.8.1 SOLAR SYSTEM, STABILITY OF ORBITAL MOTIONS AND SATELLITES (PACK 2)

SCORE	PERCENTAGE
/39	%

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Q1.

Studying stars gives scientists evidence about the evolution of the Universe.

(a) (i) In astronomy, what is meant by a black hole?

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(2)

(ii) How is it possible to detect a black hole?

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(2)

(b) The changes which happen in stars result in new elements being formed.

Nuclei of the heaviest elements are found in the Sun.

Describe how these nuclei are formed.

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(2)

(Total 6 marks)

Q2.

One theory of the origin of the Universe was that billions of years ago all matter was in one place, then it exploded (‘big bang’).
Describe, in as much detail as you can, how our star (the Sun) formed from the time when there was just dust and gas (mostly hydrogen) up to now when it is in its main stable period.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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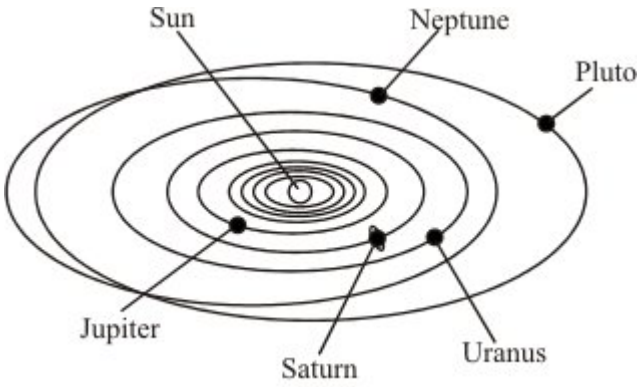
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(Total 5 marks)

Q3.

The Sun at the centre of our solar system is a star.



(a) The Sun contains nuclei of the heaviest elements. Atoms of these heaviest elements are also present in the planets of the solar system. What does this suggest about the material from which the solar system is formed?

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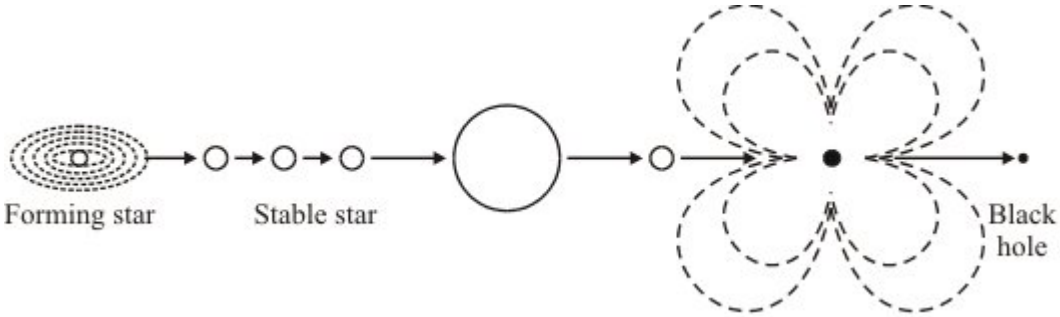
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(1)

(b) Stars form from gas (mostly hydrogen) and dust.



Describe, in as much detail as you can, what forces allow a stable star to exist and how the star may eventually form a black hole.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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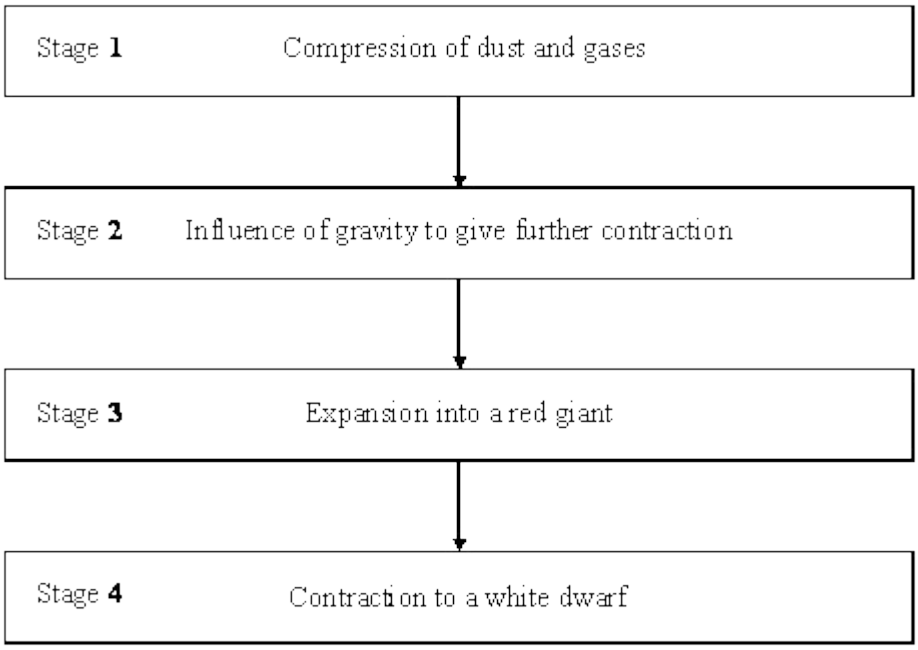
(6)

(Total 7 marks)

Q4.

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The flowchart shows four stages thought to occur in the evolution of a star such as our Sun.



At a particular time a star might have reached one of these stages or be between stages or be at a further stage. What period in its evolution has our star, the Sun, reached?

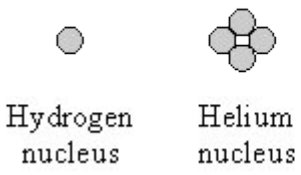
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(Total 1 mark)

Q5.

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.

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(3)

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(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.

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(2)

(Total 5 marks)

Q6.

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%.
- 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/s²])

  (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*.)

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(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

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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.

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(2)

(ii) Suggest an explanation for this relationship.

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(3)

(Total 9 marks)

Q7.

Describe, in as much detail as you can, the life history of a star like our Sun.

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(Total 6 marks)

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