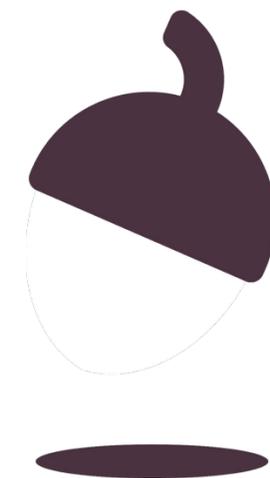


Physics - Key Stage 4
Space

Element synthesis

Students' downloadable resources

Mr C White



OAK
NATIONAL
ACADEMY

Question slides from video



Independent task 1

Answer these questions.

- (1) What is the most abundant element in the universe?
- (2) Which element is made in the core of a main sequence star?
- (3) What is the process called when small nuclei join to make larger nuclei?
- (4) What is the largest nucleus that is able to be made inside the core of a red giant?
- (5) Approximately how many (to the nearest 10) naturally occurring elements are there?
- (6) Name the two possibilities for the end of the life cycle of a star much more massive than our Sun.



Independent task 2

Answer these questions.

- (1) Explain why a supernova is a likely reason why elements are distributed throughout space.
- (2) A student asked his teacher if the Sun would one day become a black hole. State the likely ending of the Sun's life and explain why the Sun could not become a black hole.
- (3) The element helium was discovered in the Sun before it was found here on Earth. Suggest and explain where
 - (a) the helium in the Sun originated and
 - (b) the helium on the Earth originated.



EXAM STYLE QUESTIONS - PART ONE

(1) Choose words from the list below to complete the sentences.

FISSION FUSION HYDROGEN HELIUM CARBON STARS
BLACK HOLES NEUTRON STARS NEBULAE

The early universe only contained the element _____. At this point in the past, stars had not formed, so the element _____ could not have been formed in _____ by the process of _____. (4 marks)

(2) Explain the differences between:

(a) a protostar and a main sequence star; (2 marks)

(b) fusion in a red giant and fusion in a main sequence star. (6 marks)



EXAM STYLE QUESTIONS - PART TWO

(3) A student argued that in order for the main sequence period of a star's life to end, the helium in the star needed to run out.

(a) Explain whether the student is correct or not. (2 marks)

A scientist theorised that some very ancient planets that were the first to form after the first, sun-like stars died, would not be made up of a diverse range of chemical compounds.

(b) Explain why this could be true. (3 marks)

Gold can be found in mines on Earth.

(c) What does this suggest about the origin of the matter that made the Earth? (2 marks)



Answers



Independent task 1 - SOLUTIONS

- (1) What is the most abundant element in the universe? **hydrogen**
- (2) What element is made in the cores of main sequence stars? **helium**
- (3) What is the process called when small nuclei join to make larger nuclei? **(nuclear) fusion**
- (4) What is the largest nucleus that is able to be made inside the core of a red giant? **iron**
- (5) Approximately how many (to the nearest 10) naturally occurring elements are there? **90**
- (6) Name the two possibilities for the end of the life cycle of a star much more massive than our Sun. **neutron star/black hole**



Independent task 2 - SOLUTIONS

- (1) Explain why a supernova is a likely reason why elements are distributed throughout space. **Supernova is an explosion with large quantity of kinetic energy which propels matter into space**
- (2) A student asked his teacher if the Sun would one day become a black hole. State the likely ending of the Sun's life and explain why the Sun could not become a black hole. **Black dwarf / it does not have enough mass to become a black hole**
- (3) The element helium was discovered in the Sun before it was found here on Earth. Suggest and explain where
 - (a) the helium in the Sun originated **from the fusion (of hydrogen) in the Sun**
 - (b) the helium on the Earth originated **from the fusion of hydrogen from previous stars - Earth is made from matter from dead stars**



EXAM STYLE QUESTIONS - SOLUTIONS - PART ONE

(1) Choose words from the list below to complete the sentences.

FISSION FUSION HYDROGEN HELIUM CARBON STARS
BLACK HOLES NEUTRON STARS NEBULAE

The early universe only contained the element **HYDROGEN**. At this point in the past, stars had not formed, so the element **HELIUM** could not have been formed in **STARS** by the process of **FUSION**. (4 marks)

(2) Explain the differences between:

(a) a protostar **COOLER/LOW TEMP (1) /NO FUSION (1)** and a main sequence star **FUSION/EMITS HIGHER ENERGY RADIATION - distinction must be clear**

(b) Fusion in a red giant **fuses He (1) to make elements up to Fe (1)/RADIATION LESS ENERGETIC (1)** and fusion in a main sequence star **fuses H (1) to make He (1) /RADIATION MORE ENERGETIC (1) owtte.**



EXAM STYLE QUESTIONS - PART TWO

(3) A student argued that in order for the main sequence period of a star's life to end, the helium in the star needed to run out.

- (a) Explain whether the student is correct or not. **Not correct (1) /hydrogen fusion decreases as hydrogen starts to deplete NOT helium (1)**

A scientist theorised that some very ancient planets that were the first to form after the first stars died, would not be made up of a diverse range of chemical compounds.

- (b) Explain why this could be true. **Some planets may be made from matter left over ONLY from the first smaller stars (1) /no nuclei larger than iron produced (1) /less variety of elements, fewer compounds (1)**

Gold can be found in mines on Earth.

- (c) What does this suggest about the origin of the matter that made the Earth? **Earth must be made from matter left over from supernova explosions (in the past) (1) as these are events that can synthesise heavy elements such as gold (1)**

