Name _____
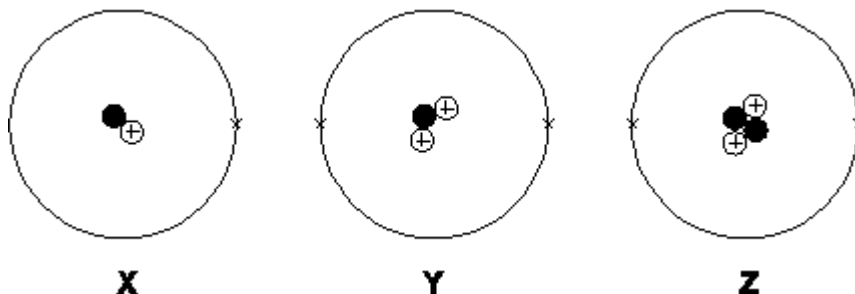
Q24.   (a)   The diagrams represent three atoms, **X**, **Y** and **Z**.

Which of these atoms are isotopes of the same element?

....

Give a reason for your answer.

....

....

(2)

(b)   In a star, nuclei of atom **X** join to form nuclei of atom **Y**.

Complete the sentences.

The process by which nuclei join to form a larger nucleus is called

nuclear ....

This is the process by which a star releases ....

(2)

(c)   *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

A star goes through a lifecycle.

Describe the lifecycle of a star like the Sun.

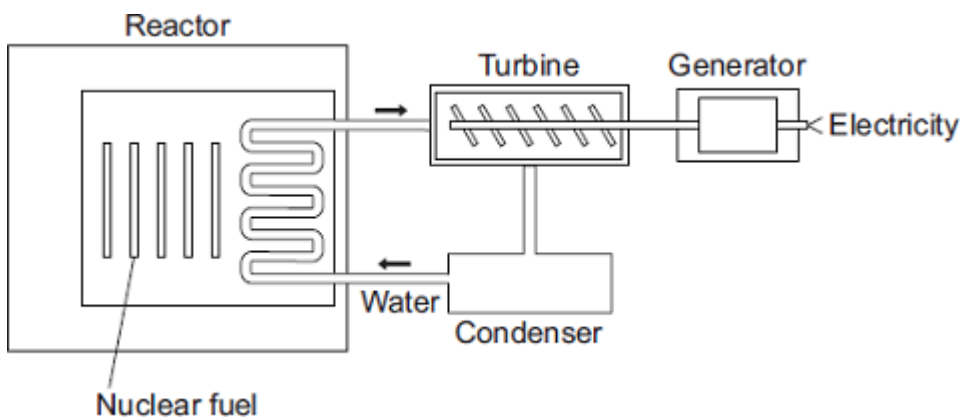...

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(6)
(Total 10 marks)

Q25. Nuclear power stations use the energy released from nuclear fuels to generate electricity.

(a)   Which substance do the majority of nuclear reactors use as fuel?

Draw a ring around your answer.

plutonium-239   thorium-232   uranium-235

(1)

(b)   Energy is released from nuclear fuels by the process of nuclear fission.

Describe what happens to the nucleus of an atom during nuclear fission.

....

....

....

....

(2)

(c)   Use words from the box to complete each sentence.

condenser	gas	generator	reactor	steam	turbine

The energy released from the nuclear fuel is used to heat water. The water turns into

.... and this is used to drive a ....

This turns a .... to produce electricity.

(3)
(Total 6 marks)

Q26.   In 1986, a nuclear reactor exploded in a power station at Chernobyl in the Ukraine.

(a)   The table gives information about some of the radioactive substances released into the air by the explosion.

Radioactive substance	Half-life	Type of radiation emitted
Iodine-131	8 days	beta and gamma
Caesium-134	2 years	beta
Caesium-137	30 years	beta

(i)   How is the structure of a caesium-134 atom different from the structure of a caesium-137 atom?

....

(1)

(ii)   What is a beta particle and from which part of an atom is a beta particle emitted?

....

....

(1)

(iii)   Once a radioactive substance is dissolved in rainwater, it can enter the food chain.

Following the Chernobyl explosion, some milk supplies were found to be radioactive.

If one litre of milk contaminated with iodine-131 gives a count rate of 400 counts/second, how long will it take for the count rate to fall to 25 counts/second?

Show clearly how you work out your answer.

....

....

....

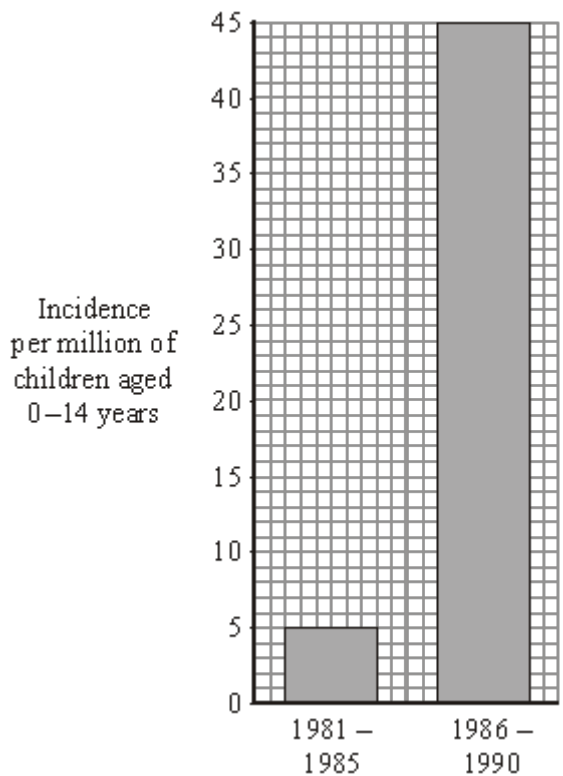Time taken = ... days

(2)

(iv)   After 20 years, the caesium-137 emitted into the atmosphere is a more serious problem than the iodine-131.

Explain why.

....

....

....

....

....

(2)

(b)   The bar chart compares the incidence of thyroid cancer in Ukrainian children, aged 0–14 years, before and after the Chernobyl explosion.

Of the children that developed thyroid cancer, 64% lived in the areas most contaminated by the radiation.

Considering this data, can you be certain that a child who developed thyroid cancer between 1986 and 1990 did so because of the Chernobyl explosion?

Explain the reason for your answer.

....

....

....

....

(2)

(c)   In 1991, some scientists compared the health of two groups of people: a *control* group and a group that had been exposed to the radiation from Chernobyl.

What people would have been in the *control* group?

....

(1)

(d)   Although there are some risks associated with nuclear power stations, it is likely that new ones will be built.

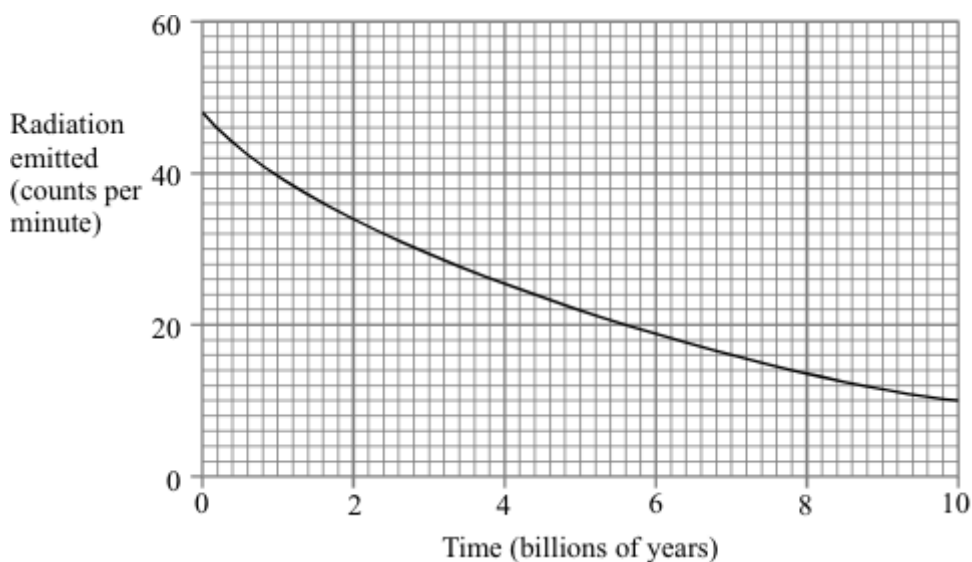Give **two** reasons to justify the use of nuclear power.

1 ....

....

2 ....

....

(2)
(Total 11 marks)

Q27.   The graph shows how the amount of radiation emitted by a sample of the radionuclide uranium 238 (U^{238}) changes as time passes.

(a)   What is the half-life of uranium 238 (U^{238})?
(You should show how you obtained your answer. You may do this on the graph if you wish.)

....

....

Answer ....

(3)

(b)   What fraction (or percentage) of the uranium 238 (U^{238}) atoms will have decayed after 9 billion years?

....

(1)

(c)   Uranium 238 (U^{238}) decays through a long series of intermediate radionuclides to stable atoms of the isotope lead 206 (Pb).

A sample of igneous rock contains 3 atoms of uranium 238 (U^{238}) for every atom of lead 206 (Pb^{206}).

(i)   The intermediate radionuclides are not important when estimating the age of the rock. Explain why.

....

....

(1)

(ii)   Estimate the age of the rock.
(You should explain how you obtained your answer.)

....

....

....

Answer .... billion years

(3)
(Total 8 marks)