Radioactivity – 2020 IGCSE 0625

1. Nov/2020/Paper_11/No.37

Which statement is correct for the nucleus of **any** atom?

A The nucleus contains electrons, neutrons and protons.

B The nucleus contains the same number of protons as neutrons.

C The nucleus has a total charge of zero.

D The nucleus is very small compared with the size of the atom.

2. Nov/2020/Paper_11/No.38

The nucleus of an atom X is represented by the notation shown.

$$^{P}_{Q}X$$

How many protons and how many neutrons are in this nucleus?

	number of protons	number of neutrons
A	P	Q
B	P	Q – P
C	Q	P
D	Q	P – Q

3. Nov/2020/Paper_11/No.39

A radiation detector records a low reading even when no radioactive source is close. This is due to background radiation.

What does **not** contribute to this background radiation?

A rocks on Earth

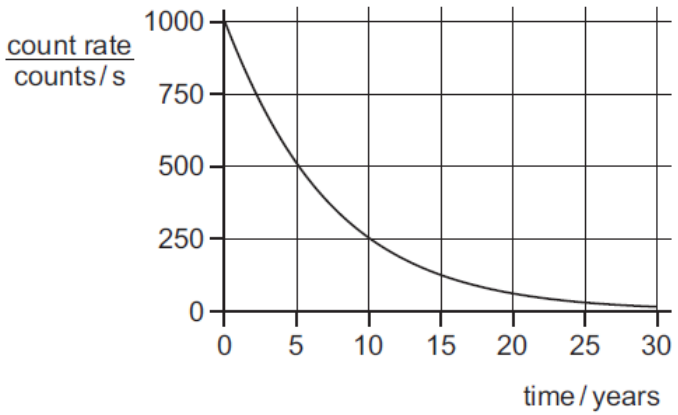
B cosmic rays from the Sun

C satellite TV signals

D waste from nuclear power stations

4. Nov/2020/Paper_11/No.40

The graph shows the radioactive decay curve of a substance.



What is the half-life of this substance?

A 0.5 years **B** 5 years **C** 15 years **D** 30 years

5. Nov/2020/Paper_12/No.37

Which statement is correct for the nucleus of **any** atom?

A The nucleus contains electrons, neutrons and protons.

B The nucleus contains the same number of protons as neutrons.

C The nucleus has a total charge of zero.

D The nucleus is very small compared with the size of the atom.

6. Nov/2020/Paper_12/No.38

The symbol represents a nucleus of zinc.

$^{68}_{30}Zn$

Which row gives the numbers of protons and neutrons in this nucleus?

	number of protons	number of neutrons
A	30	38
B	30	68
C	38	30
D	38	68

7. Nov/2020/Paper_12/No.39

Three types of radiation are α-radiation, β-radiation and γ-radiation.

Which statement is correct?

A α-radiation is less ionising than β-radiation.

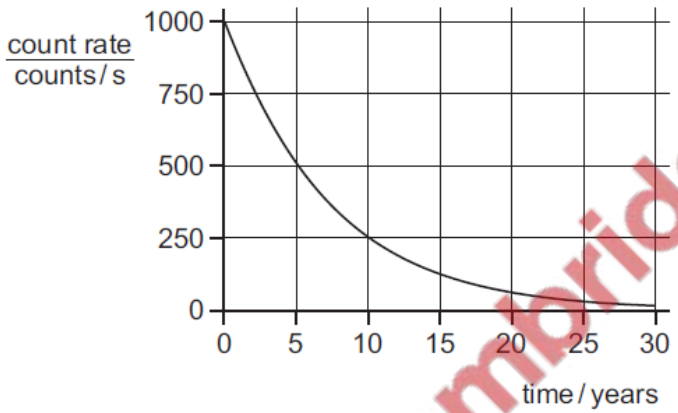
B α-radiation is less ionising than γ-radiation.

C γ-radiation produces no ionisation.

D β-radiation is more ionising than γ-radiation.

8. Nov/2020/Paper_12/No.40

The graph shows the radioactive decay curve of a substance.



What is the half-life of this substance?

A 0.5 years **B** 5 years **C** 15 years **D** 30 years

9. Nov/2020/Paper_13/No.37

Which statement is correct for the nucleus of **any** atom?

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B The nucleus contains the same number of protons as neutrons.

C The nucleus has a total charge of zero.

D The nucleus is very small compared with the size of the atom.

10. Nov/2020/Paper_13/No.38

How many protons and how many neutrons are in a nucleus of $^{234}_{90}Th$?

	protons	neutrons
A	90	144
B	90	234
C	144	90
D	234	90

11. Nov/2020/Paper_13/No.39

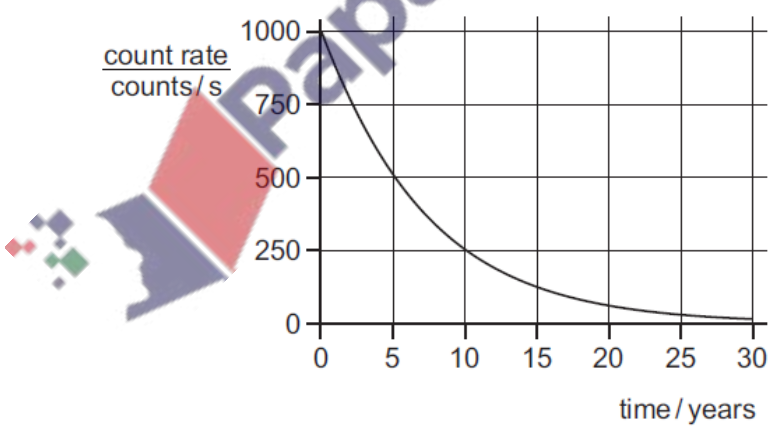
A radiation detector in a laboratory is measuring background radiation.

Which row describes the readings and the cause?

	readings	cause
A	vary with no pattern	background radiation is random
B	vary with no pattern	radiation detectors are unstable
C	slowly increase during the day	background radiation increases as temperature increases
D	slowly reduce during the day	background radiation decreases as temperature increases

12. Nov/2020/Paper_13/No.40

The graph shows the radioactive decay curve of a substance.



What is the half-life of this substance?

A 0.5 years **B** 5 years **C** 15 years **D** 30 years

13. Nov/2020/Paper_21/No.37

A beam of particles moves through a magnetic field.

In which situation do the particles experience a magnetic force?

A a beam of α-particles moving parallel to the magnetic field lines

B a beam of electrons moving parallel to the magnetic field lines

C a beam of β-particles moving perpendicularly across the magnetic field lines

D a beam of neutrons moving perpendicularly across the magnetic field lines

14. Nov/2020/Paper_21/No.38

Which statement is correct for the nucleus of **any** atom?

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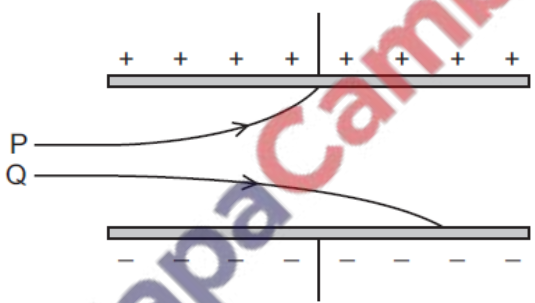
C The nucleus has a total charge of zero.

D The nucleus is very small compared with the size of the atom.

15. Nov/2020/Paper_21/No.39

Two beams of radiation, P and Q, enter an electric field as shown.



Which type of radiations are P and Q?

	P	Q
A	beta (β)	alpha (α)
B	beta (β)	gamma (γ)
C	gamma (γ)	alpha (α)
D	gamma (γ)	gamma (γ)

16. Nov/2020/Paper_21/No.40

Which equation represents the β-decay of lead-209?

A $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{83}Bi$

B $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{81}Tl$

C $^{209}_{82}Pb \rightarrow {}^{209}_{83}Bi + {}^{0}_{-1}e$

D $^{209}_{82}Pb \rightarrow {}^{209}_{81}Tl + {}^{0}_{-1}e$

17. Nov/2020/Paper_22/No.37

Which statement is correct for the nucleus of **any** atom?

A The nucleus contains electrons, neutrons and protons.

B The nucleus contains the same number of protons as neutrons.

C The nucleus has a total charge of zero.

D The nucleus is very small compared with the size of the atom.

18. Nov/2020/Paper_22/No.38

The symbol represents a nucleus of zinc.

$$^{68}_{30}Zn$$

Which row gives the numbers of protons and neutrons in this nucleus?

	number of protons	number of neutrons
A	30	38
B	30	68
C	38	30
D	38	68

19. Nov/2020/Paper_22/No.39

The diagram shows a beam of β-particles passing through a strong electric field.

In which direction will the β-particles be deflected?

A upwards towards the top of the page

B downwards towards the bottom of the page

C into the plane of the page

D out of the plane of the page

20. Nov/2020/Paper_22/No.40

Which equation represents the β-decay of lead-209?

A $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{83}Bi$

B $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{81}Tl$

C $^{209}_{82}Pb \rightarrow {}^{209}_{83}Bi + {}^{0}_{-1}e$

D $^{209}_{82}Pb \rightarrow {}^{209}_{81}Tl + {}^{0}_{-1}e$

21. Nov/2020/Paper_23/No.37

Which statement is correct for the nucleus of **any** atom?

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C The nucleus has a total charge of zero.

D The nucleus is very small compared with the size of the atom.

22. Nov/2020/Paper_23/No.38

How many protons and how many neutrons are in a nucleus of $^{234}_{90}Th$?

	protons	neutrons
A	90	144
B	90	234
C	144	90
D	234	90

23. Nov/2020/Paper_23/No.39

Which statement about γ-rays is correct?

A They are deflected by both electric and magnetic fields.

B They are deflected by magnetic fields but not by electric fields.

C They are deflected by electric fields but not by magnetic fields.

D They are not deflected either by electric fields or by magnetic fields.

24. Nov/2020/Paper_23/No.40

Which equation represents the β-decay of lead-209?

A $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{83}Bi$

B $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{81}Tl$

C $^{209}_{82}Pb \rightarrow {}^{209}_{83}Bi + {}^{0}_{-1}e$

D $^{209}_{82}Pb \rightarrow {}^{209}_{81}Tl + {}^{0}_{-1}e$

25. Nov/2020/Paper_31/No.11

(a) Fig. 11.1 represents the particles in a neutral lithium atom.

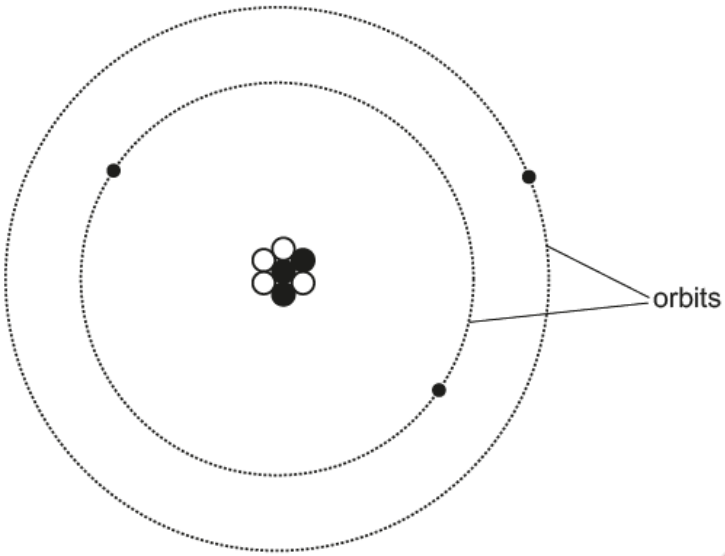

Fig. 11.1

Use the information in Fig. 11.1 about the lithium atom to answer **(a)(i)**, **(a)(ii)** and **(a)(iii)**.

(i) Determine the number of electrons. ..... [1]

(ii) Determine the value of the nucleon number. ..... [1]

(iii) Determine the number of neutrons. ..... [1]

(b) The count rate of a radioactive sample is 2400 counts per minute at 10 am on one day. The half-life of the sample is two days.

Predict the count rate at 10 am four days later.

count rate = ... counts per minute [3]

[Total: 6]

26. Nov/2020/Paper_32/No.12

A teacher is investigating radioactivity.

The teacher measures the background radiation in the laboratory.

(a) State **one** source of background radiation.

..... [1]

(b) A teacher measures the count rate of a radioactive isotope.

Fig. 12.1 shows the graph of her results.

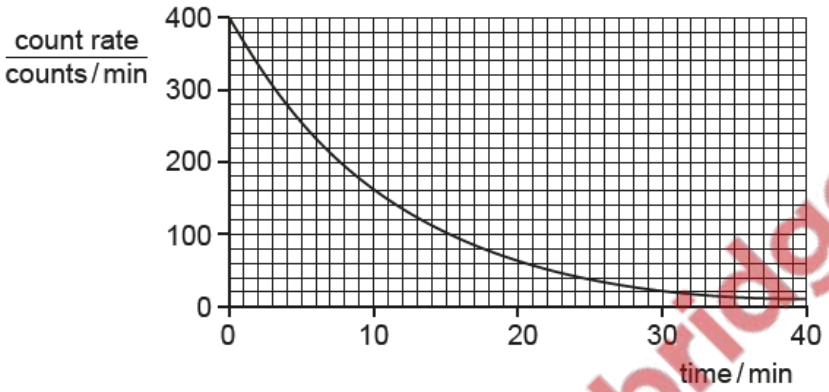

Fig. 12.1

(i) Determine the half-life of the radioactive isotope. Use information from Fig. 12.1.

Show on Fig. 12.1 how you obtained your value.

half-life = ... minutes
[3]

(ii) The radioactive isotope emits γ-radiation.

Describe **one** method of safely storing the radioactive isotope.

.....

..... [1]

[Total: 5]

27. Nov/2020/Paper_33/No.11

(a) Fig. 11.1 represents the structure of four atoms P, Q, R and S.

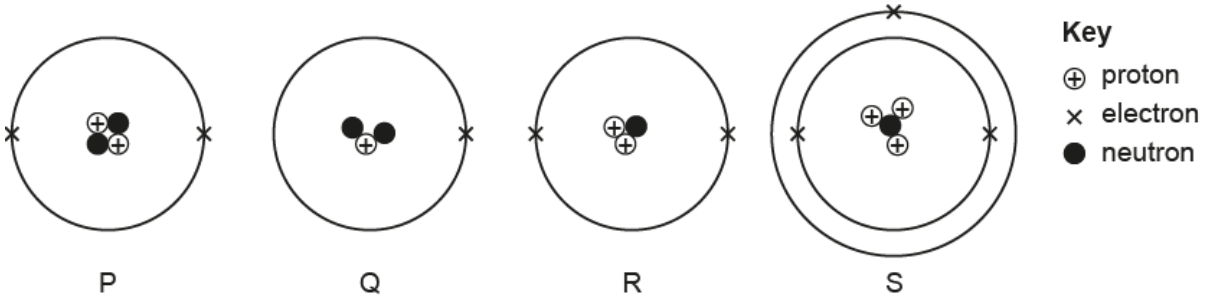

Fig. 11.1

State which **two** atoms are isotopes of the same element and explain your answer.

..... and .....

explanation .....

.....

[2]

(b) Radiographers use X-ray machines in hospitals. X-rays can cause damage to living things.

(i) State an example of the damage that may be caused by X-rays.

..... [1]

(ii) State and explain how radiographers can be protected from damage caused by X-rays.

.....

.....

..... [2]

(c) A radioactive source is placed near to a detector, as shown in Fig. 11.2.

The meter shows a reading of 239 counts per second.

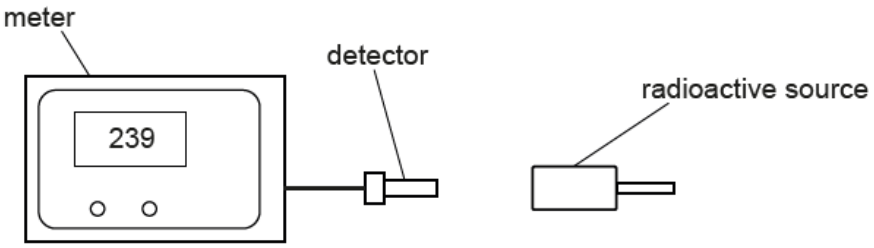

Fig. 11.2

A sheet of paper is placed between the detector and the radioactive source. The meter shows a reading of 240 counts per second.

The sheet of paper is removed and a thin sheet of aluminium is placed between the detector and the radioactive source. The meter shows a reading of 3 counts per second.

(i) Deduce the type of radiation emitted by the radioactive source.

..... [1]

(ii) The radioactive source is removed. The meter shows a reading of 3 counts per second.

State why the meter does not show a reading of zero counts per second.

..... [1]

[Total: 7]

28. Nov/2020/Paper_41/No.10

A radiation detector is placed on the bench in a laboratory. It detects a background count rate of 40 counts / minute.

(a) State what is meant by background radiation. Suggest one source for it.

.....

.....

..... [2]

(b) A sample containing atoms of the radioactive isotope polonium-208 is removed from a lead container and brought close to the detector. The average count rate increases to 890 counts / minute.

When two sheets of paper are inserted between the sample and the detector, the average count rate returns to 40 counts / minute.

Polonium-208 is represented by the symbol $^{208}_{84}Po$. It decays to an isotope of lead (Pb).

(i) Deduce the type of radiation emitted by polonium-208. Explain your answer.

.....

.....

.....

..... [2]

(ii) Write down the nuclide equation for the decay of polonium-208.

[3]

[Total: 7]

29. Nov/2020/Paper_42/No.11

(a) State **two** differences between nuclear fission and nuclear fusion.

1 .....

.....

2 .....

.....

[2]

(b) Radioactive tracers emitting γ-rays can be used in medicine. The half-life of the source of these γ-rays is 6 hours.

(i) Explain why a source of γ-rays used in this way should not have a half-life shorter or longer than about 6 hours.

.....

.....

.....

..... [2]

(ii) Technetium-99 is a source of γ-rays often used as a radioactive tracer. It is produced from molybdenum-99 which emits β-particles. The symbol for technetium is Tc and the symbol for molybdenum is Mo.

Complete the nuclide equation for this decay.

$$^{99}_{42}\text{Mo} \rightarrow {}^{\cdots\cdots}_{\cdots\cdots}\text{Tc} + {}^{\cdots\cdots}_{\cdots\cdots}\beta$$

[3]

(iii) Technetium-99 is a radioactive nuclide.

State another use of radioactive nuclides in medicine.

.....

..... [1]

[Total: 8]

30. Nov/2020/Paper_43/No.11

(a) Fig. 11.1 shows a beam of α-particles, β-particles and γ-rays directed between two metal plates P and Q.

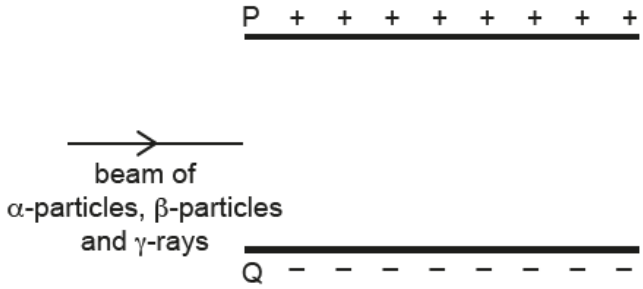

Fig. 11.1

The metal plates are parallel and there is a large potential difference (p.d.) between them. Plate P is positive and plate Q is negative.

On Fig. 11.1, draw the paths of each of the radiations between the plates and after leaving the plates.

Label the paths α, β and γ. [5]

(b) State and explain **one** practical application of γ-rays.

application .....

explanation .....

.....

[2]

[Total: 7]