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

Q1.

(a) Background radiation is all around us all the time.

(i) Radon is a natural source of background radiation.

Name another natural source of background radiation.

_____

(1)

(ii) X-rays are an artificial source of background radiation.

Name another artificial source of background radiation.

_____

(1)

(iii) An atom of radon-222 decays by emitting an alpha particle.
The equation representing the decay is shown below.

$$^{222}_{86}Rn \longrightarrow {}^{218}_{84}X + \text{alpha particle}$$

How can you tell from the equation that 'X' is not an atom of radon?

_____

_____

(1)

(b) Having an X-ray taken increases your exposure to radiation.

The table gives:

- the radiation doses received for 6 different medical X-rays;
- the number of days' of exposure to natural background radiation each dose is equivalent to.

Medical X-ray	Radiation dose received (in arbitrary units)	Equivalent number of days of exposure to natural background radiation
Chest	2	2.4

Skull	7	8.4
Pelvis	22	26.4
Hip	44	52.8
Spine	140	
CT head scan	200	240

A hospital patient has an X-ray of the spine taken.
Calculate the number of days of exposure to natural background radiation that an X-ray of the spine is equivalent to.

Show how you work out your answer.

_____

_____

_____

Equivalent number of days = _____

(2)

(c) Scientists have shown that X-rays increase the risk of developing cancer.
The scientists came to this conclusion by studying the medical history of people placed in one of two groups, **A** or **B**.
The group into which people were put depended on their X-ray record.

(i) Person **J** has been placed into group **A**.
Place each of the people, **K**, **L**, **M**, **N** and **O**, into the appropriate group, **A** or **B**.

Person	**J**	**K**	**L**	**M**	**N**	**O**
						
Medical X-ray record	3 arm	None	None	2 skull	None	4 leg

Group A	**Group B**

J	

(1)

(ii) To be able to make a fair comparison, what is important about the number of people in each of the two groups studied by the scientists?

_____

_____

(1)

(iii) What data would the scientists have compared in order to come to the conclusion that X-rays increase the risk of developing cancer?

_____

_____

(1)

(iv) The chance of developing cancer due to a CT head scan is about 1 in 10 000.
The chance of developing cancer naturally is about 1 in 4.

A hospital patient is advised by a doctor that she needs to have a CT head scan.
The doctor explains to the patient the risks involved.

Do you think that the patient should give her permission for the CT scan to be taken?

Draw a ring around your answer.

Yes **No**

Give a reason for your answer.

_____

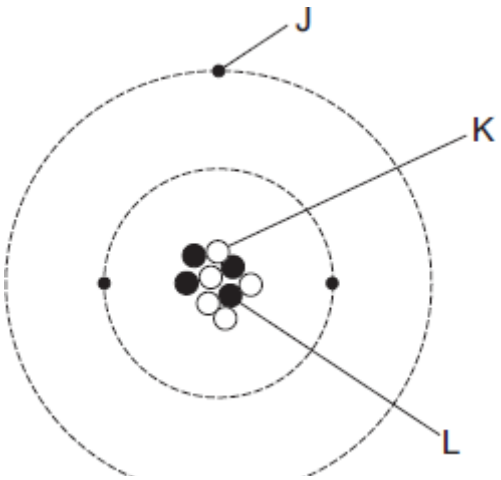
_____

(1)

(Total 9 marks)

Q2.

The diagram represents an atom of beryllium.



(a) Complete the following statements by writing one of the letters, **J**, **K** or **L**, in each box.

Each letter should be used only **once**.

The particle with a positive charge is ☐

The particle with the smallest mass is ☐

The particle with no charge is ☐

(2)

(b) Give the reason why all atoms have a total charge of zero.

_____

_____

(1)

(c) Complete the following sentence.

There are several isotopes of beryllium. Atoms of different beryllium isotopes will have different numbers of _____

(1)

(d) What happens to the structure of an atom to change it into an ion?

_____

_____

(1)

(Total 5 marks)

Q3.

The process of nuclear fusion results in the release of energy.

(a) (i) Describe the process of nuclear fusion.

_____

_____

_____

_____

(2)

(ii) Where does nuclear fusion happen naturally?

_____

(1)

(b) For many years, scientists have tried to produce a controlled nuclear fusion reaction that lasts long enough to be useful. However, the experimental fusion reactors use more energy than they produce.

(i) From the information given, suggest **one** reason why nuclear fusion reactors are not used to produce energy in a nuclear power station.

_____

_____

(1)

(ii) Suggest **one** reason why scientists continue to try to develop a practical nuclear fusion reactor.

_____

_____

(1)

(Total 5 marks)