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

Q1.

Scientists developed different models of the atom as new discoveries were made.

(a) Which particle in the atom was discovered first?

Tick (✓) **one** box.

Electron ☐

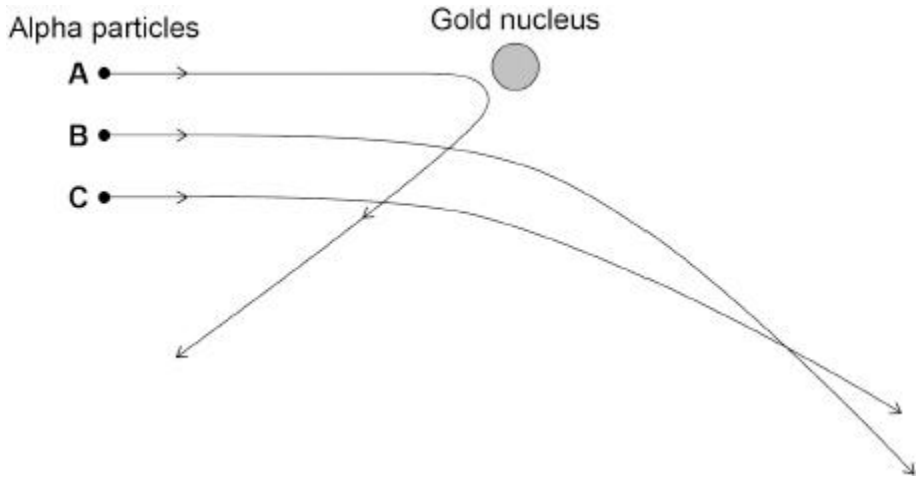
Neutron ☐

Proton ☐

(1)

In an experiment that led to the nuclear model of the atom, alpha particles were directed at a sheet of gold foil.

The figure below shows the path of three alpha particles passing close to a gold nucleus.



(b) An alpha particle has a radius of 1.7 femtometres.

The radius of a gold nucleus is 4.2 times larger than the radius of an alpha particle.

Calculate the radius of a gold nucleus in femtometres.

_____

_____

_____

Radius of a gold nucleus = _____ femtometres

(2)

(c) Alpha particles are deflected by the gold nucleus.

What are the charges on an alpha particle and a gold nucleus?

Tick (✓) **one** box.

An alpha particle and a gold nucleus are both neutral.	☐
An alpha particle and a gold nucleus are both positively charged.	☐
An alpha particle is positively charged and a gold nucleus is neutral.	☐

(1)

(d) Which statement describes the force between the alpha particle and the gold nucleus?

Tick (✓) **one** box.

A contact force	☐
A force of attraction	☐
A force of repulsion	☐
There is no force	☐

(1)

(e) Which alpha particle in the figure above experiences the largest force from the gold nucleus?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

(1)

The table below lists different models of the atom in alphabetical order.

Model
Bohr
Nuclear

Plum pudding
Tiny spheres that cannot be divided

(f) Which model in the table above was developed first?

_____

(1)

(g) Which model in the table was developed last?

_____

(1)

(Total 8 marks)

Q2.

Some isotopes emit nuclear radiation.

(a) Carbon-12 and carbon-14 are both isotopes of carbon.

Complete the sentences.

Choose answers from the box.

alpha particles	**electrons**	**neutrons**	**protons**

The nucleus of a carbon-12 atom and the nucleus of a carbon-14 atom have the **same** number of _____.

The nucleus of a carbon-12 atom and the nucleus of a carbon-14 atom have a **different** number of _____.

(2)

(b) Different radioactive isotopes have different half-lives.

What does 'half-life' mean?

Tick (✓) **one** box.

Half the time taken for all of the nuclei in a sample to decay. ☐

The time taken for half the nuclei in a sample to decay. ☐

The time taken for one nucleus to split in half. ☐

(1)

(c) **Table 1** shows the half-life of some different isotopes of carbon.

Table 1

Isotope	Half-life in seconds
Carbon-15	2.45
Carbon-16	0.75
Carbon-17	0.19
Carbon-18	0.09

Which isotope is the least stable?

Tick (✓) **one** box.

Carbon-15 ☐

Carbon-16 ☐

Carbon-17 ☐

Carbon-18 ☐

(1)

(d) Workers in nuclear power stations must be aware of nuclear irradiation and radioactive contamination.

Draw **one** line from each term to an example of the term.

Term	Example
Radioactive contamination	Exposure to a beam of gamma rays
	Exposure to ultraviolet radiation from the Sun
Nuclear irradiation	Accidental transfer of plutonium onto a human body
	Using a mobile phone

(2)

(e) Why are workers required to walk across a sticky floor before leaving the nuclear power station?

Tick (✓) **one** box.

To remove alpha particles from their shoes. ☐

To remove gamma radiation from their shoes. ☐

To remove radioactive dust from their shoes. ☐

(1)

(f) The places where people work and live contribute to the nuclear radiation they are exposed to.

Table 2 shows the mean daily dose of radiation caused by two different jobs.

Table 2

Job	**Mean daily dose in mSv**
Aeroplane pilot	0.072
Nuclear power station worker	0.00050

Calculate the number of days a nuclear power station worker must work before receiving the same dose that an aeroplane pilot receives in one day.

_____

_____

_____

Number of days = _____

(2)

(g) The process of nuclear fission takes place in nuclear power stations.

The process of nuclear fusion takes place in the Sun.

Draw **one** line from each process to its fuel.

Process	**Fuel**
	Hydrogen
Nuclear fission	
	Iron
	Lead
Nuclear fusion	
	Uranium

(2)

(Total 11 marks)