

Name of the Student: \_\_\_\_\_

Max. Marks : 24 Marks

Time : 24 Minutes

**Q1.**

Nuclear power stations generate electricity through nuclear fission. Electricity can also be generated by burning shale gas.

- (a) Shale gas is natural gas trapped in rocks. Shale gas can be extracted by a process called fracking. There is some evidence that fracking causes minor earthquakes. Burning shale gas adds carbon dioxide to the atmosphere.

Describe the advantages of nuclear power compared with the use of shale gas to generate electricity.

---

---

---

---

---

---

---

---

---

---

(3)

- (b) What is the name of **one** fuel used in nuclear power stations?

---

(1)

- (c) Describe the process of nuclear fission.

---

---

---

---

---

---

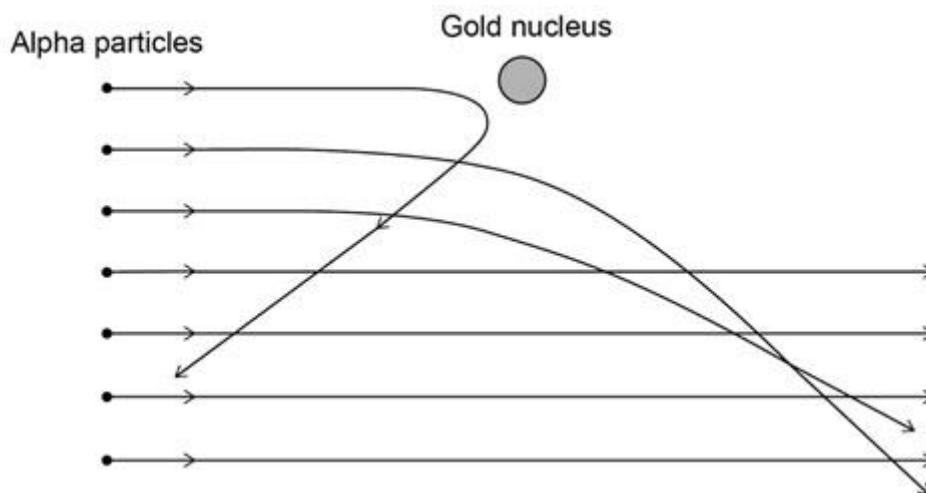
---

---

**Q2.**

In the early 20th century, scientists developed an alpha particle scattering experiment using gold foil.

The diagram shows the paths of some of the alpha particles in the alpha particle scattering experiment.



- (a) Explain how the paths of the alpha particles were used to develop the nuclear model of the atom.

---

---

---

---

---

---

---

---

---

---

(4)

- (b) Niels Bohr adapted the nuclear model by suggesting electrons orbited the nucleus at specific distances.

Explain how the distance at which an electron orbits the nucleus may be changed.

---

---

---

---

---

---

(3)  
(Total 7 marks)

**Q3.**

Nuclear fission and nuclear fusion are two processes that release energy.

(a) The following nuclear equation represents the fission of uranium-235 (U-235).



Chemical symbols:

- Ba = barium
- Kr = krypton
- ${}_0^1\text{n}$  = neutron

Describe the process of nuclear fission.

Use the information in the equation.

---

---

---

---

---

---

---

---

---

---

(4)

(b) Explain what happens in the process of nuclear fusion.

---

---

---

---

---

---

---

(c) Fission reactors are used in nuclear power stations.

Engineers are developing fusion reactors for use in power stations.

Fusion uses isotopes of hydrogen called deuterium and tritium.

- Deuterium is naturally occurring and can be easily extracted from seawater.
- Tritium can be produced from lithium. Lithium is also found in seawater.

The table shows the energy released from 1 kg of fusion fuel and from 1 kg of fission fuel.

Type of fuel	Energy released from 1 kg of fuel in joules
Fusion	$3.4 \times 10^{14}$
Fission	$8.8 \times 10^{13}$

Suggest **two** advantages of the fuel used in a fusion reactor compared with the fuel used in a fission reactor.

1. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2)

(Total 9 marks)