Topic 4 Atomic Structure Extended Writing Questions

Name: _____

Class: _____

Date: _____

Time:	**20 minutes**
Marks:	**20 marks**
Comments:	

Q1. Scientists sometimes replace one scientific model with a different model.

For example, in the early 20th Century the plum pudding model of the atom was replaced by the nuclear model of the atom.

Explain what led to the plum pudding model of the atom being replaced by the nuclear model of the atom.

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(Total 6 marks)

Q2. The picture shows a man at work in a factory that uses radioactive materials.

The radioactive material is kept behind glass shields. The man wears gloves so that he cannot touch the radioactive material directly.

Explain, as fully as you can, why these precautions are taken.

To gain full marks in this question you should write your ideas in good English. Put them into a

sensible order and use the correct scientific words.

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(Total 4 marks)

Q3. Nuclear fission and nuclear fusion are two processes that release energy.

(a)   (i)   Use the correct answer from the box to complete each sentence.

Geiger counter	**nuclear reactor**	**star**

Nuclear fission takes place within a ....

Nuclear fusion takes place within a ....

(2)

(ii)   State **one** way in which the process of nuclear fusion differs from the process of nuclear fission.

....

....

(1)

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

$$_{0}^{1}n + {}_{92}^{235}U \longrightarrow {}_{92}^{236}U \longrightarrow {}_{56}^{141}Ba + {}_{36}^{92}Kr + 3{}_{0}^{1}n + energy$$

Chemical symbols:

Ba - barium

Kr - krypton
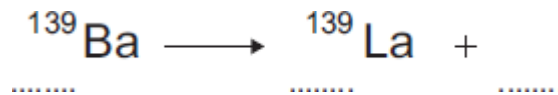
(i)   Use the information in the equation to describe the process of nuclear fission.

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(4)

(ii)   An isotope of barium is Ba-139.
        Ba-139 decays by beta decay to lanthanum-139 (La-139).

        Complete the nuclear equation that represents the decay of Ba-139 to La-139.

$$^{139}Ba \longrightarrow \ ^{139}La \ + \ \underline{\hspace{1cm}}$$

....

(3)
(Total 10 marks)

M1. Level 3 (5–6 marks):
A detailed and coherent explanation is provided. The student gives examples that argue a strong case and demonstrate deep knowledge. The student makes logical links between clearly identified, relevant points.

Level 2 (3–4 marks):
An attempt to link the description of the experiment and the results with differences between the two models. The student gives examples of where the plum pudding model does not explain observations. The logic used may not be clear.

Level 1 (1–2 marks):
Simple statements are made that the nuclear model is a better model. The response may fail to make logical links between the points raised.

0 marks:
No relevant content.

Indicative content
- alpha particle scattering experiment
- alpha particles directed at gold foil
- most alpha particles pass straight through
- (so) most of atom is empty space
- a few alpha particles deflected through large angles
- (so) mass is concentrated at centre of atom
- (and) nucleus is (positively) charged
- plum pudding model has mass spread throughout atom
- plum pudding model has charge spread throughout atom

[6]

M2. Quality of written communication

correct use of **three** <u>scientific</u> terms e.g. radiation / α **or** β **or** γ / cells / ionisation / mutation (not cells or body) / chromosomes / DNA / genes / cancer

1

any **three** from:

(materials emit) radiation

named type of radiation (α **or** β **or** γ)

damage / harm / kill
      dangerous is neutral

cells / chromosomes / DNA / genes

cancer

mutations

ionisation

gloves or glass absorb radiation / prevent radiation reaching body or cells

3

[4]

M3.(a) (i) nuclear reactor

1

star

1

(ii) nuclei are joined (not split)
        accept converse in reference to nuclear fission
        *do **not** accept atoms are joined*

1

(b) (i) any **four** from:

- neutron
- (neutron) absorbed by U (nucleus)
    ignore atom
    *do **not** accept reacts*
    *do **not** accept added to*
- forms a larger nucleus
- (this larger nucleus is) unstable
- (larger nucleus) splits into two (smaller) <u>nuclei</u> / into Ba and Kr
- releasing <u>three</u> neutrons and energy
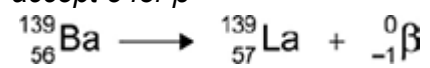   *accept fast-moving for energy*

4

(ii) 56 (Ba)

1

57 (La)

*if proton number of Ba is incorrect allow **1** mark if that of La is 1 greater*

1

$$_{-1}^{0}\beta$$

accept e for β

$$_{56}^{139}Ba \longrightarrow \, _{57}^{139}La \, + \, _{-1}^{0}\beta$$

*scores **3** marks*

1

[10]