OCR
Oxford Cambridge and RSA

GCSE Physics A (Gateway)

J249/04 Physics A P5-P8 and P9 (Higher Tier)

Question Set 4

1 Nuclear radiation, such as gamma, is used to irradiate some fresh food to increase its 'shelf-life' and make it last longer.

Fresh herbs and spices are dried and irradiated with gamma rays.

(a) Explain the difference between nuclear **irradiation** and nuclear **contamination**.

Irradiation occurs when an object is exposed to a source of radiation outside the object. This exposure does not cause the object to become radioactive.
on the other hand, contamination occurs if the radioactive source is on or in the object. This can cause the object to be radioactive too. **[2]**

(b) Explain how the gamma rays can increase the 'shelf-life' of herbs and spices to make them last longer.

when food is irridated, it absorbs energy. This absorbed energy kills bacteria that can cause the food to perish. It also kills bacteria that can cause food poisoning. **[2]**

(c) Some people are worried about eating irradiated food.

Write down two **concerns** they may have about irradiated food.

- Irridated food may be toxic and may affect your health. eg. stunting growth.
- Irridated food could make people 'radioactive' (which is not true).
- Irridation could form toxic chemicals which can cause cancer

[2]

(d) Carbon is a common element. Carbon has two different isotopes called carbon-12 and carbon-14. Both of these isotopes have six protons in the nucleus.

(i) Carbon-14 is radioactive and carbon-12 is **not** radioactive.

Explain why some isotopes are radioactive.

Some isotopes are unstable due to the different amount of neutrons. **[1]**

(ii) Describe how the nucleus of carbon-12 is different to the nucleus of carbon-14.

carbon-12 has 6 neutrons whereas carbon-14 has 8 neutrons. **[1]**

(e) Decay equations are used to show the type of emission from different radioactive elements.

(i) Complete the decay equation for **alpha** emission.

$$^{230}_{92}U \rightarrow {}^{4}_{2}He + {}^{226}_{90}Th$$

[2]

(ii) Complete the decay equation for **beta** emission.

$$^{214}_{83}Bi \rightarrow {}^{0}_{-1}\beta + {}^{214}_{84}Po$$

[2]

(iii) Complete the decay equation for **gamma** emission.

$$^{235}_{92}U \rightarrow {}^{0}_{0}\gamma + {}^{235}_{92}U$$

[2]

Total Marks for Question Set 4: 14