Mark schemes

Q1.

(a) 2 marks for 4 correct answers
1 mark for 2 or 3 correct answers

Source of background radiation	Natural	Man-made
Cosmic rays	✓	
Medical X-rays		✓
Nuclear accidents		✓
Radon gas	✓	

2

(b) rock **C**

1

(because) alpha is stopped by
(one sheet of) paper
or
(one sheet of) paper significantly decreased the radiation detected
MP2 dependent on scoring MP1
allow alpha is the least penetrating

1

(c) rock **A**

1

(because) beta radiation is stopped by (a thick) aluminium (sheet)

or

the (thick) aluminium (sheet) significantly decreased the radiation detected
MP2 dependent on scoring MP1

1

(d) wearing protective gloves

1

(e) the activity is half the original activity

1

(f) the greater the activity, the greater the risk of harm

1

[9]

Q2.

(a) nuclei

1

neutrons

1

gamma rays

this order only

1

(b) energy = power × time
or
$E = P \times t$

1

(c) P = 500 000 000 (W)

1

E = 500 000 000 × 3600

allow a correct substitution of an incorrectly / not converted value of P

1

E = 1 800 000 000 000 (J)
or
$E = 1.8 \times 10^{12}$ (J)

allow an answer consistent with an incorrectly / not converted value of P

1

(d) any **one** from:

- bury the radioactive waste
- put the radioactive waste in cooling ponds

allow store it for (at least) one half-life

- transport the radioactive waste in secure vessels
- store the radioactive waste in metal containers
- cover the radioactive waste in concrete

ignore references to high / medium / low level waste

ignore label the waste as hazardous

1

(e)

number of days = $\frac{92}{100} \times 365$

1

number of days = 335.8

allow answers of 335 and 336 days

allow an answer of 29.2 (days) for 1 mark

1

[10]

Q3.

(a) protons

this order only

1

neutrons

1

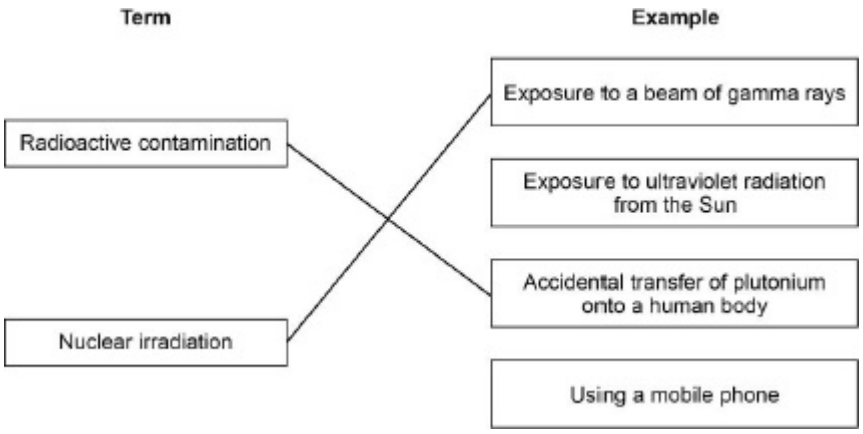
(b) the time taken for half the nuclei in a sample to decay

1

(c) carbon-18

1

(d)



1 mark for each correct line

additional line from a box on the left negates the mark for that box

2

(e) to remove radioactive dust from their shoes

1

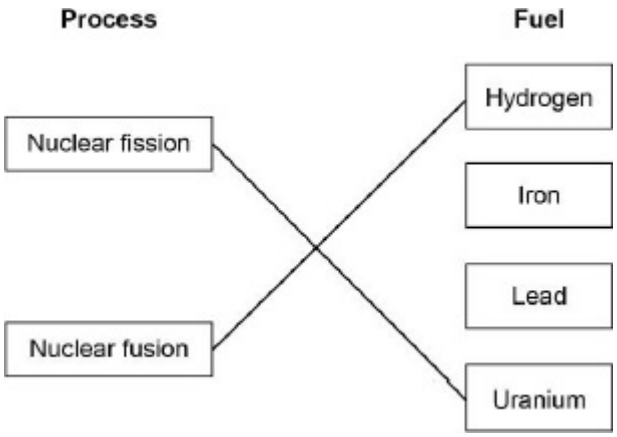
(f) $$\text{number of days} = \frac{0.072}{0.00050}$$

1

number of days = 144

1

(g)



1 mark for each correct line

additional line from a box on the left negates the mark for that box

2

[11]

Q4.

(a) 2 protons and 2 neutrons

1

(b) an electron

1

(c) $^{85}_{36}Kr \longrightarrow {}^{85}_{37}Rb + {}^{0}_{-1}e$

1

(d)

Type of radiation	Most radiation is stopped by:		
	the sheet of paper	the sheet of aluminium	the block of lead
Alpha	Yes	Yes	Yes
Beta	No	Yes	Yes
Gamma	No	No	Yes

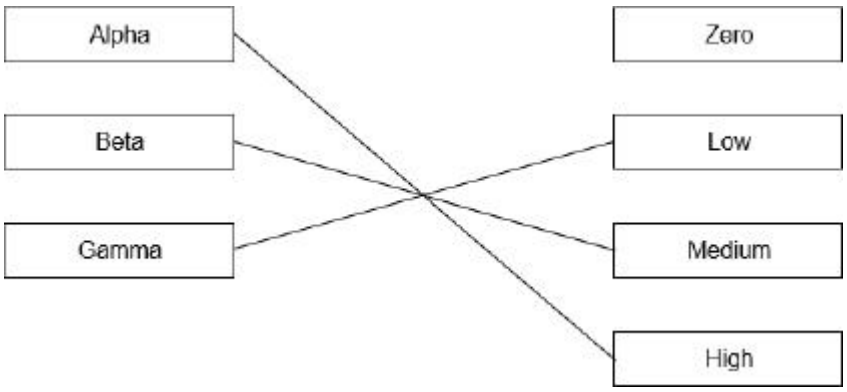
***1** mark for each correct row*

allow ticks and crosses in place of yes and no

any incorrect answer on a row negates the mark for the row

3

(e)



***1** mark for each correct line*

if more than one line drawn from radiation type list principle applies

3

(f) nuclear accidents

1

(g) number = $\frac{2.0}{0.005}$

1

number = 400

1

[12]