M1. (a) top and bottom boxes identified

1

(b) Medical (treatment)

or X-rays

answer must be in table
accept treatment for medical treatment

1

(c) 15

*allow **1** mark for correctly identifying 300 as the average dose*

2

[4]

M2. (i) radon (gas)

*do **not** accept gas*

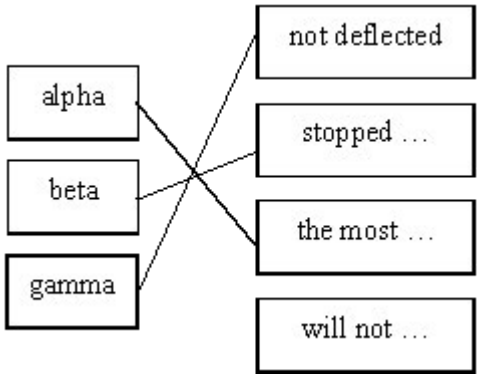
1

(ii) background

1

[2]

M3. (a) 3 lines correctly drawn



*1 mark for each correct line if more than one line is drawn from a box in List **A** all lines from that box are wrong*

3

(b) nucleus

accept nuclei
*do **not** accept nuclear*

1

(c) **Y**

*do **not** accept gamma*

any **two** from:

*do **not** accept other properties of gamma*

- least dangerous (inside the body)
  *do **not** accept not dangerous*
  accept not as harmful as alpha
  (inside the body)
- least ionising
- penetrates through the body
  *do **not** accept can be detected externally*

1

- is a gas / can be breathed in
  accept it is not a solid
  *(cannot score if **Z** chosen)*
  *if **X** chosen can score this gas mark*
  *if **Z** chosen can score **both** gamma marks*

2

(d) any **one** from:

*do **not** accept kills bacteria*

- longer shelf life
  accept stays fresh longer / stops it going bad / mouldy
- food can be supplied from around the world
- wider market for farmers
- cost to consumers (may be) lower
- less likely to / will not get food poisoning
  accept infection / disease / ill for food poisoning

1

[8]

M5. (a) cosmic rays

1

radon gas

1

(b) (i) Radioactive decay is a random process

1

(ii) 19

1

(iii) 140

accept 159 – their (b)(i) correctly calculated

1

(iv) gamma

1

the count stayed the same

1

or

gamma does not have a charge

accept gamma is an electromagnetic wave

(so) gamma is not deflected / affected by the magnetic field

accept magnet for magnetic field

*do **not** accept is not attracted to the magnet*

last two marks may be scored for an answer in terms of why it cannot be alpha or beta

only answer simply in terms of general properties of gamma are insufficient

1

(c) lead absorbs (some of the) radiation

accept radiation cannot pass through (the lead)

or

less radiation emitted into the (storage) room

1

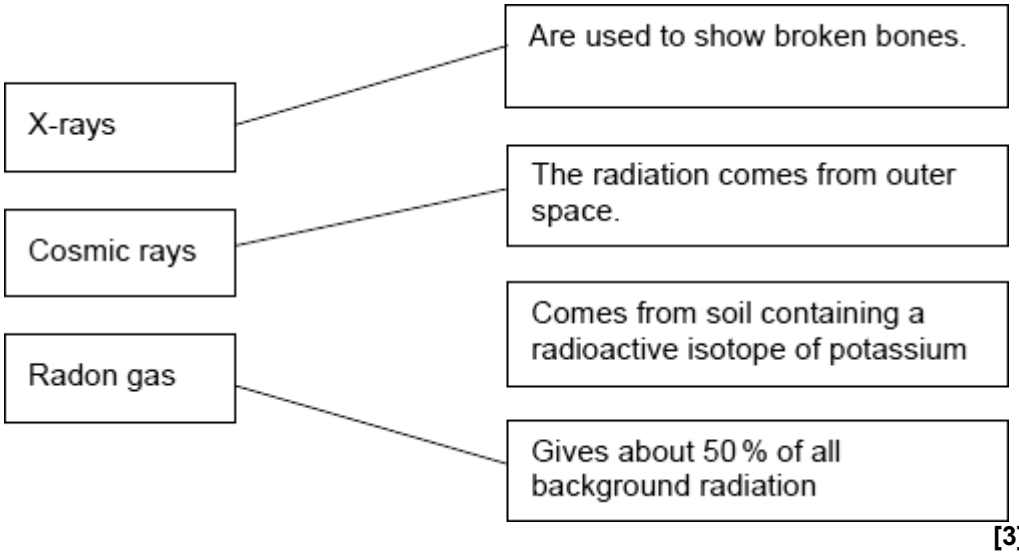
(d) Should radioactive waste be dumped in the oceans

1

[10]

M6. **1** mark for each correct line

*If more than 1 line has been drawn from a box in **List A** then all those lines are marked incorrect.*



[3]

M7. (a) (i) half / ½ / 50%

accept 1 (part) in 2 (parts) 1

1

(ii) (the) food (we eat) is radioactive

accept because of the food (we eat)

accept we breathe in radon

radon in the air is neutral

1

(b) higher in village B

1

by 6 units

allow 1 mark for correctly obtaining a height difference of 180(m)/ 4 times higher – this refers to height and not radiation levels

accept for 3 marks in village A it is 2 units (extra) and in village be it is 8 units (extra)

allow 1 mark for a correct radiation calculation based on incorrect height readings

2

[5]

M8. (a) (i) half / 50 %

1

(ii) Measure the radon gas level in more homes in this area

1

(b) (i) 86

1

(ii) 222

1

[4]

M9. (a) (i) on average, cosmic rays produce less background radiation than rocks.

1

having no X-rays reduces a person's radiation dose.

1

(ii) 4

*allow **1** mark for 350 / 4*

*allow **1** mark for an answer 3.5*

2

(b) (i) (risk) increases

1

(ii) C

*reason only scores if **C** chosen*

1

shows a lower risk for low doses (than for zero exposure)

accept risk reduces when you go from low to moderate (doses)

1

(c) (i) *no mark for YES or NO, marks are for the explanation*

YES

fewer mice exposed first to a low dose

1

get cancer (than those only exposed to a high dose)

only scores if first marking point scores

NO

the results are for mice (1)

and may not be applicable to people (1)

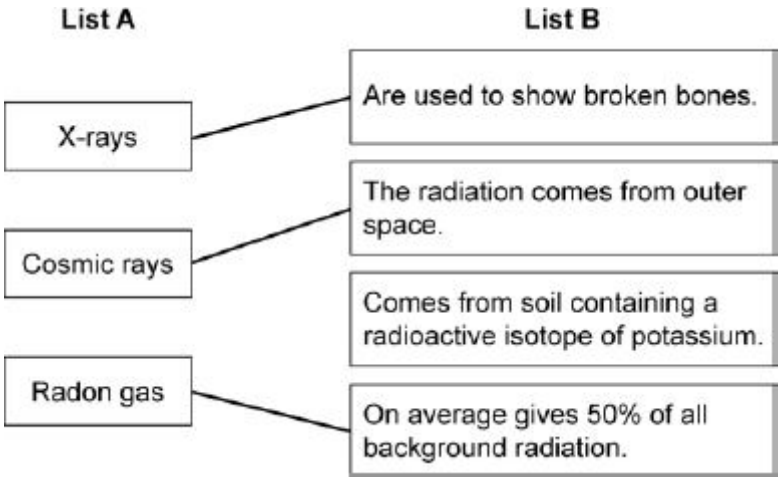
1

(ii) ethical

1

[10]

M10. (a) 1 mark for each correct line



*if more than 1 line has been drawn from a box in **List A** then all those lines are marked incorrect*

3

(b) higher in village B

1

by 6 units

*allow **1** mark for correctly obtaining a height difference of 180 (m) / 4 times higher – this refers to height not radiation levels*

*accept for **3** marks in village A it is 2 units (extra) and in village B it is 8 units (extra) allow **1** mark for a correct radiation calculation based on incorrect height readings*

2

[6]