

Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Mark Schemes

Q1.

(a) *electron*
accept e 1

(b) *5400 – 7000*
horizontal line drawn corresponding to their halving 1

or

a cross in the correct position on the line 1

(c) *count rate converted to 14.5/min for 1g mass*
accept 14.5 clearly marked on graph 1

decay time taken as 750 years ± 100 years
accept 750 years clearly marked on graph 1

refer their answer to 837 years (or approximately 800 or a value 837 - 937 years)

no the shirt was made after he died (if numbers justify)

or

yes it could have been his shirt (if numbers justify)
allow an alternative answer working backwards from 837 years 1

[6]

Q2.

(a) (i) *helium nuclei* 1

or

two protons and two neutrons or $\frac{4}{2} \text{ He}$

do **not** accept it is a particle emitted by an unstable nucleus of Californium -241

- (ii) time taken for the activity **or** count rate **or** number of nuclei **or** number of atoms **or** number of radioactive particles to decrease to half

1

- (iii) Technetium-99

this mark **cannot** score without Technetium- 99

1

any **two** of the following:

- suitable short half-life or activity quickly reduced to a safe level or it **doesn't** stay in the body long
this mark **can** score if Cobalt -60 is given
- (gamma emitter so) it can be detected outside the body
- less (ionising) damage to cells **or** tissue
this mark **can** score if Cobalt -60 is given

2

- (b) any **three** of the following:

- transport of waste into the area
- possibility of accident or leakage from transport
- safe levels not reached for hundreds or thousands of years
- Possible leakage **or** contamination of land **or** water **or** increase in background radiation
- increased risk of (radiation linked) illness **or** cancer

3

[8]

Q3.

- (a) (i) an unstable nucleus **or** atom **or** isotope
accept nucleus has too much energy

an atom **or** nucleus **or** isotope which decays

1

- (ii) sodium – 24

if Mg-27 chosen can get third mark if explained

sufficiently long to allow circulation and take readings

short enough that levels of radiation in the body will become insignificant quickly

3

- (iii) each axis is given a linear scale

1

curve concave to axes drawn

1

(curve) shows correct half-life of five years

must show two half lives check first two plotted points correct to $\pm$ half square

1

(b) any **three** points from the following:

- waste remains radioactive for a long time **or** waste has to be disposed of
- waste may leak from its storage point
- possibility of accident at power station **or** in transport of fuel
- contamination of the local environment
- people living close to a power station may have a greater risk of developing cancer **or** leukaemia
accept harmful to people
- high cost to decommission power station
do **not** accept expensive

3

[10]