



General Certificate of Education

Applied Science

8771/8773/8776/8779

SC08 Medical Physics

Mark Scheme

2008 examination – June series

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Question 1

(a)(i)	Liquid expands when heated Rises up inner tube Measurement read off scale / greater the temperature the more it expands or rises	(1) (AO1) (1) (AO1) (1) (AO1)	3
(ii)	Doesn't measure core temperature Affected by external temperature	(1) (AO2) (1) (AO2)	2
(b)	No because temperature was too high / though the temperature was below normal Hypothermia occurs at 32°C or below Answers referring appropriately to it perhaps not being core temperature may be credited	(1) (AO1) (1) (AO1)	2
(c)	Sensible suggestion Basic explanation of why more suitable Further explanation of why more suitable e.g. could suggest an electronic thermometer connected to an audible alarm (1) Could monitor continuously (1) with no human error / alarm would sound if temperature fell too much (1)	(1) (AO2) (1) (AO2) (1) (AO2)	3

Total Mark: 10**Question 2**

(a)(i)	To illuminate areas inside the body e.g. for diagnosis	(1) (AO1)	1
(ii)	E.g. for therapy such as cauterising ulcers	(1) (AO1)	1
(b)	Any two suitable precautions e.g. Non reflecting surfaces Eye protection (not just 'goggles') Warning signs Not looking directly into the beam	(1) (AO1) (1) (AO1)	2

Total Mark: 4**Question 3**

(a)	Label – A Name – cathode Function – emit electrons	(1) (AO1)	3
	Label – B Name – anode Function – produce X-rays / attracts electrons	(1) (AO1)	
	Label – C Name – evacuated glass tube (accept vacuum) Function – prevent electrons colliding with air particles	(1) (AO1)	
(b)(i)	Any suitable precaution (e.g. goes behind a lead screen)	(1) (AO1)	1
(ii)	Explanation that matches precaution stated (e.g. X-rays cannot penetrate lead)	(1) (AO1)	1

(c)	Somatic (cao) Stochastic (cao)	(1) (AO1) (1) (AO1)	2
(d)(i)	Absorbed by dense materials / bone Transmitted through less dense materials / soft tissue (Big) difference in density between bone and soft tissue / soft tissue less dense than bones Transmitted X-rays detected by photographic film / paper NB any reference to X-rays being reflected will negate first two points	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1)	4
(ii)	Contrast medium has a high density/higher density than soft tissue Density difference between contrast medium and soft tissue is high./helps absorb X-rays	(1) (AO2) (1) (AO2)	2
(e)	Any two relevant points e.g. CAT scans use higher doses CAT scans are 3D CAT scans photograph the body from many different angles CAT scans have to involve the use of computers CAT scans can image soft tissue effectively.	(1) (AO1) (1) (AO1)	2

Total Mark: 15**Question 4**

(a)	EEG / electroencephalograph	(1) (AO1)	1
(b)	<ul style="list-style-type: none"> (increase) <u>electrical</u> conductivity improve contact/remove air/increase conductivity (NB 'ensure good electrical contact/ good electrical conductivity achieves both marks)	(1) (AO1) (1) (AO1)	2
(c)(i)	Beta	(1) (AO1)	1
(ii)	Delta	(1) (AO1)	1
(iii)	Beta	(1) (AO1)	1

Total Mark: 6**Question 5**

(a)(i)	The time taken for the activity of the sample to halve (wtte)	(1) (AO1)	1
(ii)	0.5 g One compensation mark for recognising 3 half lives OR for using correct iterative method Max 1 mark if no/wrong unit	(1) (AO2) (1) (AO2)	2
(iii)	4 months One compensation mark for recognising there are two half lives OR that the activity has decreased by a factor of 4	(1) (AO2) (1) (AO2)	2
(b)(i)	Large even scale and all points plotted correctly Acceptable line of best fit (curve)	(1) (AO2) (1) (AO2)	2
(ii)	As read from acceptable line of best fit (curve) with correct unit At least two readings taken and average calculated	(1) (AO2) (1) (AO3)	2

(c)	(A) / the one with the shortest half life stated Any two relevant points e.g. If bought activity would fall too quickly Would soon be too weak to use Would be paying for isotope you couldn't use Unnecessary risk of storing radioactive material for very little benefit	(1) (AO2) (1) (AO2) (1) (AO2)	3
(d)	(B) /the one with the longest half-life stated Any two suitable reasons for one mark each e.g. Will stay active long enough to treat the problem Patient will not need the implant changed frequently Activity remains stable for a long time	(1) (AO2) (1) (AO2) (1) (AO2)	3
(e)(i)	Suitable equipment(must include a detector) Suitable method outlined Describes how will recognise beta radiation is present Describes how will know whether alpha and gamma are present Describes how will know if ONLY beta is present	(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3)	5
(ii)	E.g. background radiation Will detect radiation that is not coming from the sources being tested so will give 'false positives' Allow answers related to sample decaying/ short half life, random nature of decay.	(1) (AO3) (1) (AO3)	2
(f)	Any three valid points: Gamma has very high penetration Will leave body without having a great effect on target cells (must be clearly linked to penetration rather than to excretion) May have an effect on vulnerable nearby cells as doesn't act at site but travels through nearby cells Low ionisation so has very little effect on target cells Allow radiation can penetrate out of body so possible effect on other people	(1) (AO2) (1) (AO2) (1) (AO2)	3
(g)(i)	3 days Allow one mark compensation for correct equation, correct substitution, correct manipulation of inverses – maximum 2 marks	(1) (AO2) (1) (AO2) (1) (AO2)	3
(ii)	Some material removed through excretion / metabolised	(1) (AO1)	1

Total Mark: 29

Question 6

(a)(i)	20 000Hz Unit needed	(1) (AO1)	1
(ii)	360 m/s unit penalty, 1 mark Allow one mark compensation for correct equation and/or correct substitution	(1) (AO2) (1) (AO2) (1) (AO2)	3
(b)(i)	Similar	(1) (AO1)	1
(ii)	0.01 (allow 92 for 2 marks – has calculated reverse direction) One compensation mark for correct equation, correct substitution and/or correct manipulation of squares- max 2 Ignore units	(1) (AO2) (1) (AO2) (1) (AO2)	3
(c)(i)	Any two sensible reasons e.g. Less dangerous X-rays wouldn't give good contrast, ultrasound will	(1) (AO2) (1) (AO2)	2
(ii)	Any sensible advantage of method 1 e.g. better acoustic contact Matching explanation e.g. because can ensure the gel is in contact with both the transmitter and the surface NB reference to invasive or non-invasive needs justification to gain marks. Any sensible advantage of method 2 e.g. likely to get strong reflections Matching explanation e.g. less other soft tissue in the way	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2)	4
(d)	Non invasive Absolutely nothing enters the body / only detecting heat energy leaving the body	(1) (AO2) (1) (AO2)	2

Total Mark: 16