Version 1.0: 0207

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Applied Science 8771/8773/8776/8779

SC08 Medical Physics

Mark Scheme

2007 examination - January series

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Question 1

(a)	Uses (conductive) gel	(1)(AO1)	**1**
(b)	Any two of: (one mark each) • Interference • Movement produces electrical impulses • Electrical impulses in nerves/muscles	(2)(AO2)	**2**
(c)(i)	Theta	(1)(AO1)	**1**
(ii)	Mental activity	(1)(AO1)	**1**
(iii)	Deep sleep	(1)(AO1)	**1**

Total Mark: 6

Question 2

(a)(i)	One mark for each correct label	(4)(AO1)	**4**
(ii)	Rotates Reduce number of electrons Hitting the same point Other valid answers accepted	(1)(AO2) (1)(AO1)	**2**
(b)(i)	Any suitable precaution E.g. shielding other areas	 (1)(AO1)	**1**
(ii)	Suitable explanation linked to precaution stated.	(1)(AO2)	**1**
(iii)	Any suitable condition E.g. cancer, burns, genetic damage	 (1)(AO1)	**1**
(iv)	Stochastic – extent of damage depends on amount of radiation received Somatic – not inherited	(1)(AO1) (1)(AO1)	**2**
(c)(i)	Well defined images	(1)(AO1)	**1**
(ii)	Contrast media used Increase difference in density/absorption Appropriate answers relating to exposure time and/or energy of X-rays accepted.	(1)(AO1) (1)(AO1)	**2**
(d)	Any two suitable reasons e.g. • Cheaper • Quicker • More machines available • More trained personnel available • Lower dose of radiation/safer	(1)(AO1) (1)(AO1)	**2**

Total Mark: 16

Question 3

(a)(i)	Time taken for half the radioactive Nuclei present to decay (or wtte)	 (1)(AO1)	**1**
(ii)	0.125g 1 compensation mark for either: • 4 half lives • correct use of iterative method	(2)(AO2)	**2**
(iii)	Any two clear points e.g. • Can ensure activity is as expected • Won't have had time to decay much • No need to buy material not needed • No need to store	(2)(AO2)	**2**
(b)(i)	Large even scale & points plotted correctly Acceptable line of best fit (curve)	(1)(AO3) (1)(AO3)	**2**
(ii)	As read from graph Evidence of taking more than one value and averaging	(1)(AO3) (1)(AO3)	**2**
(c)(i)	Half life short enough for patient safety Half life long enough to do the trace	(1)(AO2) (1)(AO2)	**2**
(ii)	Suitable experiment outlined Result expected for gamma Result expected if alpha and beta Suitable source of error identified	(1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3)	**4**
(d)	Any two of: (1 mark each) • Gamma can leave body • High penetration • Needs to be detected externally Any two of: (1 mark each) • Alpha and beta act at site • Alpha and beta too ionising • Alpha and beta too damaging	(2)(AO2) (2)(AO2)	**4**
(e)	Any two sensible pieces of information (1 mark each) E.g. toxicity, cost, availability, organ affinity with corresponding reasons e.g. don't want to poison patient	 (2)(AO1) (2)(AO2)	**4**
(f)	24 days 1 mark compensation for: Correct equation Correct substitution Correct re-arrangement Correct inversion Maximum 2 marks compensation	(3)(AO2)	**3**

Total Mark: 26

Question 4

(a)	1.35 Allow 1.3 – 1.4 Allow 1 mark compensation for: Correct equation Correct substitution or correct use of sines Maximum 2 compensation marks	(3)(AO2)	**3**
(b)(i)	Correct diagram showing ray • emerging into the air • bending away from the normal	 (1)(AO2) (1)(AO2)	**2**
(ii)	Correct diagram showing ray • totally internally reflecting • angle i = angle r (by eye)	 (1)(AO2) (1)(AO2)	**2**
(c)	Any four of: (1 mark each) • TIR only when angle > c • Endoscope uses TIR • High n = low c • More chance of reflection when c is small • More chance of reflection when n is large • If angle<c ray emerges into air • More rays reflecting gives brighter light	(4)(AO2)	**4**
(d)(i)	To keep the refractive index constant OR prevent light being lost	(1)(AO1)	**1**
(ii)	(Slightly) lower	(1)(AO1)	**1**
(e)	Any suitable condition e.g. stomach ulcers	(1)(AO1)	**1**

Total Mark: 14

Question 5

(a)	Sound/longitudinal waves Higher frequency than audible/above 20kHz	(1)(AO1) (1)(AO1)	**2**
(b)(i)	Any two points (1 mark each) e.g. • Removes air • Improves transmission • Reduces reflection • At surface of body • Minimises density difference	(2)(AO1)	**2**
(ii)	Any 4 correct points in sequence (1 mark each) e.g. • When they hit tissue of different density • They are reflected • Reflections occur at different times • Different tissue densities produce different intensity reflections • (Transducers) detect reflections • Reflections analysed • Image created from analysis	(4)(AO1)	**4**
(c)(i)	Heat (radiation) emitted from the body Detected by camera/film/electronic detectors	(1)(AO1) (1)(AO1)	**2**
(ii)	Nothing enters the body	(1)(AO2)	**1**

Total Mark: 11

Question 6

(a)(i)	Above normal	(1)(AO1)	**1**
(ii)	(145) Systolic/in systole (or wtte) (90) Diastolic/in diastole (or wtte)	(1)(AO1) (1)(AO1)	**2**
(b)	Any suitable advantage for 1 mark e.g. • Less chance of infection Any suitable disadvantage for 1 mark e.g. • Less accurate • If using invasive method can remove blood for other purposes without having to put another line into the artery.	(1)(AO1) (1)(AO1)	**2**
(c)	Method B (no marks) Can monitor continually Can have audible warning (Other sensible reasons accepted)	 (1)(AO2) (1)(AO2)	**2**

Total Mark: 7