



## **General Certificate of Education**

# **Applied Science** **8771/8773/8776/8779**

**SC08      Medical Physics**

## **Mark Scheme**

*2007 examination – June series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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**Question 1**

	CAT scanner-cancerous tumour EEG – brain ECG – heart X-ray- skeletal structure Ultrasound – foetal development	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1)	<b>5</b>
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**Total Mark: 5****Question 2**

(a)	Any three points for one mark each:  Use of strong magnetic field Views body from different angles Different effects on different organs Effects depend on chemical composition Computer generates image	(3) (AO1)	<b>3</b>
(b)	Any two points for one mark each:  Do not use such high energy radiation/ X-rays No evidence that strong magnetic fields have such damaging effects on cells X-rays are known to damage cells CAT scans use very high doses of X-rays.	(2) (AO2)	<b>2</b>

**Total Mark: 5****Question 3**

(a)	Liquid expands when heated. Rises up (inner) tube The greater the temperature, the further it rises. Other relevant points, such as expansivity of liquid and glass, adhesion of liquid etc will be credited	(1) (AO1) (1) (AO1) (1) (AO2)	<b>3</b>
(b)	Suitable advantage e.g. more accurate Explained e.g. closer to measuring core temperature  Suitable disadvantage e.g. hard to read accurately Explained e.g. because liquid thread is very thin	(1) (AO1) (1) (AO2)  (1) (AO1) (1) (AO2)	<b>4</b>
(c)	This patient is suffering from hypothermia	(1) (AO2)	<b>1</b>

**Total Mark: 8**

**Question 4**

(a)(i)	Sound/longitudinal/compression <u>wave</u> Above 20Khz/above human hearing range	(1) (AO1) (1) (AO1)	<b>2</b>
(ii)	Electromagnetic wave High frequency/high energy	(1) (AO1) (1) (AO1)	<b>2</b>
(b)	Better contrast Explained	(1) (AO1) (1) (AO2)	<b>4</b>
	Less dangerous Explained	(1) (AO1) (1) (AO2)	
(c)	Any suitable condition	(1) (AO1)	<b>1</b>
(d)(i)	0.02 (allow compensation mark for correct equation/substitution/rearrangement)	(2) (AO2)	<b>3</b>
	m	(1) (AO1)	
(ii)	Velocity does not change	(1) (AO2)	<b>2</b>
	Determined by medium/wavelength halves	(1) (AO2)	
(e)(i)	Evacuated tube-allows electrons to travel across tube freely	(1) (AO1)	<b>4</b>
	Cathode – produces electrons	(1) (AO1)	
	Lead housing – stop X-rays escaping from the machine.	(1) (AO1)	
	Anode produces X-rays/attracts electrons	(1) (AO1)	
(ii)	To prevent overheating	(1) (AO1)	<b>2</b>
	As electrons will not be hitting the same part all the time.	(1) (AO1)	
(f)	X-rays use (differential) absorption	(1) (AO2)	<b>2</b>
	Ultrasound uses (differential) reflection	(1) (AO2)	

**Total Mark: 22****Question 5**

(a)	Total internal Reflection	(1) (AO1)	<b>1</b>
(b)	High refractive index means low critical angle	(1) (AO2)	<b>3</b>
	Any two of the following points for 1 mark each: Light reflects if angle is greater than critical angle The smaller the critical angle, the more rays will hit at an angle greater than the critical angle More light will reflect (if the critical angle is small)	(2) (AO2)	
	Clear indication that candidate knows what the critical angle is	(1) (AO3)	
	Indication that the angle measured is the angle between the ray and the normal	(1) (AO3)	
(c)	Description of equipment used (must include a way of measuring angles)	(1) (AO3)	<b>4</b>
	Description of how equipment is used	(1) (AO3)	
(d)	1.589 (1.5)(1.58) (1.6)	(3) (AO2)	<b>3</b>
	One compensation mark for each of the following (max 2)		
	Correct equation $n = 1/\sin c$		
	Correct substitution $n = 1/\sin 39^\circ$ or $1/0.629$		
	Correct use of sines		

**Total Mark: 11**

**Question 6**

(a)	Tracer – something put into the body which then has its path traced Diagnosis – finding out what is wrong	(1) (AO1) (1) (AO1)	<b>2</b>
(b)(i)	Gamma Any two of: Least ionising Will do least damage Most penetrating Can be detected outside the body.	(1) (AO1) (2) (AO2)	<b>3</b>
(ii)	Between 1 hour and 2 weeks accepted. Long enough for trace to take place Patient does not remain radioactive for too long	(1) (AO1) (1) (AO2) (1) (AO2)	<b>3</b>
(iii)	Any two suitable properties – one mark each Explained – one mark each. e.g. toxicity because you don't want to poison the patient; organ affinity because you may want to target a specific organ	(2) (AO1) (2) (AO2)	<b>4</b>

**Total Mark: 12****Question 7**

(a)(i)	Any two of: Acts at site/less penetrating Will do little harm to surrounding tissue Very ionising Does most damage to cancer cells	(2) (AO2)	<b>2</b>
(ii)	At least one month Will remain active for long enough to do its job Will not have to be replaced too often	(1) (AO1) (1) (AO2) (1) (AO2)	<b>3</b>
(b)	To ensure tumour can be attacked from all angles To minimise damage to surrounding cells.	(1) (AO2) (1) (AO2)	<b>2</b>

**Total Mark: 7**

**Question 8**

(a)(i)	50 days Evidence of taking more than one reading (and averaging)	(1) (AO2) (1) (AO3)	<b>2</b>
(ii)	Comment on suitability Effect of using larger time intervals Effect of using shorter time intervals	(1) (AO3) (1) (AO3) (1) (AO3)	<b>3</b>
(b)	4 days  1 compensation for: 4, correct equation, correct substitution, correct re-arrangement Max 2  Excreted Further detail / absorbed	(3) (AO2)       (1) (AO2) (1) (AO2)	<b>5</b>

**Total Mark: 10**