OCR
RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced GCE

Unit **G635:** Working Waves

Mark Scheme for June 2011

Oxford Cambridge and RSA Examinations

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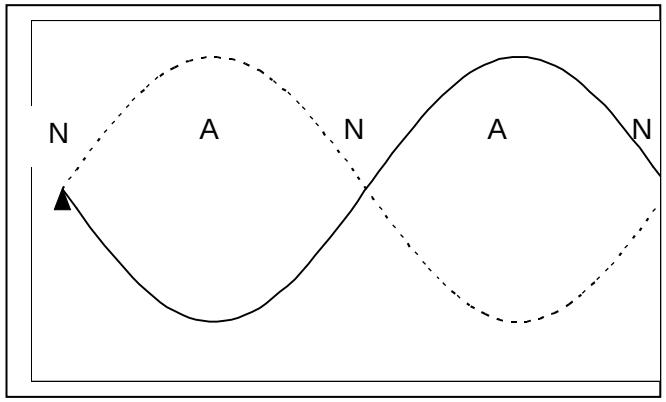
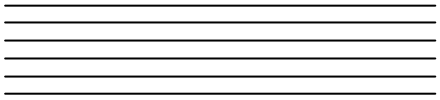
Question			Expected Answer		Mark	Rationale/Additional Guidance
1	a		Distance moved from its equilibrium position / in a specified direction ✓		1	Specified direction could be e.g. up/down/left/right **Accept** height but not level (= a specified direction) **Reject** amplitude
	b		Amplitude ✓		1	
	c		1.5(0) (m) ✓		1	**Accept** 150 cm **Reject** 150 m
	d		9 x 0.5/5 ✓ (= 0.90 m s^{-1})		1	**Accept** 4.5/5
	e		velocity = $f\lambda$ ✓ $f = \frac{v}{\lambda}$ $= \frac{0.90}{1.5}$ ✓ = 0.6(0) Hz✓		1 1 1	stated or implied **Accept** c in place of v **Allow** ecf from (c) for ($\lambda = 4.5$ m gives f = 0.2 Hz) **Allow** any sf but must have correct unit
	f		$f = \frac{\text{number of cycles}}{t}$ ✓ number of cycles $= f \times t$ $= 0.60 \times 5.0$ ✓ = 3 or 3.0 ✓	**Or** number of cycles = total distance/λ ✓ = 4.5/1.5 ✓ =3 ✓	1 1 1	Stated or implied **Allow** ecf from (c) or (e) ($\lambda = 4.5$ m and/or f = 0.2 Hz gives number of cycles =1)

Question			Expected Answer	Mark	Rationale/Additional Guidance
	g		any **three** from the following points: for progressive waves the wave appears to move along the pool✓ for standing waves the water has stationary point/ does not move at all at some points ✓ for standing waves the (maximum) amplitude is twice/greater than that for the progressive wave ✓ for standing waves the amplitude (of the movement of individual particles) is different at different points ✓ for standing waves the water only moves up and down (at some points) ✓ the movement of the water particles in standing waves between any two adjacent nodes are in phase ✓ for standing waves the water moves vertically at all points ✓	3	**Accept** maximum displacement for amplitude ora OR the movement of the water particles in standing waves between any two successive pairs of nodes are in antiphase at all points
	h	**i**	two nodes correctly marked ✓ both antinodes correctly marked ✓	1 1	 **Reject** contradictions. i.e. if N shown at A position or A shown N position scores zero

Question			Expected Answer	Mark	Rationale/Additional Guidance
					Letters can be placed anywhere vertically above or below positions shown **Accept** three Ns if in correct position, otherwise additional letters lose marks for that letter
		ii	2.0 (m) ✓	1	
		iii	node to antinode = $\lambda/4$ ✓ (4 x 0.33) = 1.32 (m) ✓	1 1	stated or implied
			Total	**[18]**	

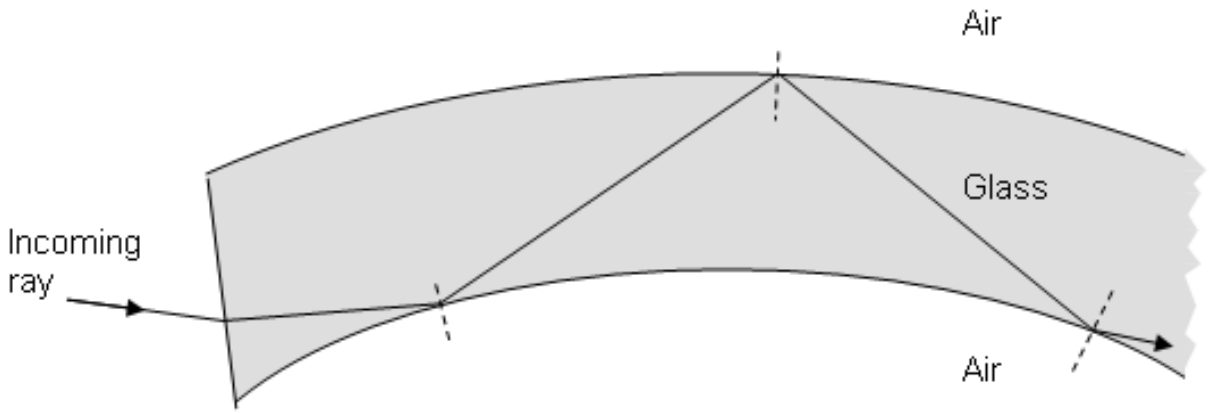
Question			Expected Answer	Mark	Rationale/Additional Guidance
2	a		infra-red ✓	1	**Accept** IR
	b		one which absorbs all the radiation (of any wavelength/frequency) (falling on it) ✓	1	**Accept** … emits maximum the radiation **…** **Accept** …absorbs most of the radiation … **Reject** emits no radiation
	c		**Banded marking range:** **[0 mark]** response not worthy of credit. **[1 mark]** Candidate demonstrates limited knowledge of the use of thermal imaging by describing at least one of the above points. Errors of grammar, punctuation and spelling may be intrusive. **[2-3 marks]** Candidate demonstrates understanding of the use of thermal imaging by describing and explaining: For 2 marks at least two valid points. For 3 marks at least three valid points. There may be occasional errors in spelling, punctuation and grammar. **[4-5 marks]** Candidate demonstrates a high level of knowledge and understanding of the use of thermal imaging by describing: for 4 marks at least four valid points. for 5 marks five valid points. There are few, if any, errors in spelling, punctuation and grammar.	5	Expected knowledge and learning could include the following valid points Use of camera ✓ Link fault to (unusual) temperature/ warm/cool ✓ Differences in temperatures /hotter/colder ✓ Difference in wavelength/frequency/intensity emitted ✓ Image has different colours/brightness/shades of grey ✓

Question			Expected Answer	Mark	Rationale/Additional Guidance
	d		Idea of ears being at a different temperature (from body) ✓ Plausible suggested reason for different temperature ✓ e.g. blood vessels close to surface ears have a larger surface area (to volume ratio) / less fur insulation / reduced blood flow (rate)	2	**Accept** either hotter of colder or less/ more /different heat
	e		**spatial**: separation of points which can be distinguished / can distinguish between points close together ✓ **thermal**: difference of temperature which can be distinguished / can distinguish between points at close temperatures ✓	1 1	**Accept** (Good spatial resolution means that) can see fine detail **Accept** Pixel size/number of pixels not just pixelated **Accept** (Good thermal resolution means that) can detect small temperature difference
			Total	**[11]**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
3	a		**Banded marking range:** **[0 mark]** response not worthy of credit **[1-2 mark]** Candidate demonstrates limited knowledge of coherent and incoherent optical fibres by describing: For 1 marks at least one valid point/diagram. For 2 marks at least two valid points/diagrams. The answer may not be clearly set out. **[3-4 marks]** Candidate demonstrates understanding of coherent and incoherent optical fibres by describing and explaining: For 3 marks at least three valid points/diagram. For 4 marks at least four valid points/diagrams. The answer will be set out in a manner that is easy to follow. **[5-6 marks]** Candidate demonstrates a high level of knowledge and understanding of coherent and incoherent optical fibres by describing: For 5 marks at least five valid points/diagram. For 6 marks at least six valid points/diagrams. The answer will be set out in a clear and logical manner. .	6	Expected knowledge and learning could include the following valid points: **coherent bundles:** fibres arranged in the same order throughout/at both ends **or** fibres parallel ✓ used to carry image (from object to eye) / so that image is not jumbled up / to keep pixels in the correct position / order / arrangement ✓  IN OUT OR  **incoherent bundles:** fibres arranged in the random order ✓ used carry light (from lamp to object) / cheaper / easier to manufacture ✓  IN OUT OR  diagrams are indicative. Diagrams must be labelled to identify which is which. alternative valid diagrams are also acceptable

Question			Expected Answer	Mark	Rationale/Additional Guidance
	b	**i**	any **one** of: telephone lines ✓ (cable) television ✓ (fast) internet /broadband ✓ LAN connections ✓ **Non-medical** use of endoscope ✓	1	**Accept** telephones **Accept** communications
		ii	(decorative / Christmas tree / display cabinet / car dashboard) lighting ✓	1	**Reject** light <u>bulbs</u> **Reject** "light" with no further detail
	c	**i**	total internal reflection ✓	1	

Question			Expected Answer	Mark	Rationale/Additional Guidance
		ii	any **three** points from: diagram showing ray inside fibre travelling towards wall at $i > \sim 45^{o}$ ✓ diagram showing reflections along fibre with $i = r$ ✓ Correct refraction of ray shown entering fibre ✓ AVP ✓	3	(by eye) (by eye) i.e. by eye no labels, no normal or no angle marks needed i.e. towards normal e.g. diagram showing *i* or *C* between ray (and normal) see diagram below



Question			Expected Answer	Mark	Rationale/Additional Guidance
		iii	any **two** points from: refractive index of air<refractive index of glass ✓ angle of incidence > critical angle / 42^0 ✓ Ray is not refracted out of (sides of) fibre ✓	2	Or value in range 41.8° to 45°
	d	i	39° ✓	1	
		ii	$n = \frac{1}{\sin 39}$ ✓ 1.6 ✓	1 1	Mark is for rearrangement and substitution **allow** ecf from (i) or use of C = 42^0 Stated or implied. (e.g. may be implied by answer 1.59 with no working) n=1/0.63 scores. 0.63 = 1/n does not score (42^0gives ans = 1.5 51^o gives ans = 1.3) must be to 2 sig figs
	e	i	cladding	1	
		ii	any **two** points from: fewer reflections ✓ bigger angle of incidence required (to get reflection) ✓ fewer rays will pass along the fibre ✓ only rays entering at an angle closer to the axis will pass along the fibre ✓ less dispersion/better signal quality ✓	2	**Accept** shorter time/distance to travel along fibre **Reject** faster
		iii	1. (protective) sheath ✓ 2. protection / prevention of (physical) damage ✓	1 1	**Accept** jacket / PVC coating **Reject** cladding
			Total	**[22]**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
4	a	i	users take it in turns to talk / send (information) ✓	1	**Accept** only one user can talk at a time **Accept** Twp people can talk at the same time
		ii	CB radio / Walkie Talkie /AVP ✓	1	**Accept** historic military use
	b	i	both users can talk/send (information) at the same time ✓	1	
		ii	(mobile) telephone ✓	1	**Accept** mobile
	c		Simplex only ever one way and half duplex only one way at a time **or** in simplex/broadcast (radio/TV) one user can never speak /send (half duplex the other user can speak when first user finishes) ✓	1	
	d	i	all four correct ✓	1	Fig. 4.1 analogue Fig. 4.2 digital Fig. 4.3 analogue Fig. 4.4 digital
		ii	binary is one example of digital **or** in a binary system (the signal) can (only) have values of 0 and 1 ✓ any **one** from: digital refers to any system using discrete numbers ✓ any other example of digital such as 0 – 9 ✓ Fig. 4.2 is digital but not binary ✓	1 1	
	e	i	amplitude modulation ✓ frequency modulation ✓	1 1	
		ii	in AM the **amplitude** of the signal **varies** (according to the audio signal) but **frequency** stays the **same** ✓ in FM the **frequency** of the signal **varies** (according to the audio signal) but **amplitude** stays the **same** ✓	1 1	 **Accept** FM signals provide better quality than AM
			Total	**[12]**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
5	a		0.5 – 20 miles/1 – 40 km ✓	1	**Accept** any value in range If overlapping range given accept if max is no more than 40 miles / 80 km and min is no less than 0.25 miles / 0.5 km
	b		hexagonal cells at least 4 drawn ✓	1	**Accept** 4 adjacent hexagons even if additional cells arte other shapes
	c		base stations shown at the centre or at intersections of cells ✓ base stations shown at alternate intersections of cells ✓	1 1	**Accept** clear alternatives to X If more than 3 base stations all must meet criteria
	d		Any **three** from (To allow) more people to make calls (at the same time) ✓ frequency re-use / Many cells use same frequency ✓ in non-adjacent cells / (min.) 7 (pairs of) frequencies needed ✓ Lack of signal strength/ large power needed (if one big cell) ✓ Hazard of large power from mobile phone ✓	3	**Accept** calls using the same frequency don't interfere
	e		Multiplexing / TDMA/FDMA/CDMA/time division multiple access / frequency division multiple access / code division multiple access✓	1	
	f		up-link: signal from phone to base station / mast down-link: signal from base station / mast to phone / "vice versa"✓	1	NOT satellite both correct to score
			Total	**[9]**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
6	a		any **three** from: can cause cancer specific examples inc, leukaemia **/** genetic damage ✓ can kill / damage cells /DNA ✓ can cause change/ mutation (of cells) ✓ X and γ can reach into centre of body ✓ cells cannot reproduce / uncontrolled cell reproduction ✓ ionisation removes electrons from atoms ✓ causes chemical reaction/example ✓	3	
	b		any **two** from: use a sensitive emulsion ✓ image intensifying screens ✓ Use of X-ray filter ✓ Reduce exposure of other parts of the body/Lead screen (etc) ✓ Minimising number of images/Keeping still ✓	2	or digital equivalent **Accept** use of Grid ✓ ignore reduce time

Question			Expected Answer	Mark	Rationale/Additional Guidance
	c	i	any **three** from: need to balance risk and benefit ✓ example of risk e.g. cancer (elsewhere) / loss of hair/stress/time ✓ example of benefit e.g. kills (existing) cancer / lengthens life ✓ painful / exhausting treatment ✓ Alternative treatments (or lack of) ✓ The amount / dose / time of exposure to radiation ✓ Examples of precaution e.g. rotating beam / shielding of other parts of body ✓ Radiation over several treatments (to permit recovery) cumulative effect of multiple doses ✓ Previous radiation dose / treatment (or lack of)✓ (External source therefore) patient not radioactive after treatment ✓ Ethical considerations ✓	3	Accept success rate

Question			Expected Answer	Mark	Rationale/Additional Guidance
		ii	careful planning (qualified) / reduce the dose to parts of the body not undergoing treatment; **or** rotating source ✓	1	
	d	**i**	the time taken for the number of active nuclei to be halved **or** the average time taken for half the radioactive material present (to decay) **or** the time taken for the count rate to fall to half of its initial value ✓ due to (nuclear) decay / disintegration ✓	1 1	
		ii	the time taken for half the tracer / nuclei to be excreted ✓	1	accept specific example of excretion e.g urine, sweat
		iii	$t_{1/2}$ = 6 hours/2 half lives elapse ✓ ½ x ½ = ¼ ✓ ¼ x 20 = 5 (counts per second) ✓	1 1 1	stated or implied or 20/2 = 10 0r 10/2 =5 if stated as final answer Further divisions by 2 scores 2nd mark only
		iv	$\frac{1}{t} = \frac{1}{t_p} + \frac{1}{t_b}$ ✓ $= \frac{1}{6} + \frac{1}{12}$ ✓ $= \frac{3}{12}$ $= \frac{1}{4}$ t = 4 (hours) ✓	1 1 1	stated or implied
			Total	**[18]**	

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