www.xtrapapers.com

Rewarding Learning

ADVANCED
General Certificate of Education
2018

Life and Health Sciences

Assessment Unit A2 4

Sound and Light

[AZ041]

THURSDAY 31 MAY, AFTERNOON

MARK SCHEME

www.xtrapapers.com

Foreword

Introduction

Mark Schemes are published to assist teachers and students in the preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of 16–18-year-old students in schools and colleges. The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes therefore are regarded as a part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

www.xtrapapers.com

AVAILABLE MARKS

1 **(a)** **(i)**

Transverse	Longitudinal
Radio waves	Sound
Microwave	
Light	
X-rays	
Infrared	

[$\frac{1}{2}$] each, round down [3]

(ii) Radio/Microwave/Light/X-rays/Infrared [1]

(iii) Travel at same speed in a vacuum [2]
(travel in a vacuum – award 1 mark only)
(travel at same speed – award 0 marks)

(b) **(i)** Amplitude clearly and correctly marked [1]

(ii) sight of 19 [1]
9.5 mm [1]

(iii) 2.5 waves in 150 ms (or similar) [1]
60 (ms) [1]

(iv) Time = 0.06 s (ecf from **(iii)** to **(iv)**) [1]
1/0.06 = 16.7 [1]
(credit $\frac{1}{60}$ for 1 mark only)

(v) $v = f\lambda$ [1]
$= 16.7 \times 0.042$ (ecf for frequency from **(iv)**) [1]
0.701 (Accept 0.7, 0,70 or 0.700) [1]
([–1] power of 10 error)

16

www.xtrapapers.com

					AVAILABLE MARKS
2	(a)	(i)	(Movable) resonance tube/open pipe	[1]	
			Fixed frequency (tuning fork)	[1]	
			Metre stick	[1]	
			(or fixed tube, variable frequency, i.e. speaker, signal generator and metre stick)		
			(Deduct 1 mark if label missing or incorrect, **once** only)		
		(ii)	Frequency	[1]	
			Length of air column (not just length)	[1]	
		(iii)	freq vs $\frac{1}{\text{length}}$ or $\frac{1}{\text{length}}$ vs freq or		
			length vs $\frac{1}{\text{frequency}}$ or $\frac{1}{\text{frequency}}$ vs length		
			([1] for each axis)	[2]	
		(iv)	Calculate/find gradient	[1]	
			gradient × 4 or $\frac{1}{\text{gradient}}$ × 4 to find speed	[1]	
			[1st and 3rd] [2nd and 4th]		
	(b)	(i)	signal generator/oscillator	[1]	
		(ii)	Two nodes clearly marked	[1]	
			Two antinodes clearly marked	[1]	
		(iii)	One loop drawn	[1]	
		(iv)	120 (cm) ecf from dia (if viable diagram)	[1]	
		(v)	maximum/largest amplitude	[1]	15

www.xtrapapers.com

AVAILABLE MARKS

3 (a)

Outer ear	Middle ear	Inner ear
pinna	ossicle	oval window
auditory canal		cochlea
tympanic membrane		auditory nerve

2 correct for each mark. [3]

(b) Indicative content

- Pinna funnels sound
- Through auditory canal
- Tympanic membrane (ear drum) vibrates
- Ossicles amplify the vibrations
- Oval window separates liquid filled inner ear from air filled middle ear/inner ear filled with fluid
- Different parts of cochlea respond to different frequencies
- Cochlea changes (mechanical) vibrations into electrical signals
- Electrical signals pass along auditory nerve (to the brain)

Response	Mark
Candidate identifies and describes 7 or more of the points shown in the indicative content. There is a widespread and accurate use of appropriate scientific terminology. Presentation, spelling, punctuation and grammar are excellent. Candidates use the most appropriate form and style of writing. Relevant material is highly organised with clarity and coherency.	[7]–[8]
Candidate identifies and describes between 5 and 6 of the points shown in the indicative content. There is a widespread and accurate use of appropriate scientific terminology. Presentation, spelling, punctuation and grammar are excellent. Candidates use the most appropriate form and style of writing. Relevant material is organised with clarity and coherency.	[5]–[6]
Candidate clearly identifies between 3 and 4 of the points shown in the indicative content. There is some use of appropriate scientific terminology. Presentation, spelling, punctuation and grammar are sufficient to make the meaning clear. Candidates use an appropriate form and style of writing. There is some attempt to organise material.	[3]–[4]
Candidates clearly identify 1 or 2 of the points shown in the indicative content. There is limited reference to scientific terminology. Presentation, spelling, punctuation and grammar may contain some errors. The form and style are of a satisfactory standard. There is only a limited attempt to organise material.	[1]–[2]
Response is not worthy of credit	[0]

[8] 11

www.xtrapapers.com

				AVAILABLE MARKS
4	(a)	Energy per second (or rate of flow of energy) or power through unit area (or through 1 m^2)	[1] [1]	
	(b)	$W\,m^{-2}$	[1]	
	(c)	$I = I_O \times 10^{(dB\ level/10)}$ $= 10^{-12} \times 10^{7.7}$ $= 5.0 \times 10^{-5}$	[1] [1] [1]	
	(d)	dB level = 10 log $\frac{I}{I_O}$ dB level = 10 log $\frac{10^{-8}}{10^{-12}}$ dB level = 40	[1] [1] [1]	
	(e) (i)	each increase of 10 produces a 10 fold increase in intensity (or similar)	[1]	
	(ii)	human hearing covers a wide range of intensities/values	[1]	11
5	(a) (i)	Labelled diagram to show: glass/core and cladding Core labelled R Light TIR (by eye)	 [1] [1] [1]	
	(ii)	Can transmit data over long distances (without integrity loss) Monomode fibres are more expensive **or** can carry only one wavelength at a time	[1] [1]	
	(iii)	long distance telecommunication (phone or tv) Fibre optic decorations Broadband Laparoscopy/Endoscopy	[1]	
	(iv)	wider pulse, but with no larger amplitude	[1]	
	(b)	Sound converted to electrical signal Using a microphone Electrical signal converted to radio signal Of same frequency Using a dipole aerial Signal detected by antenna Converts radio signal back to electrical signal Speaker converts this back to sound (Any six)	 [6]	
	(c)	Short range communication Between (two) devices Using microwaves/radiowaves Wireless headphones/mouse/keyboard/phone and car, etc.	[1] [1] [1] [1]	17

www.xtrapapers.com

					AVAILABLE MARKS
6	(a)	(i)	Adjust (lens and screen) to obtain a focused image	[1]	
			Measure and record object distance from lens	[1]	
			Measure and record image distance from lens	[1]	
			For (5) sets of results (or more)	[1]	
		(ii)	Use lens formula	[1]	
			To calculate power for each set of results	[1]	
			Average the results	[1]	
			or		
			Plot 1/u against 1/v,	[1]	
			Find intercepts	[1]	
			Average	[1]	
	(b)		Power = $\frac{1}{u} + \frac{1}{v}$	[1]	
			$6.67 = \frac{1}{0.42} + \frac{1}{v}$	[1]	
			v = 0.23 (Sight of 0.23 worth [3])	[1]	
			distance = 0.65	[1]	
	(c)	(i)	convex/converging	[1]	
		(ii)	corrected near point 0.25 m	[1]	
			Far point –0.75 m	[1]	
			subs $P = \frac{1}{0.25} - \frac{1}{0.75}$ ecf from both here	[1]	
			= 2.67	[1]	16
7	(a)	(i)	Shades inside curve (threshold mark)	[1]	
			Up to but not above 80 dB (but above 70)	[1]	
		(ii)	Quietest sound that can be heard/threshold of human hearing	[1]	
		(iii)	3–4 kHz	[1]	
			Resonance in auditory canal	[1]	
		(iv)	Louder	[1]	
			Larger range of frequencies	[1]	
			Particularly at lower frequency range	[1]	
	(b)		People perceive loudness in different ways	[1]	
	(c)	(i)	(Frequency adjusted to) **1 kHz**	[1]	
		(ii)	dB meter	[1]	
		(iii)	Standard source adjusted until sources are equally loud	[1]	
			dB of standard source is noted	[1]	
			this is equal to loudness of the unknown source in phons	[1]	14
				Total	**100**