



Rewarding Learning

ADVANCED
General Certificate of Education

Life and Health Sciences

Assessment Unit A2 4

Sound and Light

[AZ041]

Assessment

**MARK
SCHEME**

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.

The abbreviation 'ecf' stands for 'error carried forward'.

			AVAILABLE MARKS	
1	(a) (i)	Longitudinal	[1]	
	(ii)	(air) particles vibrate/oscillate Parallel to direction of travel (of wave) The wave vibrates ...0/2	[1] [1] [2]	
	(b) (i)	Microphone	[1]	
	(ii)	Amplitude greater than 7 but less than 7.8	[1]	
	(iii)	$f = 1/T$ Reads $T = 20$ (ms) or 0.02 (s) 50 (Hz) Ecf for student incorrect reading of T if substituted into a correct equation max award marks [2]	[1] [1] [1] [3]	
	(iv)	$v = f\lambda$ $340 = 50 \times \lambda$ ecf $\lambda = 6.8$ m	[1] [1] [1] [3]	
	(c) (i)	Amplitude decreases Frequency remains constant If more than 2 boxes are ticked then negative marking applies [-1] for each extra box ticked, minimum mark = 0	[1] [1] [2]	
	(ii)	Maximum displacement decreases or amplitude decreases Time period is constant or time for one/each wave remains constant	[1] [1] [2]	15

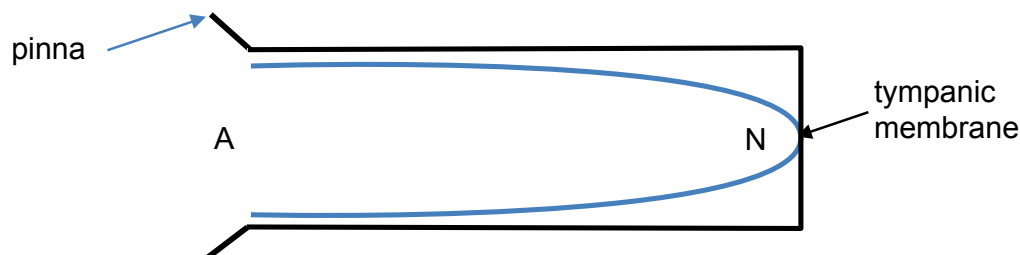
- 2 (a) Any **five** from:
- (Large) changes in pressure can cause pain/rupture of eardrum
 - And loss of hearing/muffled hearing
 - Eustachian tube connects the middle ear to the outside/throat
 - It equalizes the pressure between outside and inside the ear
 - The tube is usually closed
 - It opens during swallowing/chewing/yawning (to let air enter/leave)
- (5 × [1]) [5]

(b)

Function	Part of the inner ear
(Concerned with) balance (and plays no part in hearing.)	(semi-circular canals)
(Connects to brain via the auditory nerve.)	cochlea
(Contains receptors which respond to different frequencies.)	cochlea
(Separates the air filled middle ear from the fluid filled inner ear.)	oval window
Transmits the electrical signals (received from the nerve cells)	(auditory nerve)

[5]

(c) (i) & (ii)



Student to draw 1st harmonic as shown for [1]
 The labelling of Node(s) and Antinode(s) [1] are marked according to students own sketch even if their diagram is incorrect [2]

- (iii) $\lambda = 4 \times L$ no ecf for wrong diagram in (i) [1]
 $340 = \lambda \times 3500$ [1]
 $L = 0.024 \text{ m}$ [1]
 $L = 2.4 \text{ (cm)}$ ecf for correct change of their value in m into cm in (i) [1] [4]
- (iv) The ear is **most sensitive** at this frequency **or** sounds will appear very loud [1]

3 (a) INDICATIVE CONTENT

- Hearing aids are small devices that fit in/behind the ear
- Hearing deteriorates / can't hear everyday conversation/TV
- They can help you to hear sound louder/more clearly
- They are battery-operated
- They have a microphone that picks up the sounds and converts them to electrical signals/has a microphone which converts sound to electricity
- The signals are amplified/increased using an amplifier
- A speaker converted back into sounds

[6]

Response	Marks
Candidate identifies and describes 5 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 organised with clarity and coherency.	[5]–[6]
Candidate clearly identifies between 3 or 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 at least 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]

(b) (i) (×) 1000 [1]

(ii) (×) 8 [1]

(c) (i) $I = I_0 \times 10^{\text{dB level}/10}$ [1]
 $I = 10^{-12} \times 10^{8.5}$ [1]
 $I = 3.16 \times 10^{-4} \text{ (Wm}^{-2}\text{)}$ [1] [3]

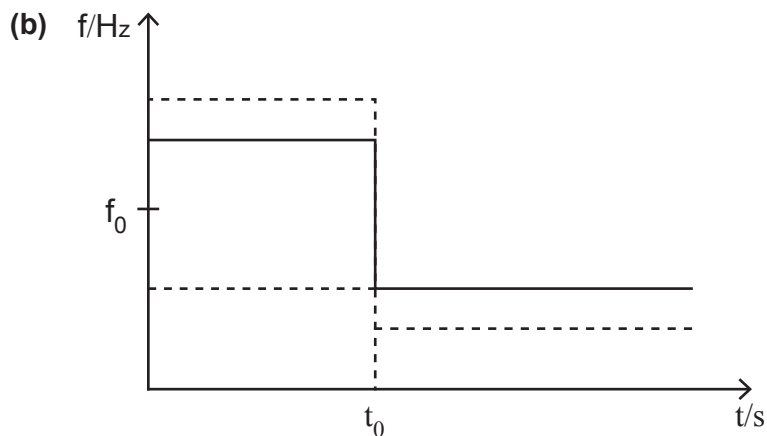
(ii) dB level = $10 \log(I/I_0)$ [1]
 dB level = $10 \log(7.9 \times 10^{-7}/10^{-12})$ [1]
 dB level = 59 [1]
 $85 - 59 = 26 \text{ (dB)}$ ecf for correct subtraction of their dB value from 85 [1] [4]

AVAILABLE MARKS

15

				AVAILABLE MARKS		
4	(a) (i)	Real	There should be 3 boxes ticked	[1]	[3]	
		Diminished	[-1] for any extra boxes ticked	[1]		
		Inverted	Minimum marks [0]	[1]		
	(ii)	Any six from:				
		<ul style="list-style-type: none"> • Rays of light refract/bend most at the cornea • Rays focus on the retina • Rays also refract/bend at the lens • A thin lens produces less bending or less curved lens • This is used when observing far away objects • A thick lens produces more bending or more curved lens • This is used when observing close up objects • The ciliary muscles change the shape of the lens 				
		(6 × [1])			[6]	
		(or The lens shape determines the amount of refraction for 1 .. if no detail of shape of lens provided)				
4	(b)	Comparison	Cat can see better in dark	[1]		
			Humans see more/better in colour	[1]		
			Humans can see in greater detail/better focus/sharper	[1]		
	Explanation	Rods cannot distinguish between colours (whereas there are 3 types of cones which distinguish between colour)	[1]			
			Cones share fewer nerve endings so can distinguish fine detail/1 cone to 1 nerve	[1]		
			Cones have less light sensitivity/rods have greater light sensitivity/due to many rods to 1 nerve	[1]	[6]	15
5	(a)	Distance between the lens centre and the focus			[1]	
	(b) (i)	P = 1/f		[1]	[2]	
		f = 0.20 m		[1]		
	(ii)	P (or 1/f) = 1/u + 1/v		[1]	[3]	
		5 = 1/0.3 + 1/v	or 50 = 1/30 + 1/v	[1]		
		v = 0.60 m	v = 60 cm = 0.6 m	[1]		
	(c) (i)	They can't clearly focus on close up objects/lens can't be made thick enough			[1]	
		Don't accept can't 'see' close up objects				
	(ii)	Rays don't meet before the retina or appear to meet after retina		[1]	[2]	
		Rays meet at the retina		[1]		
	(iii)	P = 1/0.25 – 1/0.8	([1] for negative image)	[2]	[3]	12
		2.75 D	no ecf for positive v	[1]		
		No credit for 2.75 without evidence from a calculation				

- 6 (a) (i) (Apparent) Change in frequency [1]
When there is (relative) movement between source and observer **or** the source moves [1] [2]
- (ii) High pitch is source moving towards observer [1]
Lower pitch when source is moving away from observer [1] [2]

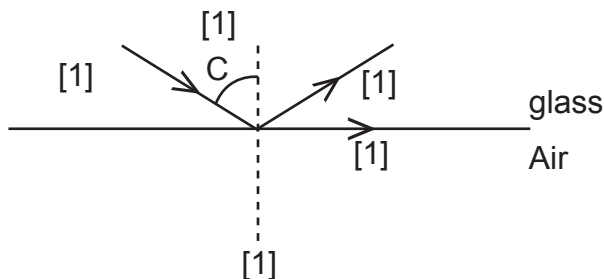


- (i) t_0 labelled correctly on the X axis [1]
- (ii) f_0 labelled correctly between highest and lowest freq values on the Y axis [1]
- (iii) Initial frequency higher than before
Final frequency lower than before
Change/drop in frequency at t_0 [3]
Each part is marked independently
- 7 (a) (i) Clearly labelled sketch to include semicircular block, ray box, incident ray directed towards circular side [3]
[1] for each
- (ii) Any **four** from:
 - Draw a normal (at the centre of the straight side of the block) can be shown on diagram [1]
 - Shine a ray through the (curved side aimed at the normal) glass [1]
 - Change the incident angle [1]
 - Until the refracted ray is at 90° /along straight edge [1]
 - Measure the angle of incidence using a protractor [1] [4]
- (iii) Repeat and average [1]
- (iv) Any **one** from:
Dark room/bright source/measure from incident to reflected ray and divide by 2/narrow slits [1]

AVAILABLE MARKS

9

- | | | |
|---|-----|-----|
| (b) Ray in glass (incident) | [1] | |
| Normal (correctly drawn) | [1] | |
| Critical Angle (correctly labelled). Can't access mark if incident ray drawn in air | [1] | |
| Refracted ray at 90° in air. Can't access mark if incident ray drawn in air | [1] | |
| Internally reflected ray correctly drawn | [1] | [5] |



Max marks if incident ray drawn in air is [2]

- | | | |
|---|------------|-----|
| (c) (i) Single Mode Fibre – diameter of core is thinner.
or
Multimode Fibre – diameter of core is thicker. | | [1] |
| (ii) Many different paths/modes of transmission/
angles of incidence (in the fibre)
Signals arrive at different times | [1]
[1] | [2] |

Total

17

100

AVAILABLE
MARKS