Mark Scheme (Results)

June 2018

BTEC Level 3 National in Applied Science
Unit 1: Principles and Applications of Science – Physics (31617H1P)

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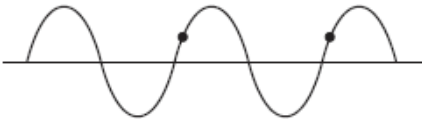# Unit 1: Applications of Science I – sample marking grid

General marking guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Marking grids should be applied positively. Learners must be rewarded for what they have shown they can do, rather than be penalised for omissions.
- Examiners should mark according to the marking grid, not according to their perception of where the grade boundaries may lie.
- All marks on the marking grid should be used appropriately.
- All the marks on the marking grid are designed to be awarded. Examiners should always award full marks if deserved. Examiners should also be prepared to award zero marks, if the learner's response is not rewardable according to the marking grid.
- Where judgement is required, a marking grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the marking grid to a learner's response, a senior examiner should be consulted.

Specific marking guidance

The marking grids have been designed to assess learner work holistically. Rows in the grids identify the assessment focus/outcome being targeted. When using a marking grid, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner's response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer, in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band, depending on how they have evidenced each of the descriptor bullet points.

Question Number	Answer	Additional guidance	Mark
1 (a)(i)	sound/P waves	allow ultrasound/infrasound	1
1 (a)(ii)	Any two from: - (they) move {backwards and forwards/oscillate/vibrate} (1) parallel to or in the same direction of {propagation/ energy transfer/wave travel} (1) (by a series of) either compressions or rarefactions (1)	accept a labelled diagram for all marks allow to and fro ignore up and down and left and right and side to side	2
1 (b)(i)	2 (Hz)	accept 2.0 and two	1
1 (b)(ii)	B 		1
		total	5 marks

Question Number	Answer	Additional guidance	Mark
2 (a)	microwave/ radio waves		1
2 (b)(i)	Award one mark for an identification and one mark for a linked expansion up to a maximum of two marks: There will be one linked pair {high/wide} bandwidth/ high frequency (1) (so) can send {many instructions/a large amount of data} (to the receiver) (1) OR does not pass through walls (1) (so they) cannot (accidentally) connect to other devices in another room (1) OR only work for one device (1) (so) can be coded (1)	allow {low/short/small} wavelength	2
2 (b)(ii)	Award one mark for an identification and one mark for a linked expansion up to a maximum of two marks: There will be one linked pair easily blocked/absorbed by obstacles (1) (because) line of sight needed (1) OR signal affected by heat and light sources (1) (so) needs to be used close to the receiver/short range (1)	allow sunlight	2
		total	5 marks

Question Number	Answer	Additional guidance	Mark
3 (a)	Award one mark for an identification and one mark for a linked expansion up to a maximum of four marks: There should be two linked pairs light is reflected (in the fibre) (1) (because the) angle of incidence is greater than the critical angle (1) OR because the fibre has to bend (1) {multiple/many} reflections (until light reaches top of fibre)/because light travels in straight lines (1) OR no light escapes from the fibre (1) (because) of total internal reflection/the core is denser than the cladding (1) marks for a labelled diagram (optical fibre showing multiple reflections) max 2 for marking points one and three	allow bounces back	4
3 (b)(i)	reduces/lowers/less/slower/decrease /smaller	allow stays the same	1

3 (b)(ii)	substitution (1) $$\sin(C) = \frac{1}{1.495}$$ rearrangement (1) $$(C) = \sin^{-1} 0.6689$$ evaluation (1) C = 41.92(°)	substitution and rearrangement in either order allow 1 mark for any value rounding to 0.7 e.g. 0.6689 allow $\sin^{-1}\{0.67\ to\ 0.7\}$ allow $(C) = \sin^{-1}\left(\frac{1}{1.495}\right)$ for 2 marks allow any answer that rounds to 42(°) without working for 3 marks	3
		total	8 marks

Question Number	Answer	Additional guidance	Mark
4 (a)	(waves that have) {the same/in} phase /constant phase difference (1) (waves that have) the same frequency/wavelength (1)	ignore speed /amplitude allow synchronised	2

Question number	Indicative content
4 (b)	Some indicative content may be exemplified by a labelled diagram. **Diffraction** light passes through the slits/small gaps in a diffraction grating (diffraction grating slits) disperse /spread the light waves the light waves (pass through each slit) cross/ interfere the different wavelengths show as different lines/colours on the screen. the greater the wavelength the bigger the change in direction as they pass through the slit. a smaller slit separation gives a greater diffraction **Bright line** the distance between the screen and the two adjoining slits in the grating is equal to a path difference of one whole wavelength OR (a bright region is produced on the screen) because the distance between the screen and the slits gives a path difference of a (whole number of) wavelengths so, a peak and a peak or trough and a trough meet. constructive superposition/interference a bright line is produced on the screen because of superposition **Central Maximum** the central maximum is always bright the path difference to the central maxima is always a whole number of wavelengths brightness decreases as the distance from the centre increases **Dark region** (a dark region is produced on the screen) because the distance between the screen and the slits gives a path difference of half a wavelength then a peak meets a trough, so the waves cancel destructive superposition/interference **Reason for line pattern** the light from the gas contains only certain wavelengths so only certain lines/colours can be produced on the screen

Mark scheme (award up to 6 marks) refer to the guidance on the cover of this document for how to apply levels-based mark schemes*.		
Level	**Mark**	**Descriptor**
	0	No awardable content
Level 1	1-2	- Demonstrates adequate knowledge of scientific facts/concepts with generalised comments made - Generic statements may be presented rather than linkages being made so that lines of reasoning are unsupported or partially supported - The explanation shows some structure and coherence
Level 2	3-4	- Demonstrates good knowledge and understanding by selecting and applying some relevant scientific knowledge facts/concepts to provide the discussion being presented - Lines of argument mostly supported through the application of relevant evidence - The explanation shows a structure which is mostly clear, coherent and logical
Level 3	5-6	- Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of scientific facts/concepts to provide the discussion being presented - Line(s) of argument consistently supported throughout by sustained application of relevant evidence - The explanation shows a well-developed structure which is clear, coherent and logical

Question Number	Answer	Additional guidance	Mark
4 (c)		conversion, substitution and rearrangement can be in any order	4
	conversion (1)		
	588.2nm = 5.882 x 10⁻⁷m		
	substitution (1)		
	3 x (10⁸) = 5.882 x (10⁻⁷) x f		
	rearrangement (1)	$f= v/\lambda$, 1 mark for correct rearrangement	
	(f) = $\dfrac{3 \times (10^8)}{5.882 \times (10^{-7})}$		
	evaluation (1)		
	5.1 x 10¹⁴ (Hz)/ 510<u>THz</u>	5.1 x 10¹⁴ Hz/ 510THz with no working gains full marks	
		allow power of 10 error for max 3 marks	
		if v=f x λ seen award 1 mark if no other mark scored.	
		total	12 marks

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