Mark Scheme (Results)

January 2020

Pearson BTEC Level 3 – Applied Science / Forensic and Criminal Investigation

Unit 1: Principles and Applications of Science I - Physics (31617H)

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk for our BTEC qualifications.
Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson.
Their contact details can be found on this link: www.edexcel.com/teachingservices.

You can also use our online Ask the Expert service at www.edexcel.com/ask. You will need an Edexcel username and password to access this service.

Pearson: helping people progress, everywhere
Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

January 2020
Publications Code 31617H_2001_MS

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.

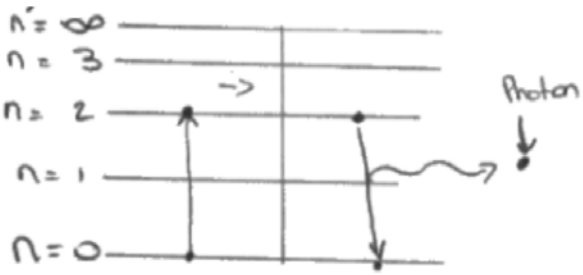
- Examiners should first make a holistic judgement on which band most closely matches the learner's response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer, in response 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.

BTEC Next Generation Mark Scheme

Applied Science Unit 1: Physics FINAL 2001

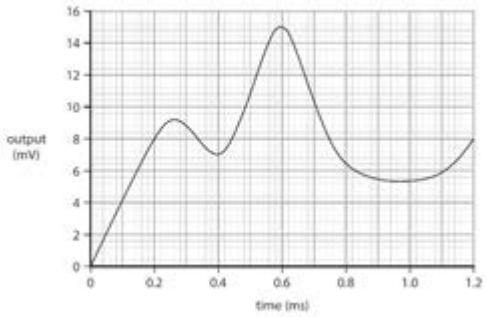
Question Number	Answer	Additional Guidance	Mark
1 (a)(i)	2(s)	accept 2.0, two	1
1 (a)(ii)	D The amplitude gradually decreases		1
1 (b)	substitution (1) (f) = $\frac{1}{5.0}$ evaluation (1) 0.2 (Hz)	accept for full marks 0.2 without working shown	2
		Total	4 marks

Question Number	Answer	Additional Guidance	Mark
2 (a)	C X and Y		1
2 (b)	Award **one** mark for an identification and **up to two** additional marks for appropriate expansions. **Identification** (hydrogen atoms) have (one) electron(s) (1) **Expansion** (hydrogen) has (electron) shells / orbitals / energy levels (1) (when hydrogen is heated) electrons absorb energy (1) electrons move up/jump (to higher energy) levels (1) electrons in higher energy levels are unstable/excited (1) electrons lose energy by falling/moving /jumping back/dropping back (to lower energy level) (1) energy emitted as light /photons (1) frequency/colour of light (produced) depends on energy level change (1)	marks may be awarded for a labelled diagram accept energy state for energy level allow any equivalent term allow any equivalent term	3

	same amount of energy released between energy levels as was absorbed (1) Example of marks from diagram  	award one mark for E=hf Text refers to electron Diagram shows electron moving up shells, and on return to lower shell emits a photon	
2 (c)	A description which includes two of the following in a logical order (at the slits) light {passes through/split up/separates} (1) (after the slits) light spreads out/overlaps (1) different {colours/wavelengths/frequencies) are deviated through different angles (1) constructive interference occurs at different angles for different {colours/wavelengths/frequencies} to produce a spectral line (1) accept any other valid response relating to diffraction.	 accept the diffraction grating/it has slits/gaps accept constructively interferes accept equivalent terms to deviated accept annotated diagrams	2

2 (d)	conversion (1) 656 nm = 6.56×10^{-7} m substitution (1) $3.00 \times 10^{8} = f \times 6.56 \times 10^{-7}$ rearrangement (1) $(f=) \frac{3.00 \times 10^{8}}{6.56 \times 10^{-7}}$ evaluation (1) 4.57×10^{14} (Hz)	accept for full marks any value that rounds to 4.6×10^{14} (Hz) without working shown conversion can be carried out at any point during the calculation substitution and rearrangement in either order f=v/λ gains 1 mark for correct rearrangement power of 10 error gains 3 marks	4
		Total	10 marks

Question Number	Answer	Additional Guidance	Mark
3 (a)(i)	refraction	do not accept bends/changes direction	1
3 (a)(ii)	total internal reflection / TIR	do not accept reflection or total reflection on its own	1
3 (b)	An explanation that includes **one** identification point and up to **two** expansion points. **Identification** no light (from the light source) reaches the light detector (1) OR signal to light sensor changes (1) **Expansion** little/no reflection where the raindrop is on the glass/at raindrop (1) angle (of incidence) of the light is smaller than 62°/critical angle (1) light is refracted{through raindrop/out of glass/out of windscreen} (1)	accept reverse argument	3
		Total	5 marks

Question Number	Answer	Additional Guidance	Mark
4 (a)	a graph that shows: line that varies continuously (1) with time/ to the right (1) e.g.  	do not accept a horizontal line at any position in sketch do not accept vertical line(s) do not accept reversing time/ the line going back on itself	2
4 (b)	An explanation using any of the following pairs: can be regenerated (1) to travel longer distances (1) OR improved quality of reception (1) less noise/interference (1) OR multiplexing/ can carry more channels (1) carries more information per second (1) OR can be encrypted (1) improved security (1) any other appropriate response	 accept makes reception clearer Accept 'harder to hack'	2
4 (c)	D 10110		1
		Total	5 Marks

Question number	Indicative content
5	**Similarities of waves** • transverse waves • part of the electromagnetic spectrum • susceptible to interference • carry energy • travel at same speed/travel at speed of light/travel at 3 x 10^8 m/s (in vacuum) **Differences of waves**

	Infrared	Bluetooth©	Comparative statement
wavelength	wavelength shorter/less than Bluetooth	radio wave/microwave/wavelength much larger than that of infrared	the wavelengths are different Bluetooth has longer/larger wavelength than IR (or reverse)
frequency	high frequency	frequency (2.4 GHz), much lower than infrared	the frequencies are different Blue tooth has a (much) lower/ smaller frequency than IR (or reverse)
bandwidth	large bandwidth (up to 16Mbps)	smaller bandwidth (about 3Mbps)	Bandwidths are different. Bluetooth has a much smaller bandwidth than IR.
penetration	must be 'line of sight'/unobstructed	can pass through obstacles	Penetrations are different. IR cannot pass through walls but Bluetooth can
interference	can get interference from sunlight, longer wavelength band used to reduce this	can get interference from other radio signals, frequency hopping used to reduce this	different methods are used to reduce interference in IR and Bluetooth
energy			IR carries more energy/information than Bluetooth (because it has a higher frequency) E=hf

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
Level 0	0	No rewardable material.
Level 1	1–2	• Demonstrates adequate knowledge and understanding of scientific facts/concepts to the given context with generalised comments made. • Generic statements may be presented rather than linkages to the context being made so that lines of reasoning are unsupported or partially supported • The comparison will contain some similarities and differences showing some structure and coherence
Level 2	3–4	• Demonstrates good knowledge and understanding by selecting and applying some relevant scientific facts/concepts to provide the comparison being presented. • Lines of argument mostly supported through the application of relevant evidence drawn from the context • Demonstrate an awareness of both similarities and differences leading to a comparison which has 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 comparison being presented. • Line(s) of argument consistently supported throughout by sustained application of relevant evidence drawn from the context • The comparison shows a logical chain of reasoning which is supported throughout by sustained application of relevant evidence