



Mark Scheme (Results)

January 2019

BTEC Level 3 National in Applied
Science

Unit 5: Principles and Applications of
Science II – Physics (31627H/1P)



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 2019

Publications Code 31627H1P_1901_MS

All the material in this publication is copyright

© Pearson Education Ltd 2019

Unit 5: Principles and Applications of Science II – 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.

Section C – Thermal physics, materials and fluids

Question Number	Answer	Additional guidance	Mark
1 (a)	C – Force		1
1 (b)(i)	change (in) (1)	allow difference(between) ignore 'delta'	1
1 (b)(ii)	distance/displacement/length (1)	allow direction do not allow extension	1
total			3 marks

Question Number	Answer	Additional guidance	Mark
2 (a)	C (J K^{-1})		1
2 (b)	<p>Award one mark for each identification and one mark for each linked expansion:</p> <p><i>identification</i> molecules move faster/more freely (1)</p> <p><i>expansion</i> because they have{gained/absorbed} energy (from surroundings) (1)</p> <p>and</p> <p><i>identification</i> arrangement of molecules goes from {fixed/regular position} to more {random /irregular/moving from place to place} (1)</p> <p><i>expansion</i> because the intermolecular forces are weakened (1)</p>	<p>the answer must refer to molecules/particles</p> <p>may come from a labelled diagram</p> <p>do not allow 'start to vibrate'</p> <p>ignore molecules moving further apart reject the molecules take up more space</p>	4
total			5 marks

Question Number	Answer	Additional guidance	Mark
3 (a)(i)	A – There is a change in temperature		1
3 (a)(ii)	Award one mark for an identification and one mark for a linked expansion <i>identification</i> not all the heat energy can be converted into work/useful energy/not 100% efficient (1) <i>expansion</i> as some of the energy must be lost to the {environment/surroundings} (1)	allow energy input equals work done plus waste energy allow steam is released to the surroundings if no other mark is awarded then allow for 1 mark 'can't be reversed' or 'heat only goes from hot to cold'	2
3 (b)	(a system that) converts/changes/transfers {thermal or heat/chemical/stored energy} (1) into mechanical energy/{movement/kinetic} energy (1) to do (useful) work (1)	allow a mechanical description e.g. steam/water/heat pushes piston/turns wheels/ {engine/turbine moves}	3
3 (c)(i)	substitution (1) $= 1 - \frac{3.5 \times 10^9}{2.9 \times 10^{10}}$ evaluation (1) = 0.88	award full marks for 0.88 without working shown allow 1- $\frac{3.5}{29}$ for 1 mark allow answers rounding up to 0.9 allow 88%/90% do not allow 88, 90 or 0.88%	2
3 (c)(ii)	any value more than 2.9×10^{10} (J)	allow more than 29 000 000 000 (J) do not allow negative numbers	1
total			9 marks

Question Number	Answer	Additional guidance	Mark
4 (a)(i)	(line is) linear/straight/has a constant gradient (1)	allow (directly) proportional to extension	1
4 (a)(ii)	0.5 (m)		1
4 (b)(i)	<p>calculation of extension (1) $2.75 - 0.5$</p> <p>substitution (1) $0.8 = k \cdot 2.25$</p> <p>rearrangement (1) $k = \frac{0.8}{2.25}$</p> <p>evaluation (1) $0.356 \text{ (Nm}^{-1}\text{)}$</p>	<p>award full marks for 0.356(N) without working shown</p> <p>2.25(m) seen</p> <p>allow ecf throughout the calculation for up to 3 marks</p> <p>if 2.75(m) for extension is used an answer rounding to $0.3\text{(Nm}^{-1}\text{)}$ gains 3 marks</p> <p>$0.8 = k (2.75 - 0.5)$</p> <p>$k = \frac{F}{\Delta x}$</p> <p>allow answers rounding to 0.40</p> <p>allow $F=k\Delta x$ for one mark if no other mark can be awarded.</p>	4

<p>4 (b)(ii)</p>	<p>correct extension Δx (1)</p> <p>1.9 m – 0.5 m</p> <p>substitution (1)</p> $\Delta E = \frac{1}{2} \times 0.5 \times (1.4)$ <p>evaluation (1)</p> <p>0.35 (J)</p>	<p>award full marks for 0.35(J) without working shown</p> <p>allow +/- half a small square error in reading from the graph</p> <p>allow ecf throughout the calculation for up to 2 marks</p> <p>allow 0.34 for 3 marks</p> <p>allow answers rounding up to 0.4 for 3 marks</p> <p>if 1.9 for extension is used an answer rounding up to 0.5(Nm⁻¹) gains 2 marks</p> <p>If $\Delta E = \frac{1}{2} k(\Delta x)^2$ or area from the graph, then mark</p> <p>use of formula /area (1)</p> <p>correct extension/area (1)</p> <p>evaluation (1)</p>	<p>3</p>
<p>4 (c)</p>	<p>Award one mark for an identification and one mark for a linked expansion</p> <p><i>identification</i> a greater force acts on the top coils (1)</p> <p><i>expansion</i> due to (the top of the spring supporting) the weight of the coils below (1)</p>	<p>ignore any reference to added weight/masses</p> <p>comparison needed i.e. greater/larger etc</p> <p>allow has to hold/withstand a greater force</p>	<p>2</p>
<p>total</p>			<p>11 marks</p>

Question Number	Answer	Additional guidance	Mark
5 (a)	A – Viscosity is a measure of a liquid's resistance to movement		1
5 (b)	<p>air flow is faster (between the two balloons) (1)</p> <p>AND</p> <p>Any one from two:</p> <p>(so the faster air flow) reduces the air pressure (between the balloons) (1)</p> <p>a {pressure difference/force} is produced as a result (1)</p>	ignore comments referring to pressure inside and outside the balloons	2
5 (c)	<p>Award one mark for each logically ordered point up to three marks:</p> <p>(shaking the bottle) increases the (shear) {stress/force} on the ketchup (1)</p> <p>this causes the ketchup viscosity to {fall/drop/reduce} (1)</p> <p>layers/particles (of ketchup) can slide/move across each other (more easily) (1)</p>		3

Question number	Indicative content
5 (d)	<p>Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content, but learners should be rewarded for other relevant answers.</p> <div data-bbox="550 481 1189 616" data-label="Diagram"> </div> <p>layers of water slide past each other without disturbance before the dent</p> <p>layers of water do not mix in streamline flow before the dent may be shown on diagram</p> <p>layers of water get mixed up after the dent may be shown on diagram</p> <p>low friction between water layers before the dent</p> <p>high friction between the water layers after the dent</p> <p>water has a high kinetic energy after the dent compared to before</p> <p>the dent causes eddies in the water flow may be shown on diagram</p> <p>the mass of water that flows each second remains the same throughout</p> <p>flow of water is faster/fastest where the pipe narrows</p> <p>pressure less/lower when water is flowing fastest (at dent)</p> <p>the viscosity of the water flowing remains the same throughout</p>

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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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.

For more information on Edexcel qualifications, please visit our website
www.edexcel.com

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE

Ofqual



Llywodraeth Cymru
Welsh Assembly Government

