Zig Zag Education

Physics

AS | AQA | 7407

Practice Exams for AS AQA Physics

Paper 1

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POD 6630

Contents

Teacher's Introduction

This collection of **four practice papers** has been written to support **Paper 1** of the **AS AQA Physics specification 7407** (first examination 2016). A separate resource is available for Paper 2 practice.

Each paper follows the same format as the specimen paper released by the exam board. Every item listed in the specification is covered, with most aspects visited several times in the pack. All the papers meet the minimum 40% mathematical skills required by the specification.

The mark schemes are written in a similar format to those written by AQA. The individual marking points are on separate lines and there is additional guidance to clarify points and indicate alternative acceptable answers.

Write-on and **non-write-on** versions are included in this pack. For **non-write-on** versions, inserts are provided at the end of each paper for questions that require the student to annotate a diagram, for example, drawing a line of best fit on a graph.

Suggested Uses

1. Set as a mock examination under exam conditions, marked by the teacher. This provides the most reliable summative assessment.
2. Set as a complete paper under exam conditions which is then marked by the student. This provides a good formative assessment as the student gets a good understanding of how the mark schemes work and what they need to do to score. Such a session could be reinforced by a lesson on exam technique.
3. Set as a complete paper under exam conditions which is then peer marked. This could be by the teacher assigning scripts to students to mark or by students swapping amongst themselves. Group marking can be particularly helpful as the students get the chance to develop their ideas by discussing why things do and don't score.
4. Go through a question at a time in a lesson. Get students to discuss their answers before revealing the mark scheme for that question.
5. Set a paper as a homework for the student to answer and mark. This would be an ideal activity for study leave, when the student could come to a tutorial to go through their script. They should be briefed to list questions that need addressing as a result of their marking of their script.

March 2016

Remember!

Always check the exam board website for new information, including changes to the specification and sample assessment material.

Specification Cross-referencing Table

	Paper 1s			
	Paper 1A	Paper 1B	Paper 1C	Paper 1D
3.1 Measurements and their errors				
3.1.1 Use of SI units	✓	✓	✓	✓
3.1.2 Limitation of physical measurements			✓	✓
3.1.3 Estimation of physical quantities		✓		
Number of marks for quantitative skills Level 2 or above	1	2	1	2
3.2.1 Particles				
3.2.1.1 Constituents of the atom	✓	✓		
3.2.1.2 Stable and unstable nuclei	✓	✓		
3.2.1.3 Particles, antiparticles and photons	✓		✓	
3.2.1.4 Particle interactions	✓			
3.2.1.5 Classification of particles			✓	✓
3.2.1.6 Quarks and antiquarks			✓	✓
3.2.1.7 Applications of conservation [illegible]	✓			✓
Number of marks for quanti[illegible] or above	0	3	5	0
3.2.2 Electromagnetic radiation and quantum phenomena				
3.2.2.1 Photoelectric effect	✓			✓
3.2.2.2 Collisions of electrons with atoms		✓	✓	
3.2.2.3 Energy levels and photon emission		✓	✓	
3.2.2.4 Wave–particle duality			✓	✓
Number of marks for quantitative skills Level 2 or above	4	4	2	6
3.3.1 Progressive and stationary waves				
3.3.1.1 Progressive waves			✓	✓
3.3.1.2 Longitudinal and transverse waves		✓		✓
3.3.1.3 Principle of superposition of waves	✓		✓	
Number of marks for quantitative skills Level 2 or above	0	0	3	5
3.3.2 Refraction, diffraction and interference				
3.3.2.1 Interference	✓			✓
3.3.2.2 Diffraction	✓			✓
3.3.2.3 Refraction at a plane surface		✓		
Number of marks for quantitative skills Level 2 or above	5	7	0	0
3.4.1 Force, energy and momentum				
3.4.1.1 Scalars and vectors		✓	✓	✓
3.4.1.2 Moments			✓	✓
3.4.1.3 Motion along a straight line		✓		✓
3.4.1.4 Projectile motion		✓		✓
3.4.1.5 Newton's laws of motion	✓			✓
3.4.1.6 Momentum	✓	✓		
3.4.1.7 Work, energy and power			✓	
3.4.1.8 Conservation of energy	✓		✓	
Number of marks for quantitative skills Level 2 or above	9	6	17	8
3.4.2 Materials				
3.4.2.1 Bulk properties of solids	✓	✓		✓
3.4.2.2 The Young modulus				✓
Number of marks for quantitative skills Level 2 or above		4	0	6
3.5.1 Current electricity				
3.5.1.1 Basics of electricity	✓		✓	
3.5.1.2 Current–voltage characteristics			✓	
3.5.1.3 Resistance		✓		✓
3.5.1.4 Circuits		✓	✓	
3.5.1.5 Potential divider	✓	✓		
3.5.1.6 Electromotive force and internal resistance	✓			✓
Number of marks for quantitative skills Level 2 or above	4	4	6	4
Overall quantitative skills	**41%**	**43%**	**49%**	**44%**
Required practicals covered (practical code)	**2&6**	**4**		**3&5**
Overall practical skills	**14%**	**17%**	**16%**	**16%**

AS Physics
Unit 7407/1

Practice Paper 1B

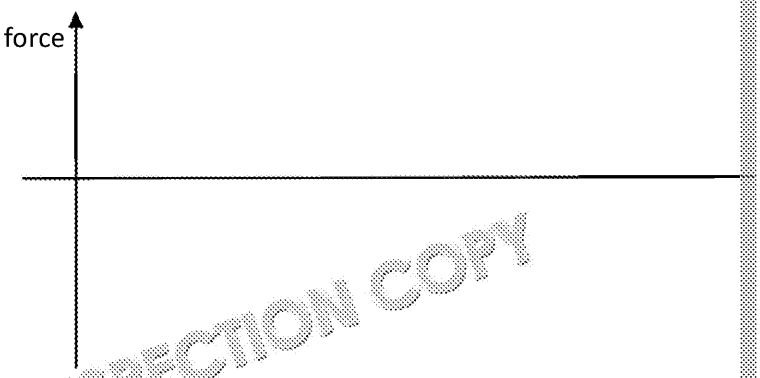
Name	

Time allowed
1 hour 30 minutes

Instructions
Answer **all** of the questions

Information
- The total marks available for this paper is **70**. The number of marks available for each question is shown in brackets.
- Students should have a data and formulae booklet, a ruler and calculator.
- Answer all questions and show all working.

1.1 Sketch the strong nuclear force curve. Make sure you label key ranges as repulsive.



1.2 Explain what is meant by the term 'isotope'.

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1.3 Estimate the diameter of a hydrogen atom.

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1.4 State the composition of the nucleus of a $^{14}_{6}C$ atom.

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1.5 Calculate the specific charge of the carbon-14 nucleus.

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1.6 The carbon-14 nucleus decays by beta decay into nitrogen.

Write down the decay equation for this process.

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1.7 State which force is responsible for beta decay.

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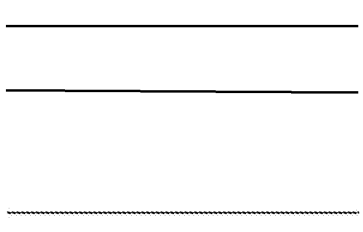
2.1 A free electron hits an electron in the lowest level in an atom. The ener
shown below.

Calculate how much energy it must have to ionise the atom.



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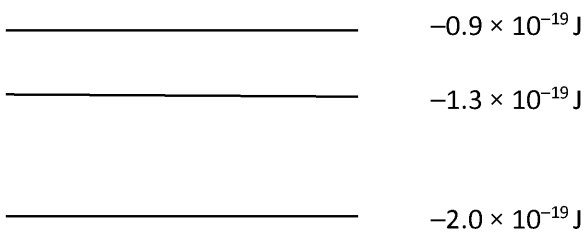
2.2 Ph with an energy of 1.1×10^{-19} J hit atoms in a gas whose energy



Mark the transition associated with the excitation of the electrons.

2.3 The excited electrons then drop back down the energy levels. They em
of light.

Calculate the lowest frequency emitted.

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2.4 Explain how visible light is emitted by a fluorescent tube.

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3.1 Describe the motion of the particles in a transverse wave.

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3.2 A block of glass slows light down to $2.1 \times 10^8\ ms^{-1}$. Calculate its refracti

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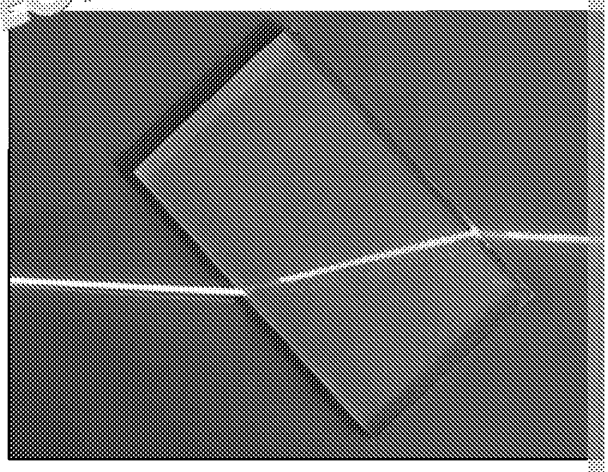
3.3 A ray of light is incident o[illegible] boundary between air and this glass blo



Calculate the angle at which it is refracted.

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3.4 Calculate the critical angle for the glass–air boundary.

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3.5 Optical fib[illegible]e to transmit information as pulses of light. Over l[illegible] h[illegible] p[illegible] up.

Explain two reasons for this.

i) .....

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ii) .....

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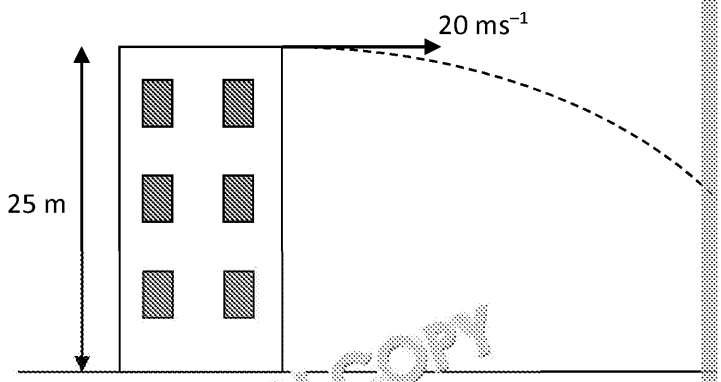
4.1 A 0.25 kg ball is projected horizontally from a 25 m building at 20 ms^{-1}.

Calculate how long it takes to reach the ground.



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4.2 Calculate how far the ball lands from the base of the building.

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4.3 Calculate the initial momentum of the ball.

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4.4 If the ball were dropped from a hot air balloon at a height of 2 km, it w
Explain what causes terminal velocity.

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5.1 A particular p[illegible] metal wire has a mass of 2.2 g and a volume of 0.2
Ca[illegible] its density.

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5.2 The wire is made into a spring of initial length 2.0 cm. When 4 N is hung
Calculate its spring constant. Make sure you include an appropriate un

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5.3 State and explain the measurements you would take to determine a re
modulus of a wire.

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6.1 A 5.0 Ω resistor is made using a material with a resistivity of 1.2×10^{-7} Ω
of 4.8×10^{-10} m^2.

Calculate how long it is.

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6.2 Three of these 5.0 Ω resistors are connected in parallel.

Calculate their combined resistance.

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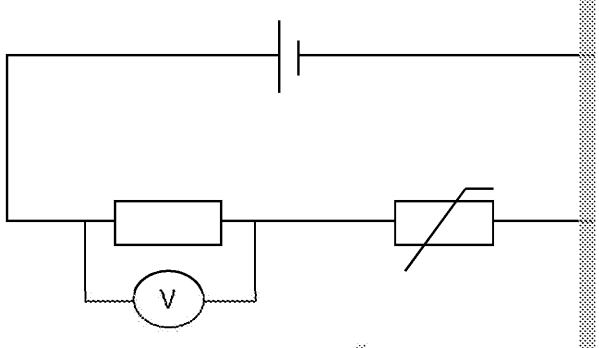
6.3 A resistor and a thermistor are connected in series. A voltmeter is conn



Explain what happens to the reading on the voltmeter as the temperat

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6.4 Explain what the critical temperature of a superconductor represents.

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AS Physics
Unit 7407/1

Practice Paper 1B

Name	

Time allowed
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Instructions
Answer **all** of the questions

Information
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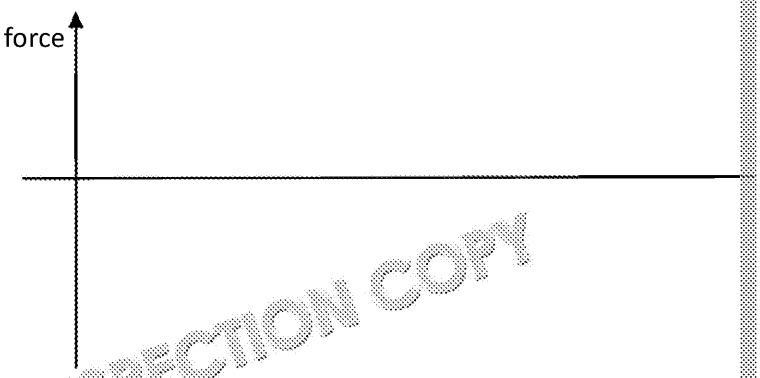


1.2 Ex hat is meant by the term 'isotope'.

1.3 Estimate the diameter of a hydrogen atom.

1.4 State the composition of the nucleus of a $^{14}_{6}C$ atom.

1.5 Calculate the specific charge of the carbon-14 nucleus. (Units are C kg^{-1})

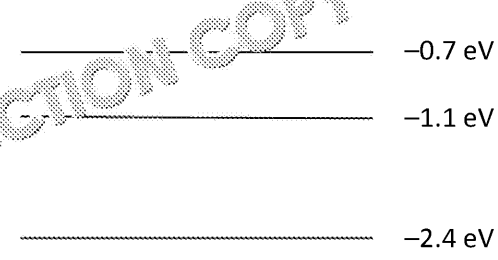
1.6 The carbon-14 nucleus decays by beta decay into nitrogen.

Write down the decay equation for this process.

1.7 State which force is responsible for beta decay.

2.1 A free electron hits an electron in the lowest level in an atom. The ener
shown below.

Calculate how much energy it must have to ionise the atom. (Units are



2.2 Photons with an energy of 1.1×10^{-19} J hit atoms in a gas whose energy

———————————— -0.9×10^{-19} J

———————————— -1.3×10^{-19} J

———————————— -2.0×10^{-19} J

Mark the transition associated with the excitation of the electrons.

2.3 The excited electrons then drop back down the energy levels. They em of light.

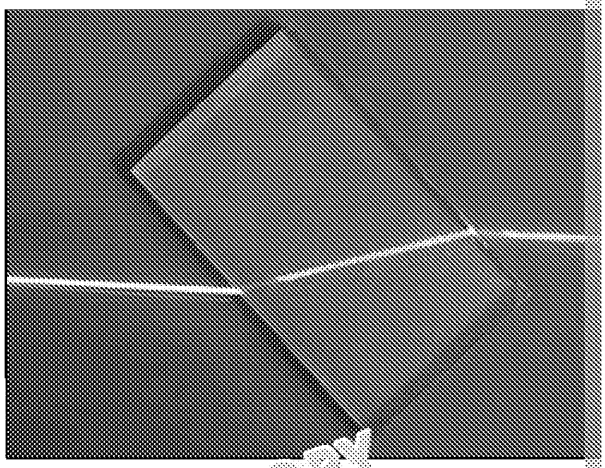
Calculate the greatest frequency emitted. (Units are Hz)

2.4 Explain how visible light is emitted by a fluorescent tube.

3.1 Describe the motion of the particles in a transverse wave.

3.2 A block of glass slows light down to 2.1×10^{8} ms^{-1}. Calculate its refracti

3.3 A ray of light is incident on the boundary between air and this glass blo



Calculate the angle at which it is refracted.

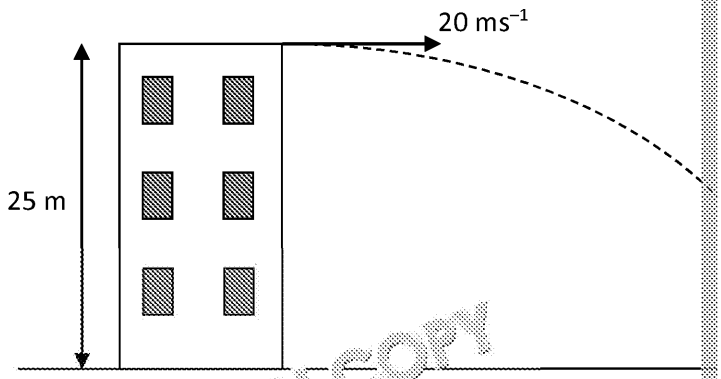
3.4 Calculate the critical angle for the glass–air boundary.

3.5 Optical fibres are used to transmit information as pulses of light. Over l harder to pick up.

Explain two reasons for this.

4.1 A 0.25 kg ball is projected horizontally from a 25 m building at 20 ms^{-1}.

Calculate how long it takes to reach the ground. (Units are s)



4.2 Calculate how f[illegible]ands from the base of the building. (Units ar[illegible]

4.3 Ca[illegible]e the initial momentum of the ball. (Units are kg ms^{-1})

4.4 If the ball were dropped from a hot air balloon at a height of 2 km, it w[illegible]
Explain what causes terminal velocity.

5.1 A particular piece of metal wire has a mass of 2.2 g and a volume of 0.2[illegible]

Calculate its density. (Units are kg m^{-3})

5.2 The wire is made into a spring of initial length 2.0 cm. When 4 N is hun[illegible]
Calculate its spring constant. Make sure you include an appropriate uni[illegible]

5.3 State and explain the measurements you would take to determine a re[illegible]
modulus of a wire.

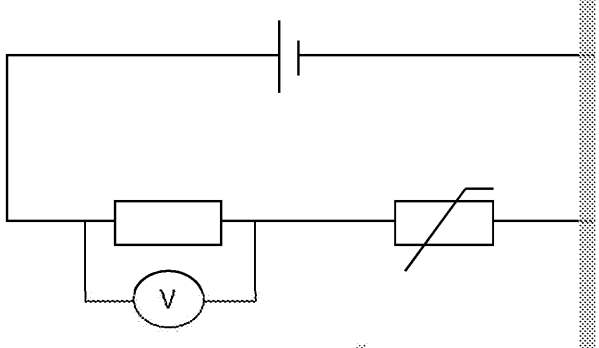
6.1 A 5.0 Ω resistor is made using a material with a resistivity of 1.2×10^{-7} [illegible]
of 4.8×10^{-10} m^2.

Calculate how long it is. (Units are m)

6.2 Three of these 5.0 Ω resistors a[illegible]ected in parallel.

Calculate their [illegible]esistance. (Units are Ω)

6.3 A resistor and a thermistor are connected in series. A voltmeter is conn

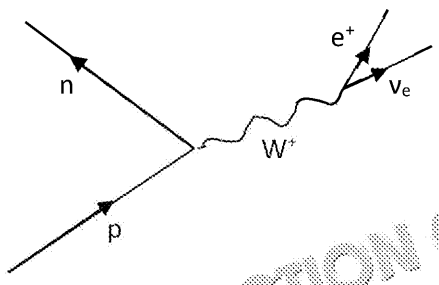


Explain what happens to the reading on the voltmeter as the temperat

6.4 Explain what the critical temperature of a superconductor represents.

Preview of Questions Ends Here

Practice Paper 1A

Question	Answers	Ac
1.1	(+)2 ✓	
1.2		First mark Second is Third is fo
1.3	baryons contain [illegible] (but) m[illegible]tain a quark and an anti-quark ✓	
1.4	on ✓	
1.5	charge is not conserved ✓	
2.1	when light above a certain frequency is shone on a metal ✓ electrons are released/emitted ✓ below the threshold frequency the (incident) photons don't have enough energy to overcome the work function ✓	The idea required
2.2	$f = \frac{3.0 \times 10^{8}}{3.0 \times 10^{-7}} = 10^{15}$ Hz ✓ $KE_{max} = 6.63 \times 10^{-34} \times 10^{15} - 6.4 \times 10^{-19} = 2.3 \times 10^{-20}$ J ✓ $v = \sqrt{\frac{2 \times 2.3 \times 10^{-20}}{9.11 \times 10^{-31}}} = 2.2 \times 10^{5}$ ✓ ms^{-1}	If using h $KE_{max} =$ $6.4 \times 10^{-}$ $v = \sqrt{\frac{2 \times}{9.}}$ ms^{-1}
2.3	$\frac{2.3 \times 10^{-20}}{1.6 \times 10^{-19}}$ ✓ = 0.14 ✓ V	Ignore sig If used 2s 2.2: $\frac{2.0 \times 10^{-20}}{1.6 \times 10^{-19}}$ ecf from 2
2.4	photon could hit an electron deeper into metal ✓ which would require more energy to liberate ✓	
3.1	phase difference is fixed ✓	Allow 'alw
3.2	constructive ✓	
3.3	zero / one wavelength[illegible]	Any whol expressed
3.4	[illegible]0 ✓ [illegible] × 10^{-3} ✓ m	1.56 × 10 omitted u
3.5	slit separation = $\frac{10^{-3}}{200}$ = 5.00 × 10^{-6} m ✓ $\sin\theta = \frac{2 \times 623 \times 10^{-9}}{5.00 \times 10^{-6}}$ ✓ = 0.249 θ = 14° ✓	Second m substituti evidence If they mi bit, then

Question	Answers	
3.6	more spread out / larger angles to orders ✓ blue (rather than red) ✓	
3.7	spectroscopy	any val
4.1	$\sqrt{2 \times 9.8 \times 5.0}$✓ = 9.9 ✓ ms^{-1} assumed negligible air resistance / drag ✓	Can ob energy
4.2	$9.9 \times 1.4 = 14$ ✓ kg ms^{-1}	
4.3	$\Delta p = 3 - (-14) = 17$✓ kg ms^{-1} $F = \frac{17}{0.25}$✓ = 68 ✓ N	Follow (e.g. 44
4.4	Newton's Third Law (of Motion)	Accept
4.5	momentum before = 1 × 1 momentum afterwards = 3.5 × 2.5 + v × 1.4 ✓ momentum before = momentum afterwards ✓ v = 3.7 ✓ ms^{-1}	First m momer momer Second 10 × 1. the firs v × 1.4
4.6	kinetic energy is not conserved ✓ (because) some is converted to other forms ✓	Accept form, s
5.1	½ × 40 × 0.2 ✓ = 4 ✓ J	
5.2	EPE = KE + GPE ✓ KE = 4 – 0.1 × 9.8 × 0.2 ✓ = 3.8 ✓ J	
5.3	A) elastic region B) yield point OR elastic limit C) necking D) fracture point / ultimate stress	

Question	Answers	
5.4		*Possibl* Young' Density Breakin it will t breakin Stiffne bend it *Possibl* Need t (above Too de under If break easy br Don't v want ri earthq *Possibl* Cost fa Constr
6.1	$I = \frac{6.0}{2.0+4.0} = 1$ A ✓ V = 1.0 × 4.0 = 4 ✓ V	OR: V =
6.2	measure terminal pd and current ✓ for a range of resistances ✓ plot a graph of terminal pd vs current ✓ emf is y-intercept ✓ internal resistance is (–) gradient ✓	
6.3	$\frac{3.0}{3.0+6.0} = \frac{V}{4.5}$ ✓ = 1.5 ✓	First m ratio o
6.4	(LDR/photodiode ✓ (used in) potential divider ✓ (with) voltmeter across fixed resistor ✓	

Mark	Criteria	QoWC
6	Correct points made about all relevant factors and at least two comments and some extra detail.	Information presented in a clear manner with logical order and helpful structure. Writing legible. Spelling, punctuation and grammar good.
5	Correct points made about all relevant factors and at least two comments.	
4	Correct points made about two or three relevant factors and least two [illegible]	Information presented in a clear manner. Writing legible. Spelling, punctuation and grammar generally OK.
3	Correct points made about two or three relevant factors and one comment.	
2	One correct point made about a relevant factor with a comment. Or two correct points made about relevant factors.	Information presented in a simple manner. Writing mostly legible. Spelling, punctuation and grammar generally OK, though there may be occasions where it hampers understanding.
1	One correct point made about a relevant factor.	
0	No correct points made on any relevant factors.	Spelling, punctuation, grammar and presentation make understanding very difficult.

Preview of Answers Ends Here