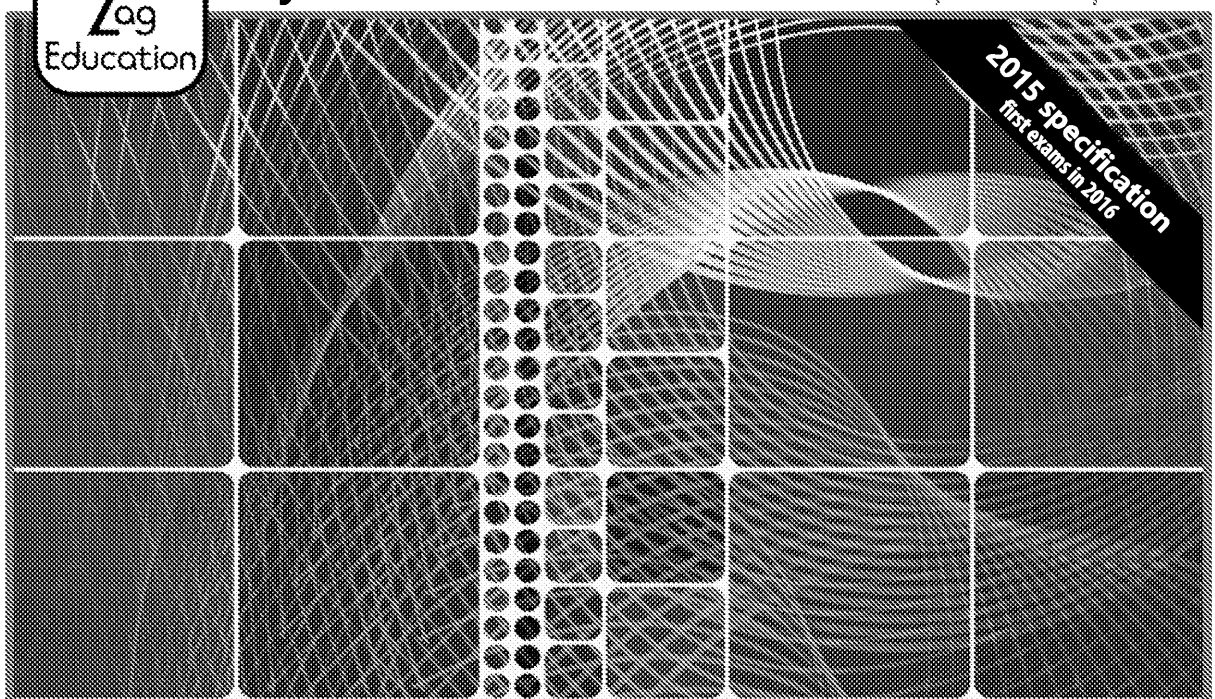
Zig Zag Education

Physics

AS | OCR A | H156



Practice Exams

for AS OCR Physics A: Paper 1

A C Shaw

zigzageducation.co.uk

POD 7250

Contents

Teacher's Introduction

This collection of four practice exams has been written to support the OCR AS Physics specification H156 (first examination 2016) for Paper 1.

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 OCR. The individual marking points are on separate lines and the type of mark (independent (B), method (M), compensatory (C) and answer (A)) is indicated. There is additional guidance to clarify points and indicate alternative acceptable answers.

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

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 among 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 one 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.

A C Shaw, March 2017

Physics A

Practice Exam 1B

Name	

Time allowed
1 hour

Instructions
Answer **all** of the questions and use the space provided.

Information
The total marks available for this paper is **70**. Section A is worth 20 marks and Section B is worth 50 marks. The number of marks available for each question is shown on the right.

For this paper, you will need:
- Data, Formulae and Relationships booklet

Additional materials required
- Electronic calculator
- Ruler (cm/mm)

Section A

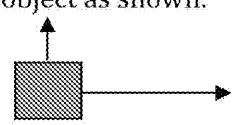
1. This table shows the readings for a solid cylinder taken by a student.

length (cm)	23.0 ± 0.1
radius (cm)	5.5 ± 0.1

What is the percentage uncertainty in the volume of the cylinder?

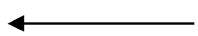
A ☐ 0.4 %
B ☐ 2 %
C ☐ 4 %
D ☐ 20 %

2. Two forces are [illegible] to an object as shown.



Which of these forces would balance those in the diagram?

A ☐



B ☐

C ☐

D ☐

3. Which row is correct?

	scalars	vectors
A ☐	temperature, acceleration	force, mome
B ☐	distance, speed	velocity, accel
C ☐	force, energy	momentum, disp
D ☐	speed, [illegible]	displacement,

4. A spacecraft of mass m is accelerated by a force F for a time t, finishing at speed v. Which expression shows how far it travelled in that time?

A ☐ $vt + \frac{Ft^2}{2m}$

B ☐ $vt - \frac{Ft^2}{2m}$

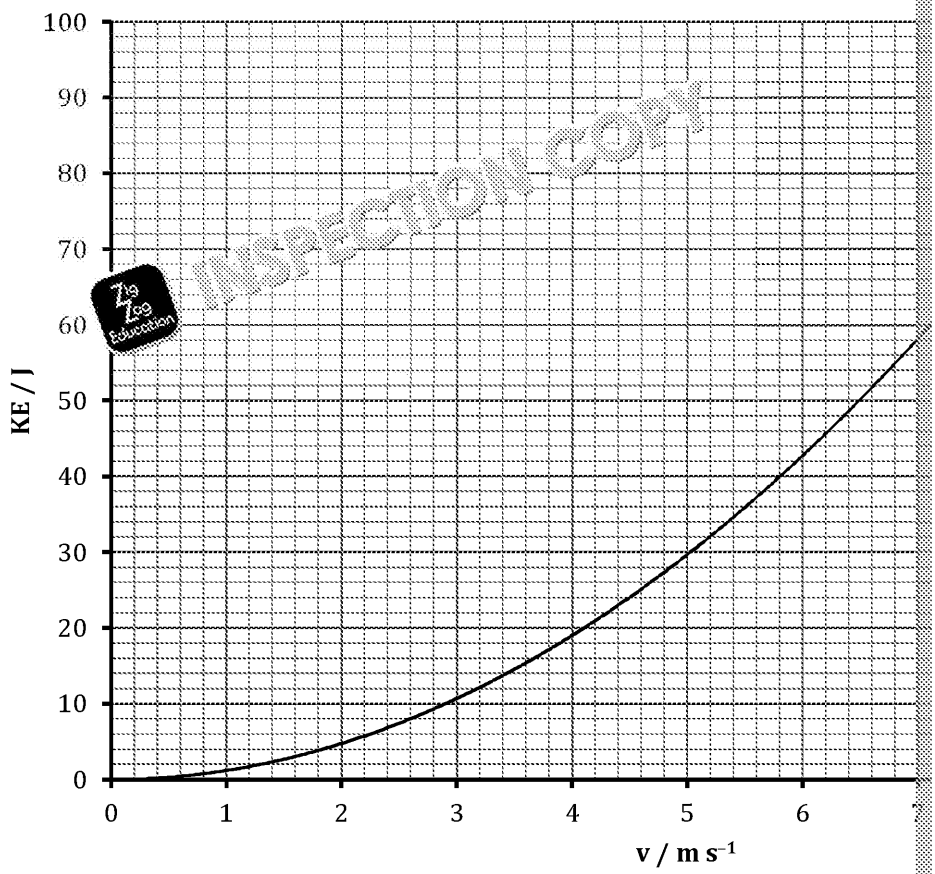
C ☐ $v - \frac{Ft^2}{m}$

D ☐ $\frac{mv^2}{2F}$

5. Which of these statements is true about collisions?

A ☐ Momentum and kinetic energy are always conserved.
B ☐ Momentum is conserved.
C ☐ Kinetic energy and velocity are always conserved.
D ☐ Speed is conserved.

6. This is a graph of the kinetic energy of an object against its speed.



What was its kinetic energy at a speed of 7.4 m s^{-1}?

A ☐ 63 J
B ☐ 65 J
C ☐ 72 J
D ☐ 73 J

7. Which statement is true about an orbiting satellite?

A ☐ It is moving at a high and constant velocity.
B ☐ Gravity is too weak to affect it and it moves at a constant speed.
C ☐ There is an unbalanced force acting and it is accelerating.
D ☐ There is not enough air resistance to slow it down and it doesn't

8. A 1.0 kg ball bounces, going from 5.0 m s^{-1} to 3.0 m s^{-1} in the opposite direction. What is the magnitude of the average force on the ball during the bounce?

A ☐ 2.0 N
B ☐ 8.0 N
C ☐ 32 N
D ☐ 60 N

9. How far would a cyclist travel in two minutes if he accelerated uniformly that time?

A ☐ 25m
B ☐ 900 m
C ☐ 1.5 km
D ☐ 3.0 km

10. A metal spanner falls 5 m to the ground.

Which of these statements about energy is true?

1	*Its gravitational potential energy increases*
2	*Its kinetic energy increases.*
3	*The sum of the gravitational [illegible] and kinetic energies is roughly*
4	*The energy disappear[illegible] spanner hits the ground.*

A ☐ [illegible]
B ☐ [illegible] 4 only
C ☐ 2 and 3 only
D ☐ all of them

11. A current of 5.0 A flows through a copper wire with a cross-sectional are charge carrier density of 8.5×10^{28} m^{-3}. What is the drift velocity of the e

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B ☐ 4.7×10^{-4} m s^{-1}
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D ☐ 8.2×10^{7} m s^{-1}

12. A potential difference of 10 V was applied across a 2 Ω resistor for 45 s. through the resistor?

A ☐ 0.44 C
B ☐ 2.3 C
C ☐ 225 C
D ☐ 900 C

13. Units can be written in different ways.

Which of these statements are true?

1	$V = J\,C^{-1}$
2	$V = A\,\Omega$
3	$V = C\,s$
4	$V = kg\,m^2\,s^{-3}\,A^{-1}$

A ☐ [illegible] 2 only
B ☐ 1, 2 and 4 only
C ☐ 1, 3 and 4 only
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14. What is the resistance of a 5.5 m long, 0.25 m radius cylinder of a materi

A ☐ $9.6 \times 10^{-2}\,\Omega$
B ☐ $0.79\,\Omega$
C ☐ $19\,\Omega$
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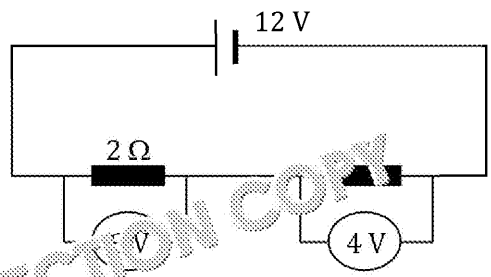

What mu[illegible] resistance, x, be?

A ☐
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C ☐ 3 Ω
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16. A cell with an emf of 1.5 V is connected to a load of 3.2 Ω. A current of 0. internal resistance of the cell.

A ☐ 0.26 Ω
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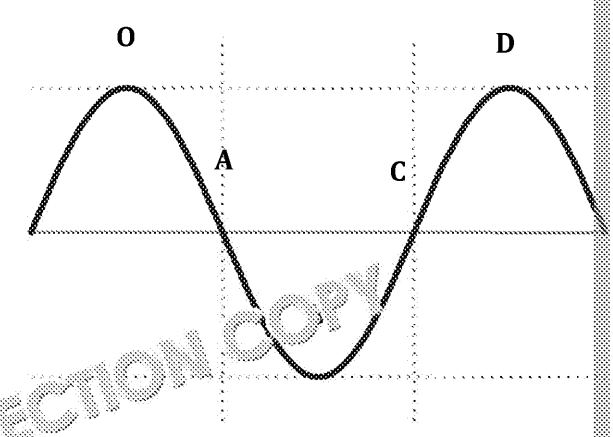

A ☐
B ☐
C ☐
D ☐

18. 620 nm light is shone on a pair of slits 3 mm apart. Calculate the fringe s

A ☐ 1.0 mm
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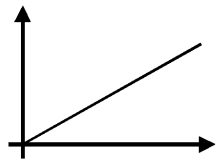
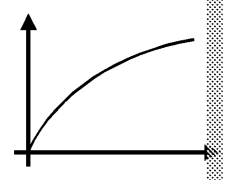
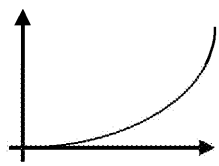
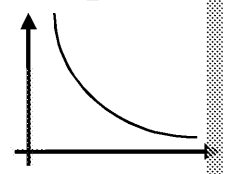
C ☐ 10 cm
D ☐ 20 cm

19. Which of these graphs shows the frequency of a wave against its wavelen









A ☐
B ☐
C ☐
D ☐

20. Progressive and stationary waves have some things in common and som

Which of these statements are true?

1	*Both have the same wavespeed in a given medium.*
2	*Both transfer energy from one place to another.*
3	*Both have the same frequency for a given wavespeed and wavelengt*
4	*Both have the same amplitude for a given input energy.*

A ☐ 1 and 3 only
B ☐ 2 and 4 only
C ☐ 1, 3 and 4 only
D ☐ all of them

Section B

21. a) State what 'upthrust' means.

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b) A sealed bottle of air floats at rest on the still water of a bath, as sho

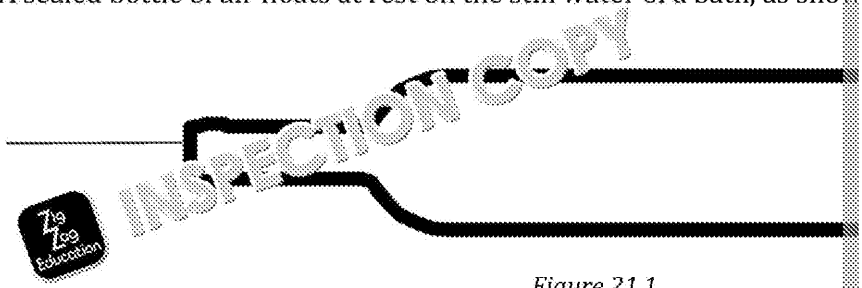

Figure 21.1

Add arrows to the diagram to show the forces acting on the bottle.

c) The bottle has a mass of 0.070 kg. When it is pushed entirely under displaced.

i) Calculate the density of the bottle of air.

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ii) Calculate the pressure on the bottle when it is submerged to a

State the units in your answer.
The density of water is 1000 kg m^{-3}.

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d) Explain, in terms of forces, why the bottle rises to the surface once r

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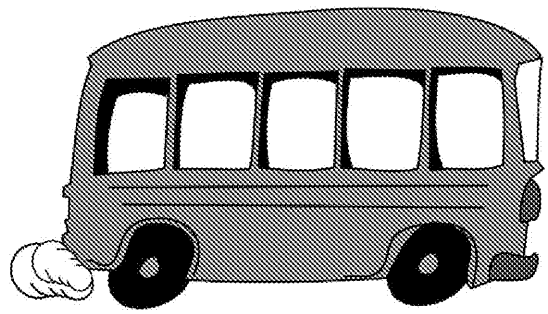
22. a) A normal bus moves 2.4 km against a resistive force of 500 N.



Calculate how much work it did overcoming the resistive force.

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b) It used 5.0 mJ of chemical energy from its fuel to do this.
Calculate its percentage efficiency.

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c) A new bus design is able to travel at 20 m s^{-1} doing 480,000 J of work
Calculate the resistive force it experiences.

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d) Explain what happens to the kinetic energy when the brakes are applied

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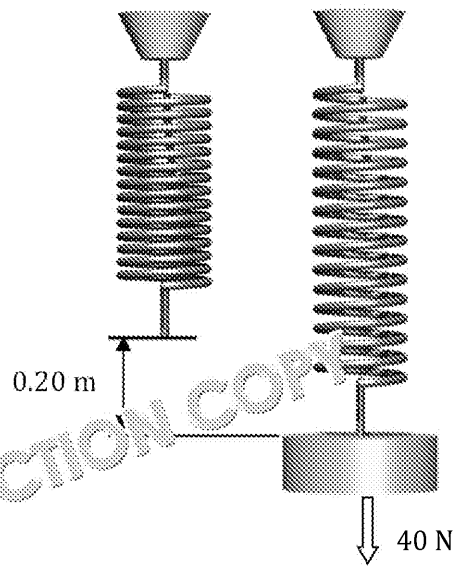
23. a) A spring is extended vertically downwards 0.20 m by a force of 40 N



i) Calculate the spring constant of the spring.

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ii) Calculate how much energy was stored in the spring.

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b) The wire that the spring is made from has a Young's modulus of 210 coiled up to make a spring, a sample extends from 0.50 m to 0.52 m Calculate its cross-sectional area.

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c) Show that $E = {}^{1}/_{\ldots}$ is homogeneous.

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24. a) Figure 24.1 shows potential difference against current for an ohmic

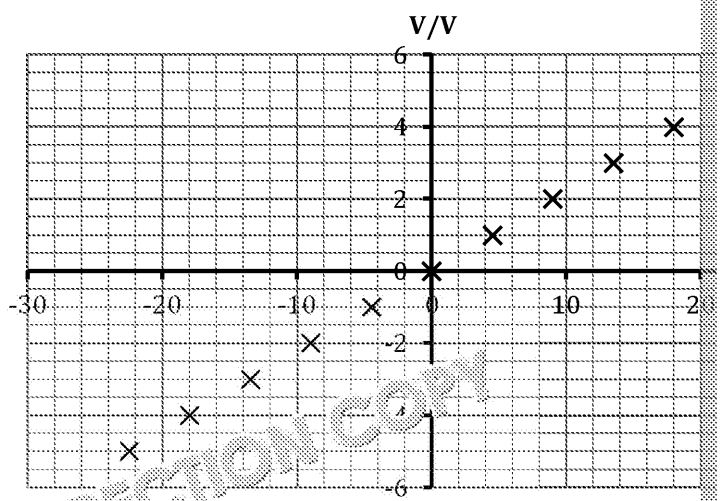

Figure 24.1

Use the graph to calculate the resistance of this ohmic conductor.

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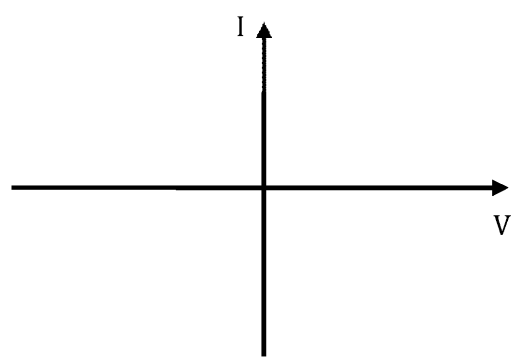
b) Sketch the current–voltage graph for a filament lamp.



c) A particular lamp is run at 6.0 V and 2.0 A.

Calculate how much energy it dissipates in 2 s.

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d) The lamp is one of the components powered by a 12 V cell.

Calculate how much energy that cell supplies for every 24 C of charge

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e) Explain what the benefit is of putting two cells in parallel.

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25. a) Describe the motion of the particles or fields in a transverse wave.

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b) A block of glass slows light down to 2.1 × 0[illegible] s⁻¹. Calculate its refr

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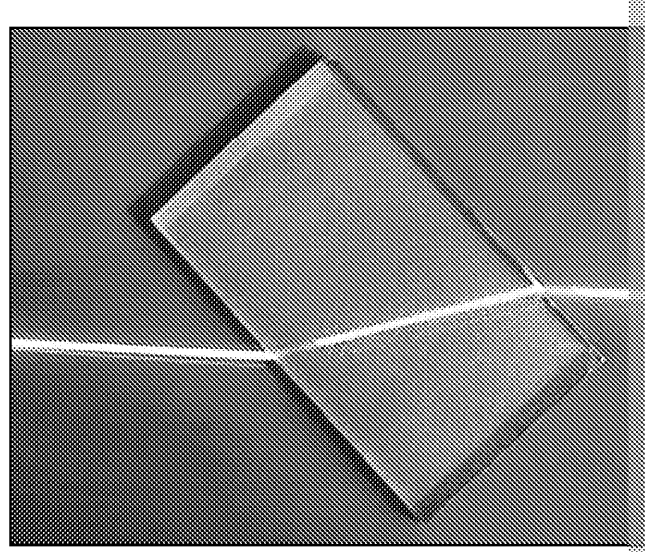
c) A ray of light is incident on the boundary between air and a glass blo



Calculate the angle at which it is refracted.

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d) Calculate the critical angle for the glass–air boundary.

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26. A student obtained this graph by varying the frequency of light shining c

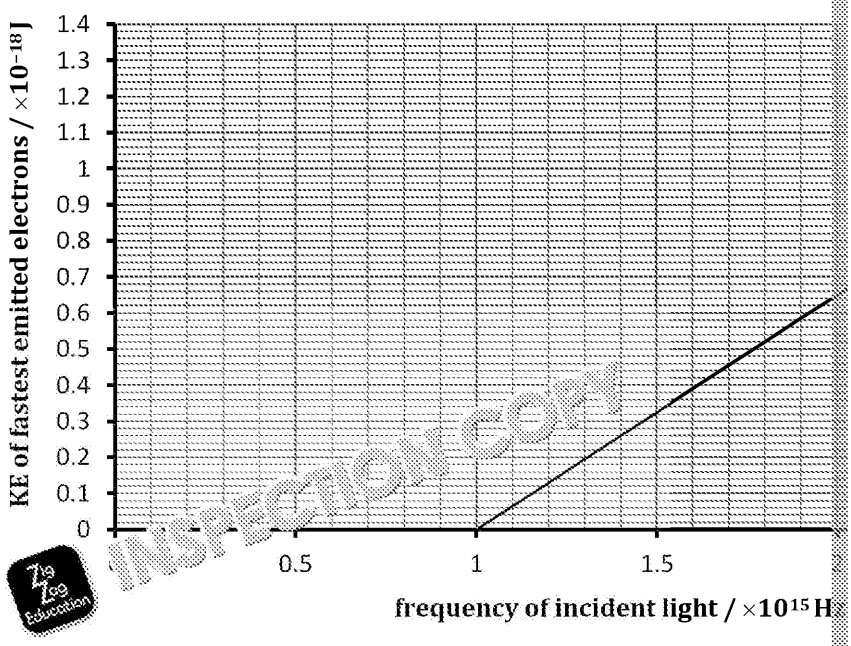

Figure 26.1

a) Use Figure 26.1 to determine a value of Planck's constant.

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b) Calculate the work function of the photocell.

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c) A particular electron was emitted with a velocity of 1.5×10^6 m s^{-1}.

Calculate its de Broglie wavelength.

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d) Describe how the wave-like nature of the elect could be demonst

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Physics A

Practice Exam 1B

Name	

Time allowed
1 hour

Instructions
Answer **all** of the questions and use the space provided.

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1. This table shows the readings for a solid cylinder taken by a student.

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What is the percentage uncertainty in the volume of the cylinder?

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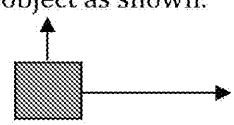

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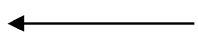

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3. Which row is correct?

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A $vt + \frac{Ft^2}{2m}$

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D $\frac{mv^2}{2F}$

5. Which of these statements is true about collisions?

A Momentum and kinetic energy are always conserved.
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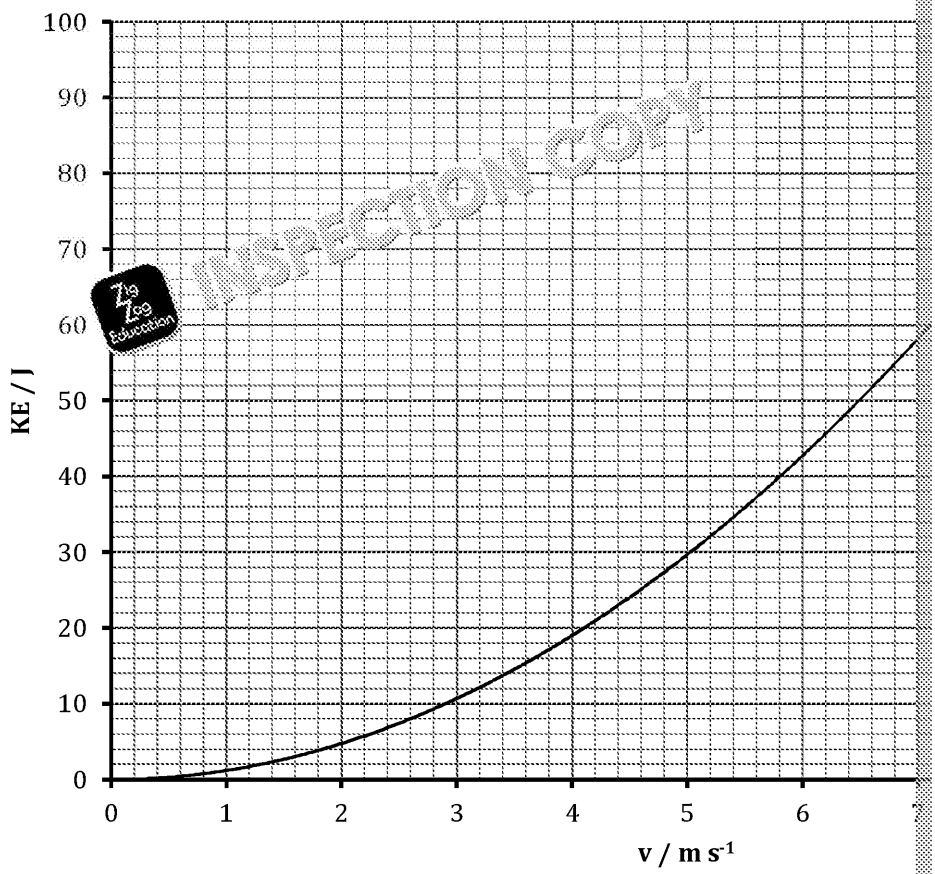
6. This is a graph of the kinetic energy of an object against its speed.



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12. A potential difference of 10 V was applied across a 2 Ω resistor for 45 s. through the resistor?

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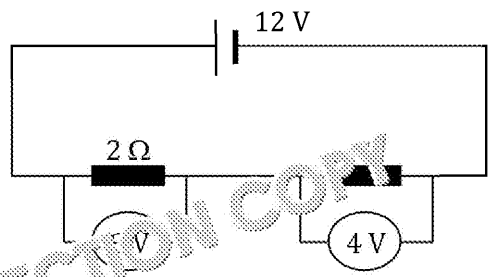

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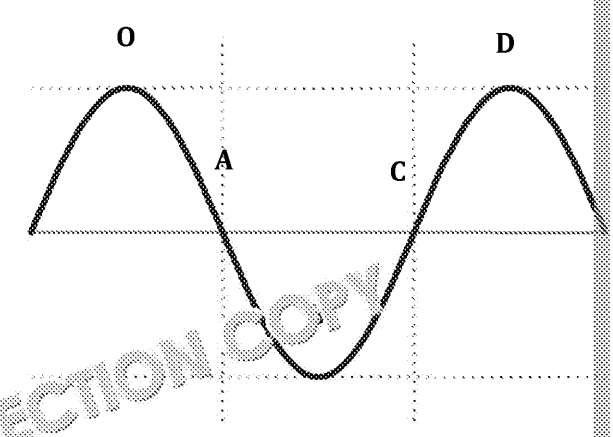

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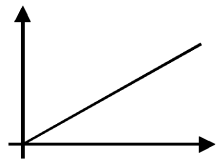

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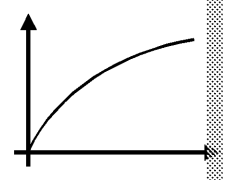
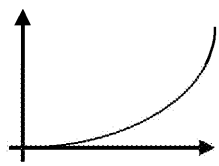


B



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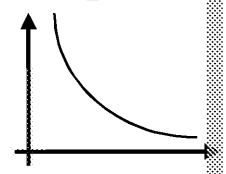

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21. a) State what 'upthrust' means.

b) A sealed bottle of air floats at rest on the still water of a bath, as sho

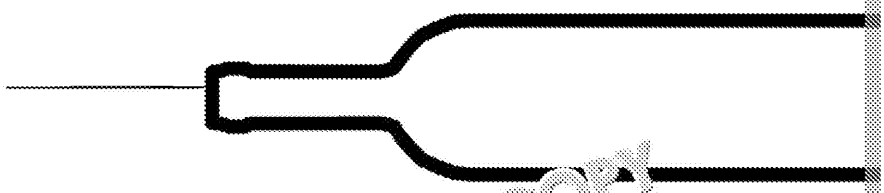


Figure 21.1

Copy the diagr a arrows to show the forces acting on the b

c) Ti e has a mass of 0.070 kg. When it is pushed entirely under displaced.

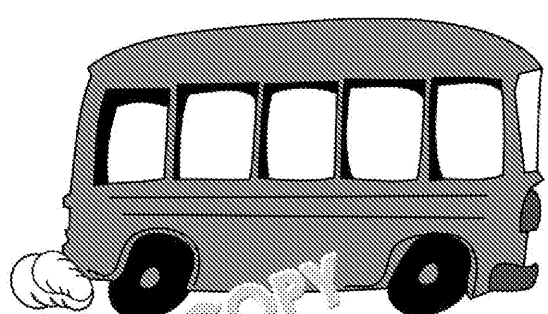
i) Calculate the density of the bottle of air.

ii) Calculate the pressure on the bottle when it is submerged to a d

State the units in your answer.
The density of water is 1000 kg m^{-3}.

d) Explain, in terms of forces, why the bottle rises to the surface once r

22. a) A normal bus moves 2.4 km against a resistive force of 500 N.



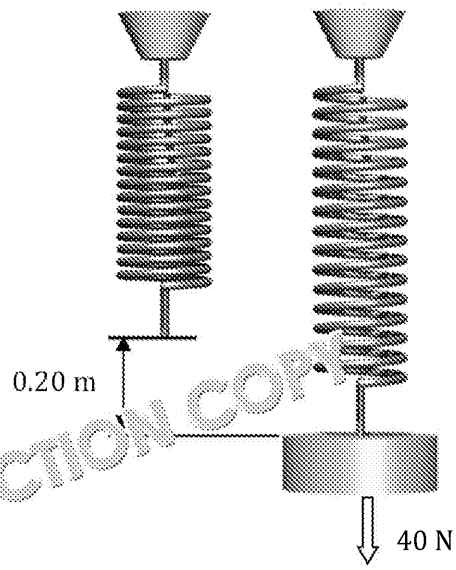
Calculate how much wo k d ercoming that resistive force.

b) It 5.0 chemical energy from its fuel to do this.
C its percentage efficiency.

c) A new bus design is able to travel at 20 m s^{-1} doing 480,000 J of wor
Calculate the resistive force it experiences.

d) Explain what happens to the kinetic energy when the brakes are app

23. a) A spring is extended vertically downwards 0.20 m by a force of 40 N



i) Calculate the spring constant of the spring.

ii) Calculate how much energy was stored in the spring.

b) The wire that the spring is made from has a Young's modulus of 210 coiled up to make a spring, a sample extends from 0.50 m to 0.52 m Calculate its cross-sectional area.

c) Show that $E = {}^{1}/_{2}\, kx^2$ is homogeneous.

24. a) Figure 24.1 shows potential difference against current for an ohmic

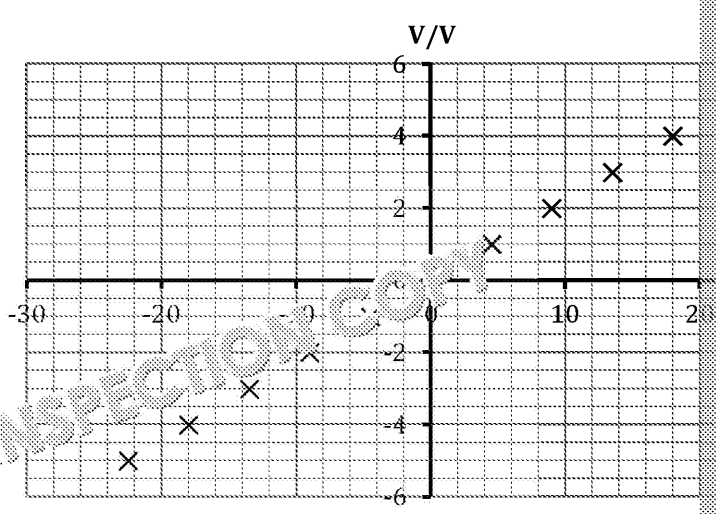
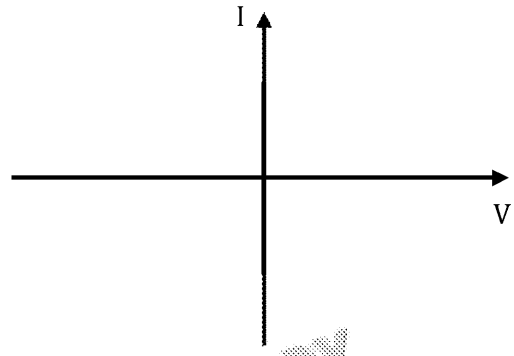


Figure 24.1

Use the graph to calculate the resistance of this ohmic conductor.

b) Sketch the current–voltage graph for a filament lamp.



c) A particular lamp is run at 6.0 V and 2.0 A.

Calculate how much energy it dissipates in 240 s.

d) This lamp is one of the components powered by a 12 V cell.

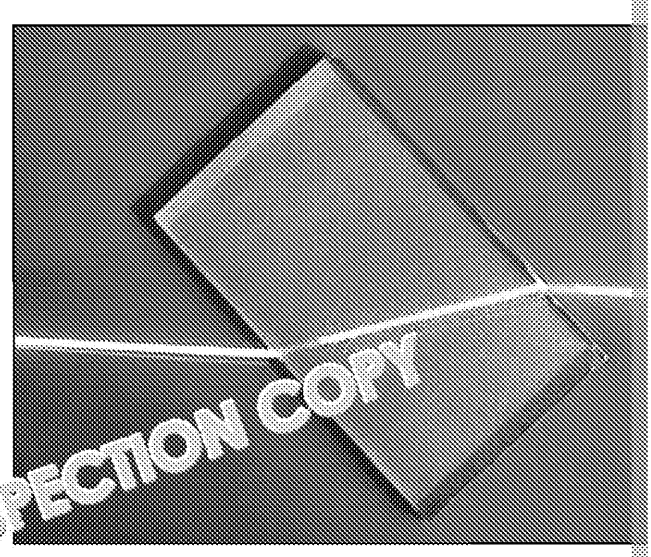
Calculate how much energy that cell supplies for every 24 C of charge

e) Explain what the benefit is of putting two cells in parallel.

25. a) Describe the motion of the particles or fields in a transverse wave.

b) A block of glass slows light down to 2.1×10^8 m s^{-1}. Calculate its refr

c) A ray of light is incident on the boundary between air and a glass blo



Calculate the angle at which it is refracted.

d) Calculate the critical angle for the glass–air boundary.

26. A student obtained this graph by varying the frequency of light shining o

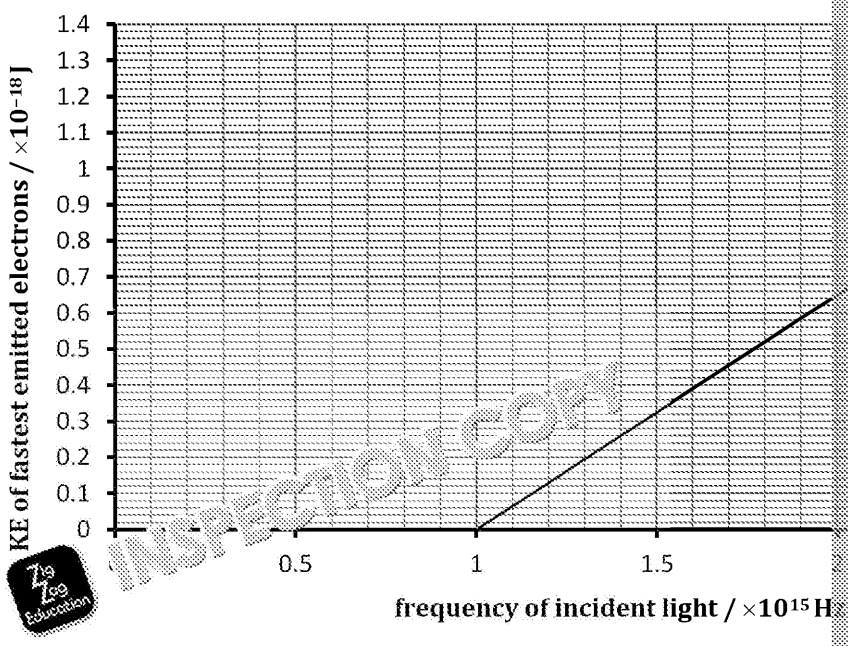


Figure 26.1

a) Use Figure 26.1 to determine a value of Planck's constant.

b) Calculate the work function of the photocell.

c) A particular electron was emitted with a velocity of 1.5×10^6 m s^{-1}.

Calculate its de Broglie wavelength.

d) Describe how the wave-like nature of the electron could be demons

Preview of Questions Ends Here

Paper 1A Mark Scheme

Types of mark
B – An independent mark.
A – An answer mark, for the end of a calculation.
C – A compensatory mark. If the A mark is awarded, any C marks are autom
shown. A C mark may be scored even if the A mark isn't.
M – A method mark that must be seen for a mark. They are not automatically av

Terms used in mark schemes
bald – an answer given without any other accompanying information
owtte – or words to that effect
ora – or reverse argument

Significant figures
Answers should be given to the same number of significant figures as the que
penalising [illegible] every occurrence to get them into good habits ready f

Section A

Question	Answer	Ma
1	B	1
2	B	1
3	D	1
4	A	1
5	C	1
6	D	1
7	D	1
8	C	1
9	C	1
10	B	1
11	A	1
12	D	1
13	B	1
14	C	1
15	A	1
16	B	1
17	C	1
18	B	1
19	C	1
20	B	1
	Total	

Section B

Question		Answer	Marks	
21	a	(Size but) no direction distance / speed / time	B1 B1	 Any
	b	Gradient calculated v = 4 (m s^{-1})	M1 A1	 Allo
	c	A component of the weight acts backwards creating a resultant force backwards	B1 B1	
	d	mass = $\frac{11800}{9.81}$ = 12[illegible] decel[illegible] $\frac{4-}{0.8}$ [illegible]eration = 3.75 m s^{-2} force = 1200 × 3.75 = 4500 (N)	C1 C1 C1 A1	NB:
			Total	/10
22	a	$v=\sqrt{2 \times 9.8 \times 5.0}$ v= 9.9 m s^{-1} p=9.9×1.4 = 14 (kg m s^{-1}) assumed negligible air resistance / drag	C1 B1 A1 B1	Can ener
	b	Newton's Third Law (of Motion)	B1	Acc
	c	Light gates Time between known points / over known distance $speed = \frac{distance}{time}$	B1 B1 B1	Or s *Alte* *Mea* *time*
			Total	/8
23	a	$A = \pi \times \left(\frac{1.5 \times 10^{-2}}{2}\right)^2 = 1.8 \times 10^{-4}$ $stress = \frac{20 \times 10^3}{1.8 \times 10^{-4}}$ = 1.1 × 10^8 (Pa)	C1 C1 A1	 Acc valu Acc
	b	Strain = $\frac{2}{}$ str[illegible] = 0	C1 A1	
	c	Diameter value too high Area too high Stress too low	B1 B1 B1	
			Total	/8

Question		Answer	Marks	
24	a	4.0	B1	
	b	Point plotted for 7.0 Ω and line of best fit drawn (magnitude of) gradient taken 1.8 (Ω)	B1 C1 A1	*(No evid best* Allo
	c	10^{-4} / 10^{-3} m s^{-1}	B1	Allo
	d	Conductor has free/delocalised electrons which carry the current In an insulator, the electrons ar[illegible] to the atoms / fixed / in orbital	M1 B1	
		Total	/7	
25	a	[illegible]ference is fixed/constant	B1	
	b	Constructive	B1	
	c	zero / one wavelength, etc.	B1	Any exp
	d	$\frac{623\times10^{-9}}{2.00\times10^{-3}} \times 5.00$ $= 1.56 \times 10^{-3}$ (m)	C1 A1	1.56 omi
	e	The fringe separation decreases Colour changes / becomes (more) blue	B1 B1	
	f	Decreased Quartered / goes down four times	C1 A1	
		Total	/9	
26	a	Exhibiting wave-like and particle-like behaviour	B1	
	b	$\frac{6.63\times10^{-34}}{9.11\times10^{-31} \times 2.5\times10^{7}}$ $= 2.9 \times 10^{-11}$ m	C1 A1	
	c	Diffracts more because wavelength gets less due to increase in momentum	B1 B1 B1	Or q
	d	Successfully predicts new observations (or) simpler than predecessor	B1 B1	
		Total	/8	

Preview of Answers Ends Here