

Mark Scheme January 2009

GCE

GCE O Physics (7540)

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7540/01 Physics Paper 1

Question Number	Acceptable Answers	Reject	Mark
1(a)(i)	(air) drag / air friction / air resistance	ignore upthrust	(1)

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	weight / force of gravity / gravitational (force) / pull of gravity /gravitational	gravity	(1)

Question Number	Acceptable Answers	Reject	Mark
1(b)	unequal acting on same body not same type of force	unbalanced	max (2)

Question Number	Acceptable Answers	Reject	Mark
1(c)(i)	3 (N) ACCEPT 3.0 (N)	another unit e.g. kg	(1)

Question Number	Acceptable Answers	Reject	Mark
1(c)(ii)	Downwards / towards ground / towards the centre of the Earth		(1)

Question Number	Acceptable Answers	Reject	Mark
1(d)	$3.0 = 6.0 \times a$ e.c.f. from (c)(i) $a = 0.5$ or $\frac{1}{2} \text{ m/s}^2$ UP allow $F = 3, 5, 8$ or 13 giving $a = 0.5, 0.83, 1.33, 2.17, 2.16 \text{ m/s}^2$	use of $a = (v - u)/t$	(1) (1)

Question Number	Acceptable Answers	Reject	Mark
1(e)	two vertical arrows in opposite directions in line with each other	arrows shown as 5(.0 N) up and 8(.0 N) down scores zero	(1)
	both labelled 8(.0) N UP dop		(1)

Question Number	Acceptable Answers	Reject	Mark
2(a)	straight line from (0,30) to (10,30)		(1)
	straight line from (10,30) to(25,0) or line of correct slope from a point on the line $v = 30$ m/s		(1)

Question Number	Acceptable Answers	Reject	Mark
2(b)	area (under graph)		(1)

Question Number	Acceptable Answers	Reject	Mark
2(c)	$30 \times 10 = 300$ must e.c.f from (a)		(1)
	$\frac{1}{2} \times 30 \times 15 = 225$ must e.c.f. from (a)		(1)
	One of these areas must be correct for 1 st mark		(1)
	$300 + 225 = 525$ m <u>UP for 3rd mark only</u> e.c.f from previous two lines		

Question Number	Acceptable Answers	Reject	Mark
3(a)	(any) gas/fluid hot/heats up		(1)
	less dense		(1)
	rises ora		(1)

Question Number	Acceptable Answers	Reject	Mark
3(b)	no (or less) convection	vacuum more evaporation	(1)
	filament (stays) hotter <i>independent mark</i>		(1)

Question Number	Acceptable Answers	Reject	Mark
4(a)	expansion/expands	gap / molecules expands	(1)

Question Number	Acceptable Answers	Reject	Mark
4(b)	expand differently	ignore conduction	(1)
	copper more/faster iron less		(1)
	'copper expands more' scores (2) ora		

Question Number	Acceptable Answers	Reject	Mark
4(c)	up		(1)

Question Number	Acceptable Answers	Reject	Mark
5(a)	(molecules) moving or have kinetic energy/momentum/velocity/speed Ignore vibrating colliding with (inside of) bag scores 2	colliding with each other	(1)
			(1)

Question Number	Acceptable Answers	Reject	Mark
5(b)(i)	32 kPa UP		(1)

Question Number	Acceptable Answers	Reject	Mark
5(b)(ii)	$32 \times 0.0006 = 100 \times V$ $V = 0.00019(2) \text{ m}^3$ UP ecf from (i) e.g. $30 \times 0.0006 = 100 \times V$ $V = 0.00018 \text{ m}^3$ $42 \times 0.0006 = 100 \times V$ $V = 0.000252 \text{ m}^3$	$V = 100 \times 0.0006 / 32$ $= 0.001875 \text{ m}^3$	(1)
			(1)

Question Number	Acceptable Answers	Reject	Mark
5(b)(iii)	constant mass/number of molecules owtte constant temperature		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
6(a)	(current is) a movement / (rate of) flow/transfer of charge (in one second)/electrons/charged particles ignore coulombs/protons	$I = V/R$ or $I = Q/t$	(1)

Question Number	Acceptable Answers	Reject	Mark
6(b)	(positively) charged ignore 'negatively'		(1)

Question Number	Acceptable Answers	Reject	Mark
6(c)	$5.4 \times 10^{-6}/60$ $= 9 \times 10^{-8}$ A UP $5.4 \times 10^{-6} / 1 = 5.4 \times 10^{-6}$ A (1)		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
6(d)	larger / greater / bigger / more (current) double (current) (scores both marks on its own)		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
7(a)	<u>very</u> large/ infinite (resistance)		(1)

Question Number	Acceptable Answers	Reject	Mark
7(b)	correct use of $I = V / R$ i.e. $6/24$ (A) allow $R = V / I$ $24 = 6 / 0.25$ or $V = I \times R$ $6 = 0.25 \times 24$ No UP		(1)

Question Number	Acceptable Answers	Reject	Mark
7(c)(i)	0.2(0) A		(1)
7(c)(ii)	total resistance = $6 / 0.20$ e.c.f. for I from (i) e.g. $0.45 \text{ A} / 13.3 \Omega / -10.7 \Omega$ $0.25 \text{ A} / 24 \Omega / 0 \Omega$ $0.225 \text{ A} / 26.7 \Omega / 2.7 \Omega$ = 30Ω UP if this is final answer ($30 - 24 =$) 6Ω UP		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
7(d)	rectifier / convert (ac) to dc / current only (flows) in one direction / half the time/half wave rectification shown graphically		(1)

Question Number	Acceptable Answers	Reject	Mark
8(a)(i)	arrow on line A to B allow arrow on or near to AB allow any clockwise arrow(s) in or near the 'square' but not if there is/are any anticlockwise arrow(s)		(1)

Question Number	Acceptable Answers	Reject	Mark
8(a)(ii)	arrow pointing anticlockwise on one of the circles allow more than one arrow if they all point anticlockwise <u>must</u> e.c.f. from (i)		(1)

Question Number	Acceptable Answers	Reject	Mark
8(b)(i)	direction of magnetic force on a N pole / direction a compass points / line from N.pole to S.pole	direction of current	(1)

Question Number	Acceptable Answers	Reject	Mark
8(b)(ii)	<ol style="list-style-type: none"> 1. use of (plotting) compass / iron filings/dust/powder 2. place on card / scatter iron filings on card 3. mark/note/shows position of needle/(N) pole / (filings) tap the card / <u>surround</u> wire with several compasses 4. move compass and mark/note (again)/ note directions of needles 5. repeat until complete a circle <p>NOTE Use of iron filings can only score first three marks</p>		max (4)

Question Number	Acceptable Answers	Reject	Mark
9(a)	too small (to see) / size of an atom / allow / very small / tiny / microscopic $1 \times 10^{-9} \text{m}$ (or smaller) UP	can only be seen under microscope	(1)

Question Number	Acceptable Answers	Reject	Mark
9(b)(i)	Water (vapour) drops / droplets / particles or alcohol drops / droplets / particles / vapour	water alcohol	(1)

Question Number	Acceptable Answers	Reject	Mark
9(b)(ii)	Ionisation / ionising / ionising ability / ionise easily	ions	(1)

Question Number	Acceptable Answers	Reject	Mark
9(b)(iii)	thick/solid/unbroken tracks straight tracks (all) same length/size/distance /energy 4-8 cm long /don't reach wall	short can't penetrate wall	max (2)

Question Number	Acceptable Answers	Reject	Mark
9(c)	<i>beta and / or gamma</i> not (very)/less ionising tracks (very) faint	not straight can penetrate wall range large or more than 8 cm	max (1)

Question Number	Acceptable Answers	Reject	Mark
10(a)(i)	transverse		(1)

Question Number	Acceptable Answers	Reject	Mark
10(a)(ii)	$3 \times 10^8 / 5 \times 10^6$ = 60 m m/(s Hz) UP		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
10(b)(i)	$3 \times 10^8 \times 1.9 \times 10^{-3}$ 5.7×10^5 m (570 000 m/ 570 km) halve distance = 2.85×10^5 m/285 km UP in <u>candidate's</u> final answer or $(1.9 \times 10^{-3}/2 =) 0.95 \times 10^{-3}$ $0.95 \times 10^{-3} \times 3 \times 10^8$ 2.85×10^5 m / 285 km		(1) (1) (1)

Question Number	Acceptable Answers	Reject	Mark
10(b)(ii)	orbit not circular / further away from Mars / distance increased / surface of Mars not even	distance changes / surface of Mars is circular	(1)

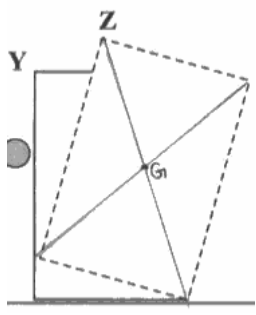
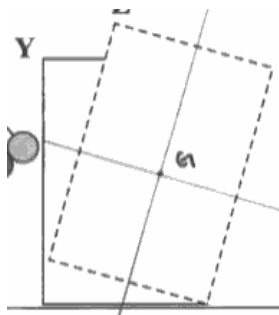
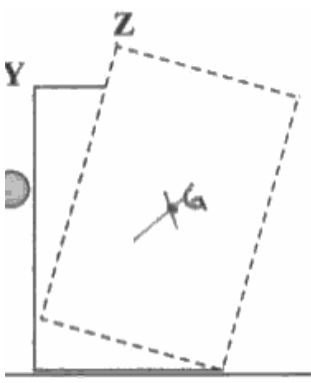
Question Number	Acceptable Answers	Reject	Mark
11(a)	move/adjust <u>lens</u> (back and forth) or change distance from <u>lens</u> to object <u>and screen</u> until <u>sharp/clear</u> image seen (on screen) dop		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
11(b)	distance from <u>lens</u> to screen/image/object / raybox allow 'optical centre' or 'surface of lens'		(1)

Question Number	Acceptable Answers	Reject	Mark
11(c)	inverted/upside down laterally inverted same size (as object) <i>each answer line must be completely correct</i>		max (2)

7540/02 Physics Paper 2

Question	Acceptable Answers	Reject	Mark
1(a)(i)	mass x velocity / mv / <u>product of mass and</u> /with/into velocity	mass x speed/weight x speed/ weight x velocity	(1)
1(a)(ii)	energy possessed by a moving body/ $\frac{1}{2}mv^2$	ignore $\frac{1}{2}mv$	(1)
1(a)(iii)	energy due to position/height/ mgh		(1)
1(b)	$((0.30 + 1.2) \div 2) \times 0.20$ = 0.15 m UP Allow equations of motion with correct solutions	$0.9 \times .2 = .18$	(1) (1)
1(c)	$0.02 \times 1.2 = (0.024)$ (kgm/s) $0.024 = (0.02 + 0.01) \times v$ $v = 0.024 / 0.03 (= 0.80 \text{ m/s})$ Allow working in cm for three marks	$0.2 \times 1.2 = (0.01 + 0.02) v$	(1) (1) (1)
1(d)(i)	$= \frac{1}{2} \times 0.03 \times 0.80^2$ = 0.0096 J UP once for J	$= \frac{1}{2} \times 0.3 \times 0.80^2$ = 0.096 J separate calculations for KE of each ball	(1) (1)
1(d)(ii)	same (as (i))/ 0.0096 J UP unless penalised in (i) ecf	$0.0096 = 0.03 \times 10 \times h$	(1)
1(d)(iii)	$0.0096 = 0.03 \times 10 \times h$ ecf <i>from d(ii)</i> $h = 0.032 \text{ m}$ UP allow $0.096(\text{from } d(ii))=0.3(\text{from } d(i)) \times 10 \times h$ =0.032m Allow use of $v^2=u^2+2as = 0.032\text{m}$ accept correct solution if seen in d(ii)	$.0096 = .03 \times h = .32\text{m}$ does not score	(1) (1)
1(e)(i)	ball rotates tape would slow down/change speed of ball /wrap round ball/friction can't fasten tape to ball Mark as a whole	effect after collision	max (2)
1(e)(ii)	light gate (+ ruler) light sensor (multi)flash photography (+ ruler)	datalogger/timer without light gate stopwatch and ruler	max (1)
1(f)(i)	point/place/position through which weight/force of gravity (or mass) of a body acts	The force which acts through the centre of gravity point where it balances	(1)

Question	Acceptable Answers	Reject	Mark
1(f)(ii)	<p>G must be shown at crossing point of two lines corner to corner as below accept a dot at crossing point with G near or an arrow labelled G pointing at crossing point</p> 	<p>A dot without label G G without unambiguous indication of the point</p>	(1)
	<p>accept lines from centre of sides as below</p> 		
	<p>Accept partial lines that would come from both corners</p> 		

Question	Acceptable Answers	Reject	Mark
1(f)(iii)	<p>G not outside base (vertical through) (sum) of ACW greater than (sum) of CWM G is to the left of point touching floor</p>	<p>collision force not big enough greater mass on the bottom base is wide stable (equilibrium)</p>	(1)

Question	Acceptable Answers	Reject	Mark
1(f)(iv)	ball <u>higher</u> up slope higher <u>initial</u> speed of ball (apply) (larger) initial force on ball use heavier ball for B	steeper slope bigger slope longer slope higher slope making the block narrower hit it more than once force applied all along the slope	max (1)

Question	Acceptable Answers	Reject	Mark
2(a)(i)	Advantage: quicker <u>conductor</u> better <u>conductor</u> <u>conducts</u> (heat) more easily Absorbs less heat	Advantage (more) even heating anything about pressure quicker rise of water without mention of conduction	(1)
	Disadvantage: breaks easily /less robust	disadvantage heat conducted more quickly (more) heat lost not reliable enough	(1)

Question	Acceptable Answers	Reject	Mark
2(a)(ii)	anomalous/uneven expansion of water/ unusual nature of water	denser water at bottom water will freeze at 0°C it will not be accurate	(1)
	between 0°C and 4°C/below 4°C		(1)
	liquid moves down (as temp rises from 0°C to 4°C)/ water contracts ora/same height for two temps possible		(1)

Question	Acceptable Answers	Reject	Mark
2(b)	28°C - 25°C = 3°C		(1)
	0.400 x 4200 x candidates temperature		(1)
	= 5040 J UP		(1)

Question	Acceptable Answers	Reject	Mark
2(c)(i)	<u>upward</u> sloping line all below first line	explanation using anomalous expansion	(1)
	curve levelling off (<i>ignore starting point of candidate's line</i>)		(1)
	compressing air/greater pressure above water (independent of line)		(1)

Question	Acceptable Answers	Reject	Mark
2(c)(ii)	vacuum (above Hg) allow no air allow gas at low pressure/ calibrated after manufacture	density of Hg > H2O Hg expands less than H2O Higher boiling point	(1)

Question	Acceptable Answers	Reject	Mark
2(d)(i)	0.03 × 1000 × 10	0.03 × 1000 = 30 Pa	(1)
	= 300 Pa (294.3/294) (N/m ²) UP	0.3 × 1000 × 10 = 3000 Pa	(1)

Question	Acceptable Answers	Reject	Mark
2(d)(ii)	(100 000 + 300) = 100 300 Pa ecf pressure at Z = pressure at Y/ pressure is atmospheric <u>plus</u> pressure of water only UP once for Pa in (i) or (ii)	pressure at Z = pressure at X	(1)
		pressure at Z = atmospheric Forces no atmospheric pressure at X	(1)

Question	Acceptable Answers	Reject	Mark
2(e)	water : close (packed)/ touching /little space air : far apart water : slide over each other/move around (within body of liquid) air : random / very high speed (Marked as one item award marks where seen)	More than solid but less than gas	(1)
			(1)
		ignore vibrate/random	(1)
			(1)

Question	Acceptable Answers	Reject	Mark
3(a)(i)	720/240 = 3 A UP allow one mark for 3 with no working shown allow both marks for 3A with no working shown Allow calculation of energy, charge transferred in 30m hence current = 3A		(1) (1)

Question	Acceptable Answers	Reject	Mark
3(a)(ii)	720 x 30 x 60 = 1 296 000 J / 1.3MJ UP or 0.72 x 0.5 = 0.36 kWh UP allow 360 Wh	1.3 mJ as UP	(1) (1) (1)

Question	Acceptable Answers	Reject	Mark
3(a)(iii)	29 000 000 x 0.35 = 10 150 000 J UP once only for J in (ii) and (iii)		(1)

Question	Acceptable Answers	Reject	Mark
3(a)(iv)	1 296 000 / 10 150 000 (x 100) = <u>0.128</u> or <u>12.8%</u> (allow 0.13/ 13%/ 0.127/ 12.7% and do not penalise excessive sig figs ie 0.127684729) ecf allowed from (ii) and (iii) provided efficiency < or = to 100% and both values in same units (J or kWh)		(1) (1)

Question	Acceptable Answers	Reject	Mark
3(b)(i)	720 (W) no loss of energy/ energy out = energy in / 100% efficient/ no heat produced or lost/ no magnetic (flux) leakage <i>independent of numeric answer</i>		(1) (1)

Question	Acceptable Answers	Reject	Mark
3(b)(ii)	720 / 12 60 A UP		(1) (1)

Question	Acceptable Answers	Reject	Mark
3(b)(iii)	2400/N _s = 240 / 12- correct use of equation N _s = 2400 x 12 / 240 correct rearrangement = 120 (turns) no UP correct answer or turns ratio = 12/240 = (0.05) turns on secondary = 0.05 x 2400 = 120 (turns)		(1) (1) (1)

Question	Acceptable Answers	Reject	Mark
3(c)(i)	rectifier / allows current (to flow) in (only) one direction / very high resistance when reversed (bias) owtte	<u>changes</u> direction	(1)

Question	Acceptable Answers	Reject	Mark
3(c)(ii)	axes labelled voltage and time /V and t (correct orientation and labels seen in (ii) or (iii)) two complete waves symmetrical by eye about time axis <i>independent marks</i>		(1) (1)

Question	Acceptable Answers	Reject	Mark
3(c)(iii)	-correct half wave rectification (hump- line twice or line- hump twice; either + or) -humps same size as in (ii) by eye award second mark if full wave shown or if only one wave shown in (ii)		(1) (1)

Question	Acceptable Answers	Reject	Mark
4(a)(i)	change of direction of light or waves / bending of light or waves	Dispersion/ splitting of light	(1)

Question	Acceptable Answers	Reject	Mark
4(a)(ii)	<u>change of speed</u> slows down on entry speeds up on leaving accept (optically) less dense to more dense and more (optically) dense to less dense or lower RI to higher RI and Higher RI to lower RI for second and third marks		(1) (1) (1)

Question	Acceptable Answers	Reject	Mark
4(a)(iii)	(centre of) <u>objective</u> lens to image <u>parallel</u> light focussed at focal point / focal distance / focal plane	6.4 cm	(1) (1)

Question	Acceptable Answers	Reject	Mark
4(a)(iv)	real where rays meet / could see on a screen / inverted/ opposite side of lens dop		(1) (1)

Question	Acceptable Answers	Reject	Mark
4(a)(v)	inverted/ upside down ray from top of object enters eye at bottom / magnifying glass does not (further) invert an image dop	magnifying glass forms an inverted image	(1) (1)

Question	Acceptable Answers	Reject	Mark
4(b)(i)	Both correct labels (focal length and mag) Both correct units plot (-1 each incorrect \pm 1mm or outside grid) smooth curve	joining the dots	(1) (1) (2) (1)

Question	Acceptable Answers	Reject	Mark
4(b)(ii)	17-19 mm UP		(1)

Question	Acceptable Answers	Reject	Mark
4(b)(iii)	line across and / or down (not just a dot) at correct place		(1)

Question	Acceptable Answers	Reject	Mark																																								
4(b)(iv)	choice of suitable pair of values from table below (must be seen) fe x magnification (<i>rearrangement</i>) = 900 mm UP or 910 mm UP		(1)																																								
	<table style="margin-left: 40px;"> <tr> <td>Fe</td> <td></td> <td>Mag</td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>x</td> <td>180</td> <td>=</td> <td>900</td> </tr> <tr> <td>10</td> <td>x</td> <td>90</td> <td>=</td> <td>900</td> </tr> <tr> <td>15</td> <td>x</td> <td>60</td> <td>=</td> <td>900</td> </tr> <tr> <td>20</td> <td>x</td> <td>45</td> <td>=</td> <td>900</td> </tr> <tr> <td>25</td> <td>x</td> <td>36</td> <td>=</td> <td>900</td> </tr> <tr> <td>30</td> <td>x</td> <td>30</td> <td>=</td> <td>900</td> </tr> <tr> <td>35</td> <td>x</td> <td>26</td> <td>=</td> <td>910</td> </tr> </table>	Fe		Mag			5	x	180	=	900	10	x	90	=	900	15	x	60	=	900	20	x	45	=	900	25	x	36	=	900	30	x	30	=	900	35	x	26	=	910		(1) (1) (1)
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35	x	26	=	910																																							

Question	Acceptable Answers	Reject	Mark
5(a)(i)	magnetic field/ lines /flux (of magnet) <u>cut</u> by (wires in) coil	charges cutting current Changing field	(1) (1)

Question	Acceptable Answers	Reject	Mark
5(a)(ii)	opposite/different poles / N then S <u>poles</u> / flux cut in opposite directions/field reverses	charges	(1)

Question	Acceptable Answers	Reject	Mark
5(a)(iii)	8 / 0.025 or 0.08 / 0.025 = 320 cm/s or 3.2 m/s 0.32 cm/ms UP	320 m/s	(1) (1)

Question	Acceptable Answers	Reject	Mark
5(b)(i)	ruler / metre rule / metre stick/ measuring tape / distance scale	tape scale	(1)

Question	Acceptable Answers	Reject	Mark
5(b)(ii)	1. height / distance from drop point to coil 2. length of <u>magnet</u> 3. time <u>between peaks</u>	EMF	(1) (1) (1)

Question	Acceptable Answers	Reject	Mark
5(b)(iii)	1. Turn on recorder 2. measure height (of magnet to coil) 3. release magnet 4. note time 5. Calculate speed 6. repeat for same height 7. repeat for different heights any 5 five points Max 5		(1) (1) (1) (1) (1) (1) (1) Max (5)

Question	Acceptable Answers	Reject	Mark
5(b)(iv)	Height and time seen suitable units all columns dop Ignore additional columns with correct units eg Length of magnet / cm or m and / or speed m/s.		(1) (1)

Question	Acceptable Answers	Reject	Mark
5(b)(v)	axes labelled height and speed line or curve from origin - speed rising		(1) (1)

Question	Acceptable Answers	Reject	Mark
5(c)	any pair from taller/higher/greater amplitude greater rate of cutting (of lines)/larger emf/ faster movement of magnet or narrower/steeper magnet moving faster or allow closer together magnet moving faster ALL reasons dependent on first mark	they would increase	 (1) (1) (1) (1) (1) (1)

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