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Mark Scheme (Results)
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GCE

GCE O level Physics
7540/02

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Question	Acceptable Answers Graduate	Reject	Mark
1(a)(i)	mass x velocity / *mv* / *product of mass and/with/into velocity*	mass x speed/weight x speed/ weight x velocity	**(1)**

Question	Acceptable Answers Graduate	Reject	Mark
1(a)(ii)	energy possessed by a moving body/$\frac{1}{2}mv^2$	ignore ½ mv	**(1)**

Question	Acceptable Answers Graduate	Reject	Mark
1(a)(iii)	energy due to position/height/*mgh*		**(1)**

Question	Acceptable Answers expert	Reject	Mark
1(b)	((0.30 + 1.2) ÷ 2) x 0.20 = 0.15 m **UP** Allow equations of motion with correct solutions	0.9 x .2 =.18	**(1)** **(1)**

Question	Acceptable Answers expert	Reject	Mark
1(c)	0.02 x 1.2 = (0.024) (kgm/s) 0.024 = (0.02 + 0.01) x v v = 0.024 / 0.03 (= 0.80 m/s) Allow working in cm for three marks	0.2 x 1.2 = (0.01 +0.02) v	**(1)** **(1)** **(1)**

Question	Acceptable Answers expert	Reject	Mark
1(d)(i)	= ½ x 0.03 x 0.80^2 = 0.0096 J **UP once for J**	= ½ x 0.3 x 0.80^2 = 0.096 J separate calculations for KE of each ball	**(1)** **(1)**

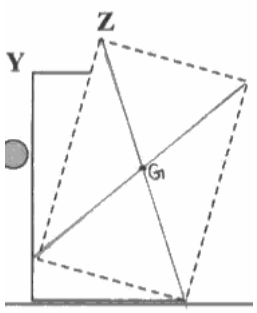
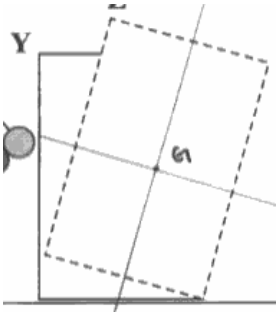
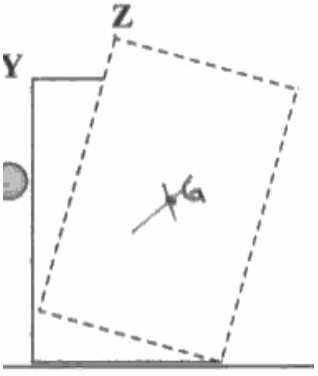
Question	Acceptable Answers expert	Reject	Mark
1(d)(ii)	same (as (i))/ 0.0096 J **UP unless penalised in (i) ecf**	0.0096 = 0.03 x 10 x h	**(1)**

Question	Acceptable Answers expert	Reject	Mark
1(d)(iii)	0.0096 = 0.03 x 10 x h **ecf** *from d(ii)* h = 0.032 m **UP** allow 0.096(from d(ii))=0.3(from d(i)x10xh =0.032m Allow use of $v^2=u^2+2as$ = 0.032m accept correct solution if seen in d(ii)	.0096 = .03x h = .32m does not score	**(1)** **(1)**

Question	Acceptable Answers Graduate	Reject	Mark
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)**

Question	Acceptable Answers Graduate	Reject	Mark
1(e)(ii)	light gate (+ ruler) light sensor (multi)flash photography (+ ruler)	datalogger/timer without light gate stopwatch and ruler	**max** **(1)**

Question	Acceptable Answers Graduate	Reject	Mark
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 general	Reject	Mark
1(f)(ii)	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  	A dot without label G G without unambiguous indication of the point	**(1)**
	accept lines from centre of sides as below  		
	Accept partial lines that would come from both corners  		

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

Question	Acceptable Answers Graduate	Reject	Mark

1(f)(iv)	ball higher up slope higher initial 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 Graduate	Reject	Mark
2(a)(i)	Advantage: quicker conductor better conductor conducts (heat) more easily Absorbs less heat Disadvantage: breaks easily /less robust	Advantage (more) even heating anything about pressure quicker rise of water without mention of conduction disadvantage heat conducted more quickly (more) heat lost not reliable enough	**(1)** **(1)**

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

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

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

Question	Acceptable Answers Graduate	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 H2Ohg Higher boiling point	 **(1)**

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

Question	Acceptable Answers expert	Reject	Mark
2(d)(ii)	(100 000 + 300) = 100 300 Pa **ecf**	pressure at Z = pressure at X	**(1)**

	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 = atmospheric Forces no atmospheric pressure at X	**(1)**

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

Question	Acceptable Answers Graduate	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 expert	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 expert	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 expert	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 Graduate	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 *independent of numeric answer*		**(1)** **(1)**

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

Question	Acceptable Answers expert	Reject	Mark
3(b)(iii)	$2400/N_s = 240 / 12$- correct use of equation $N_s = 2400 \times 12 / 240$ 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 Graduate	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 expert	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 *independent marks*		**(1)** **(1)**

Question	Acceptable Answers expert	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 Graduate	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 Graduate	Reject	Mark
4(a)(ii)	change of speed 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 Graduate	Reject	Mark
4(a)(iii)	(centre of) objective lens to image parallel light focussed at focal point / focal distance / focal plane	6.4 cm	**(1)** **(1)**

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

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

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

Question	Acceptable Answers expert	Reject	Mark
4(b)(iv)	choice of suitable pair of values from table below (must be seen) fe x magnification *(rearrangement)* = 900 mm **UP** or 910 mm **UP**		**(1)** **(1)** **(1)**

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

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

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

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

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

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

Question	Acceptable Answers Expert	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)**