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Mark Scheme (Results)
January 2010

GCE O

GCE O Physics (7540) Paper 02

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January 2010

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Abbreviations used in mark schemes:
OWTTE - or words to that effect
dop - depending on previous
ecf - error carried forward
UP - unit penalty
ora **-** or reverse argument

Question Number			Acceptable Answers	Mark
1 (a) (i)		CoG	point /where / place / position where	**1**
			weight/ mass/ force of gravity appears to act	**1**
	(ii)	Diag 2	reference to position of CoG (**X**)	**1**
			not outside base of prism / not past position of pivot/ because an anticlockwise moment acts OWTTE **dop**	**1**
(b) (i)		Diag 3	any movement	**1**
			CoG outside base 0r pivot / position of CoG falls OWTTE	**1**
	(ii)	**Diag 4**	bigger/wider/ bigger area <u>base</u> or or CoG lower OWTTE	**1**
(c)		**moment**	force x distance <u>from pivot or from a point</u>	**1**
			<u>perpendicular</u> distance	**1**
		effect	turning effect/rotation/ turning force/ torque (independent mark)	**1**
(d) (i)		**ACM**	600 x 0.10	**1**
			= 60 Nm/ 6000 Ncm **UP**	**1**
	(ii)	**CM**	Same as (i) **ecf no UP**	**1**
	(iii)	**balance**	any reasonable comment regarding part of body **or** a pole/long stick moving towards right **or** <u>her</u> left or moving body so CG is over rope Ignore CWM=ACWM	**1**
(e) (i)		**elastic**	returns to original shape	**1**
			when force removed OWTTE	**1**

	(ii)	**material**	any metal/ nylon /suitable <u>material</u> **reject** rubber or elastic band	**1**
(f)	(i)	**density**	mass/volume or mass per unit volume must be in words	**1**
	(ii)	**density change**	decreases volume increased (mass unchanged)/ particles of the material are further apart **dop**	**1** **1**

(Total 20 marks)

<table>
<tr><th>Question Number</th><th></th><th>Acceptable Answers</th><th>Mark</th></tr>
<tr><td>2. (a) (i)</td><td>acceleration</td><td>Slope / gradient /(negative) gradient/
gradient of the slope
ignore any calculation</td><td>1</td></tr>
<tr><td>(ii)</td><td>distance</td><td>area/ area under graph /area under line or curve /below graph/ under slope
reject velocity x time</td><td>1</td></tr>
<tr><td>(b) (i)</td><td>acceleration</td><td>= 30 / 4
= 7.5 m/s^2 or 7½ m/s^2 UP (ignore minus sign)</td><td>1
1</td></tr>
<tr><td>(ii)</td><td>distance</td><td>= ½ x 4 x 30
= 60 m UP
accept correct use of equations of motion</td><td>1
1</td></tr>
<tr><td>(c) (i)</td><td>graph</td><td>axes labelled with units
points plotted (-1 each incorrect ± 1mm)
ignore 0,0 (allow points covered by curve if in correct position)
curve</td><td>1

2
1</td></tr>
<tr><td>(ii)</td><td>read off graph</td><td>line seen on graph at correct velocity
value (read from graph) 32 ± 1 m no UP</td><td>1
1</td></tr>
<tr><td>(d) (i)</td><td>k.e.</td><td>½ x 800 x 25^2
= 250000 J 250 kJ UP

½ x 800 x 25 = 10000 J score 0/2</td><td>1
1</td></tr>
<tr><td>(ii)</td><td>force</td><td>Use of KE = F x d
F = 250000/38 ecf from d(i)
= 6579 / 6580 / 6600 N UP
Allow any number of sf which rounds to 6600N</td><td>1
1
1</td></tr>
<tr><td>(e)</td><td>wet conditions</td><td>
<table>
<tr><td></td><td>more</td><td>same</td><td>less</td></tr>
<tr><td>K.e</td><td></td><td>✳</td><td></td></tr>
<tr><td>Dist</td><td>✳</td><td></td><td></td></tr>
<tr><td>force</td><td></td><td></td><td>✳</td></tr>
</table>
More than one box ticked loses mark
Accept a cross in one box rather than tick
Accept correct word in any box
Ignore a crossed through tick</td><td>1
1
1</td></tr>
</table>

(Total 20 marks)

Question Number		Acceptable Answers	Mark
3. (a) (i)	**deflection**	(electromagnetic) induction field/ flux (lines round magnet) cut coils/copper wire	**1** **1** **1**
(ii)	**bigger deflection**	magnet (Y) stronger not bigger coil (Y) has more turns **ora** for both	**1** **1**
(iii)	**opposite deflection**	move magnet opposite direction /backwards /away from coil turn magnet round/push S pole into coil /reverse coil Change poles or magnets not enough on its own	**1** **1**
(iv)	**bigger deflection**	move magnet(X) faster	**1**
(b) (i)	**Metal** **reason**	(soft) iron /mumetal/ferrite/stalloy easy to magnetise/temporary magnet easy to demagnetise/loses magnetism when current turned off marks 2 and 3 dop on suitable metal	**1** **1** **1**
(ii)	**changes**	any four points from 1 to 6 1. current in coil **2.** (magnetic) field (produced) **3.** core magnetised **4.** (armature) attracted (to core) **5.** (armature) turns/pivots **6.** contacts pushed together/closed plus **7.** current passes in heater circuit/heater turns on **dependent on at least on of 4, 5 or 6** **max 4**	 **1** **1** **1** **1** **1** **1** **1**
(iii)	**current**	1920/240 = 8 A **UP**	**1** **1**
(iv)	**steel used**	any two points from permanent magnet/ stays magnetised (armature) still attracted heater stays connected/not switched off **reject** time to magnetise longer **max 2**	 **1** **1** **1**

(Total 20 marks)

Question Number			Acceptable Answers	Mark
4. (a)	(i)	**bending**	refraction (of light) **reject** refrection, reflection, reflected ray, dispersion, diffraction	**1**
	(ii)	**reason**	change of speed slows down on entry (second point on its own scores both marks) Frequency changes loses both marks ignore optical density as that is not a property of light. Ignore wavelength.	**1** **1**
	(iii)	**colours**	A – Red B – Blue/Indigo/violet (both correct to score the mark)	**1**
	(iv)	**separation**	(Colour) Dispersion **reject** diffraction or spectrum	**1**
	(v)	**separation**	different speeds (in glass/prism) blue/violet slower than red (in glass/prism) **ora** Ignore wavelengths. Second answer scores 2/2	**1** **1**
(b)	(i)	**types of radiation**	X – Infra red/IR /infra red radiation or rays Y – Ultra violet/UV/ ultraviolet radiation or rays	**1** **1**
	(ii)	**Different properties**	Any **two** points from wavelength frequency energy Ignore different effects eg one is invisible Accept two correct properties in one answer if not contradicted in the other	**1** **1** **1**
	(iii)	**similar properties**	Any **two** points from travel at same speed/speed of light (in vacuum or air) transverse waves can travel in a vacuum/ need no medium Ignore different effects eg one is invisible Ignore both part of the EM spectrum Accept two correct properties in one answer if not contradicted in the other	**1** **1** **1**

(iv)	**Detection of X**	(Blackened) thermometer or LDR/thermopile/IR detector/ IR camera/ IR film/ phototransistor/ thermistor place detector at X/ under source/ beyond A note (increase) in reading **reject** GM detectors/FM radios/ mobile phones etc Accept any suitable experiment using a detector exposed to a source of IR and a correct observation. eg blackened can of water with thermometer placed near a heater and temperature of water rising.	**1** **1** **1**
(c) (i)	**Refractive index**	RE = $3.00 \times 10^8 / 1.88 \times 10^8$ = 1.6/1.59/1.596/1.5957 **Allow** any number of dp which rounds to 1.6	**1** **1**
(ii)	**Angle of refraction**	1.6 = sin 30/sin r or sin r = sin 30/1.6 ecf r = 18.26/18.3/18.2/18.21/18.1 **Allow** any number of dp which rounds to 18.1 to 18.3	**1** **1**

(Total 20 marks)

Question Number		Acceptable Answers	Mark
5. (a) (i)	**Energy changes**	(Gravitational) Potential electric/ electrical	**1** **1**
(ii)	**loss of GPE**	0.4 x 10 x 1.5 or 0.4 x 9.8 x 1.5 or 0.4 x 9.81 x 1.5 = 6/ 5.88 / 5.886 J **UP** 0.4 x 1.5 = 0.6 scores 0/2	**1** **1**
(b) (i)	**apparatus**	1. ruler/ metre rule/ measuring tape/ distance scale 2. (electronic/top pan) balance/weighing scales reject newtonmeter 3. Ammeter 4. Stop clock /stopwatch/electronic timer **max 3**	**1** **1** **1** **1**
(ii)	**measurement**	1. height (from reservoir to outlet) 2. mass of water 3. voltage/PD/ voltmeter reading 4. Current/ ammeter reading 5. Time **max 3**	**1** **1** **1** **1** **1**
(iii)	**Description**	1. Measure mass of water / weight water 2. measure height (from reservoir to outlet) 3. release water 4. note ammeter reading/current 5. note voltmeter reading/voltage 6. Note time 7. Calculate (electrical) energy 8. repeat for same height/mass/ weight 9. repeat for different heights/ masses/ weights **max 5**	**1** **1** **1** **1** **1** **1** **1** **1**
(iv)	**Headings**	1. Height/m and/or mass (of water)/kg or g 2. Current/A and/or Voltage/V and/or time/s 3. (Electrical) Energy /J	**1** **1** **1**
(v)	**graph**	axes labelled mass and energy **no UP** Upward line or curve from origin **dop**	**1** **1**

(Total 20 marks)
Total for paper 100 Marks

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