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GCE

Edexcel GCE

Physics (7540/02)

Summer 2007

Mark Scheme

Edexcel GCE
Physics O Level 7540

GCE PHYSICS 7540/ 02

1. (a) (i) **Purpose**

Compensate/allow for /balance out/overcome friction **1**

Do not accept to remove/reduce friction/so there is no friction/to cancel friction

so no other or external forces act or affect the trolleys/ no unbalanced forces/forces Balanced/ no resultant or net force/so friction does not affect its speed **1**

(ii) **Adjustment**

Yes **1**

(Trolley 1) constant speed /velocity / no acceleration /zero acceleration **dop** **1**

dots equally spaced/same spacing/constant spacing (independent mark) **1**

Ignore "no friction" and "speeds up" here

5 marks

(b)

(i) **velocity before**

At least four large gaps measured (distance ≥3.7 cm (if more than 8 gaps has measured small gaps and does not score) **1**

(0.9 ->0.95) / 0.02
(1.8 -> 1.9)/0.04
(2.7 -> 2.8)/0.06
(3.7 ->3.8)/0.08
(4.7->4.8) /0.10
(5.7->5.8)/0.12
(6.6- >6.8)/0.14
(7.6->7.7)/0.16 **1**

=45/47.5/48 cm/s or 0.45/0.475/0.48 m/s **UP** **1**

if 48 cm/s seen then ignore further incorrect conversion to metres

If smaller gaps (after collision) used to obtain 3.2/0.2=16 cm/s or 0.16 m/s or 4.8/.3 = 16 cm/s allow final mark only

(ii) **Momentum before**

0.80 x 48 or 0.80 x 0.48 must **ecf** **1**

= 38.4 kg cm/s OR 0.384 kg m/s **UP** **1**

(36 if 45 used, 38 if 47.5 used, 12.8 if 16 used)

	(iii)	**Velocity after**	(Total) mass after 0.8 + 2.4	**1**
			0.384 = candidates mass (3.2 or 2.4 or 0.8) x v	**1**
			V = 0.1125/0.11875/0.12 m/s **UP once only for velocity**	**1**
	(iv)		(V=0.16m/s if mass of 2.4 used or v= 4.8m/s if 0.8 used can score second and third marks)	
		momentum after	(nearly the) same as (ii)/should be the same	**1**
			momentum conserved or momentum before = momentum after	**1**
			If they do not get same answer then No mark for different allow one mark for "an external force/friction was acting "	
				10 Marks
(c)	(i)	**KE before**	½ x 0.8 x 0.40^2	**1**
			= 0.064 J /Nm/ kgm^2s^{-2} **UP**	**1**
	(ii)	**KE before**	(KE before bigger/larger/greater/it has become smaller/it is now smaller **ora** no ecf	**1**
	(iii)	**Other energy**	Sound	**1**
			Heat/ thermal /internal	**1**
			independent marks	
				5 marks
				Total 20 marks

2. (a) **(i) process**

radiation/infra red /IR do not award if convection and/or conduction added **1**

Only one can travel through a vacuum or others need a medium/atoms/molecules **dop** **1**

(ii) Blackened wall

absorb radiation/energy/Infra red /light/heat **1**

(black is) best/a better /good absorber not "m
award both marks for "black is a good/better a **1**
Do not allow "attracts heat "

(iii) air heated

conduction only **1**
allow phonetic spelling but do not award if convection and/or radiation added

(iv) warm air to room

Any three points from:-

1. convection (current(s) but not energy) **1**
2. (warm) air expands/increases volume **1**
3. (warm air) becomes less dense (not lighter)
4. (warm) air/molecules rise(s) **1**

Do not award marks 2 and 3 for molecules expand or molecules less dense **1**

max 3

(v) Increased heating

air is a (good) insulator
air does not conduct heat
air conducts little heat
two sheets of glass insulate better **1**

less heat lost to surroundings/outside **owtte**

more heat kept/retained in room independent marks **1**

Do not allow "stops warm air leaving room" or "no heat leaves room"

10 marks

(b)	**(i)**	**energy**	6 x 300 x 30 x 60	**1**
			= 3 240 000 J, Ws, Nm, kgm^2s^{-2} **UP**	**1**
			(allow 6 x 300 x 30 = 54 000 J for 1 mark)	
			Allow 6 x 0.3 x ½ = 0.9kWh here	
	(ii)	**mass of wall**	6 x 0.15 x 2100	**1**
			= 1890 kg **UP**	**1**
	(iii)	**temperature rise**	3 240 000 /(1890 x 750) **ecf in Joules/ecf**	**1**
			2.28/2.29/2.3 **No UP**	**1**
			(0.038/0.04/0.038095 if 54000 used)	
	(iv)	**smaller rise**	heat lost to outside/surroundings	**1**
			heat transferred to room/ceiling/floor /windows	**1**
	(v)	**advantage**	free energy/ no pollution/ does not use fossil or non-renewable fuels/ renewable energy/ energy stored (for use later)/does not use electricity	**1**
			(Do not accept just "cheaper"/"more efficient)	
		disadvantage	(more) expensive to build or install/ no heat at night / too much heat in summer/ rooms overheated/ less heat in winter/less heat if cloudy/temperature can't be controlled/	**1**
			give credit for 2 correct statements, one clear advantage and one clear disadvantage if candidate does not state which is which.	

10 marks

Total 20 marks

3. **(a)** **(i)** **Pole**

S. Pole/ S/ South pole/South **1**

(ii) **Region X**

Uniform/constant/even/unvarying **1**

(iii) **Region Y**

If candidates do not specify X or Y, assume they refer to X **1**

They may give

Stronger, Higher, high, huge, greater or

X Stronger,X Higher, X high, X huge, X greater

They may refer to Y

Y weaker, Y lower, Y low, Y lesser, Y less

(iv) **Explain**

1 Effect on field –

(iron) rod or bar stops field spreading/ lines go through iron /area of field is reduced. No mark for charges **1**

2. Effect on clips

clips no longer in magnetic field/ shielded/not attracted/ lines or field do(es) not reach clips /field does not go outside box **1**

no mark for charges

Independent marks

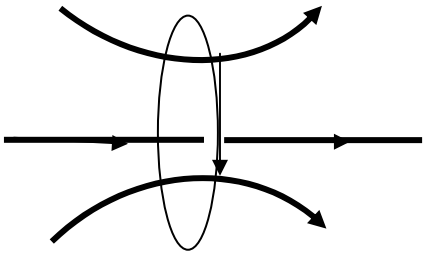
5 marks

(b) **(i)** **Flat coil**

direction of current shown on a flat coil **1**

correct shape of 2 or more field lines for a flat coil not parallel **1**

direction of field lines compatible with shown direction of current (allow this mark for a solenoid or a straight wire) where diagram is unambiguous. **1**



(ii) **Explain**

or else signal /field from transmitter goes direct to receiver /only want signal/field from object/so it is not affected by the field/signal/current from the transmitter/ so the two fields do not cancel out **1**

(iii) **a.c./d.c.**

a.c is in two opposite directions/ current reverses (not current varies)/current direction changes/current direction varies **1**

d.c. is in one direction **1**

(iv) **Why a.c.**

only a.c would induce current/emf/voltage in metal object /dc would not induce current/emf/voltage in metal object **1**

(must) have/need changing/alternating (magnetic) field/flux/ dc would produce a steady field? **1**

Do not accept dc would not produce a field

8 marks

(c)	**(i)**	**Graph**	1 axes correct orientation and suitable scale (2cm = 5cm depth or 2cm= 4 cm depth <u>and</u> 2cm = 1mA	**1**
			2 axes labelled with units (watch for A instead of mA)	**1**
			3&4 points plotted to within 1 mm (-1 for each incorrect)	**2**
			5 (best) straight line through all points	**1**
			If current points are plotted at equal intervals can only score mark 2	
	(ii)	**Depth for 2.0 mA**	28 cm **UP** allow range from 27.5 to 28.5 (unit not needed if answer is <u>only</u> given on graph axis)	**1**
			shown on graph – minimum line across at 2.0mA and/or line down at 28 cm independent of reading	**1**

7 marks

Total 20 marks

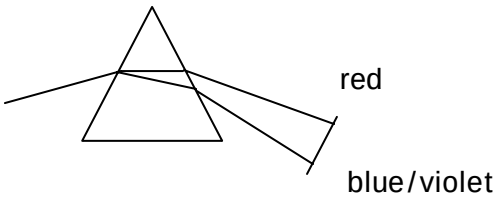
4. (a) Dispersion

1 dispersion at face XY **1**

2 increased dispersion at face XZ (by eye) not dop **1**

3 correct deviation at each face (allow for single ray) **1**

4 correct order of colours on screen (give mark for just red and blue/violet **1**



4 marks

(b) (i) A

refraction/ speed change/bends towards the normal

light slower in water/water has a higher RI **1**

slower in water scores both marks **1**

(ii) B

(total internal) <u>reflection</u>/partial reflection **1**

incident angle equals /more/greater than critical angle/angle of incidence = angle of reflection **1**

independent marks

4 marks

(iii) Red light.

Any five points from 7. Points 4, 5 and 6 must come from the same column. 1,2,5,6 can be obtained via a diagram

1 refraction (at A) / speed changes **1**

2 less bending or deviation (at A) **1**

3 slows down less than blue light/ n is lower for red light **ora** **1**

4 angle at B greater than critical	4 angle at B equal to critical	4 angle at B less than critical **1**
5 (Total internal) reflection at B	5 leaves /refracts at B	5 leaves/ refracts at B **1**
6 Refracts/ bends away from normal	6 parallel to surface at B/ $r=90^0$ at B	6 bends away from normal **1**

7 speeds up when leaving droplet **1**

Max 5

9 marks

(c)	**(i)**	**Angle of refraction**	sin 45˚ / sin *r* = 1.33	**1**
			r = 32/32.1/32.12/32.118 **No UP**	**1**
			(do not penalise larger numbers of dp	
	(ii)	**Direction of ray**	Any three points from	
			coating – bends towards normal	**1**
			RI coating > RI water **ora**	**1**
			glass – carries straight on	**1**
			RI coating = RI glass	**1**
				Max 3
	(iii)	**Critical angle**	sin *c* = 1/ 1.33	**1**
			c = 49/48.8/48.75/48.7/48.6 **No UP**	**1**
			(do not penalise larger numbers of dp	
				7 marks
				Total 20 marks

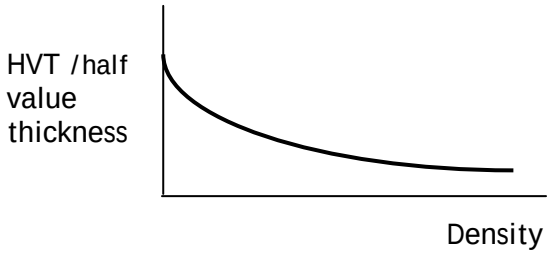
5.	**(a)**	**(i)**	**Correct for background**	Measure background (count)/measure count with no source present **1**
				Subtract background count **1**
				from count rate readings **dop** **1**
				Max 2
		(ii)	**HVT from graph**	7.5 to 9.0 (mm) If response area is blank accept a correct number written on graph **1**
		(iii)	**Half life**	Count rate would change for reason other than presence of absorber OWTTE/provides a consistent count rate /allow the experiment to work for longer/source will last for a long time/source does not need replacing **1**
		(iv)	**Repeats**	Random nature of radioactive decay / to allow an average or mean to be obtained not just "for accuracy" **1**
				5 marks
	(b)	**(i)**	**Apparatus**	1 Sensible safety item required Forceps/tongs/shielding/lead box/lead lined apron or gloves(not just safety clothing or goggles or film badge) **1**
				Then any three other items from
				2 G-M tube/ GM counter/ Geiger counter / (diffusion) cloud chamber (not just radiation

		detector	**1**
		3 Ruler/micrometer/vernier calliper	**1**
		4 Different thicknesses of lead	**1**
		5 stopwatch/stopclock/ timer/ratemeter/ (allow "counter" if not given in mark 2	**1**
			MAX 4
(ii)	**Measurements**	Any three points from	
		Background count / count without source	**1**
		Another Count (rate without lead in place)	**1**
		Count (rate) with lead in place	**1**
		Thickness of lead	**1**
		time (if count rate not seen)	
			MAX 3
(iii)	**Description**	Any four points from	
		1 Place source and detector opposite each other/pass (gamma) radiation	**1**
		2 Measure count (rate)(without lead)/allow background	**1**
		3 Place lead plate between source and detector	**1**
		4 Measure thickness of lead	**1**
		5 Measure new count (rate)	**1**
		6 Change thickness of lead and take new count (rate)/repeat for different thickness	**1**
		7 Keep distance between source and detector or source and lead constant throughout or repeat readings for each thickness	**1**
			MAX 4
(iv)	**Table**	Table with column headings thickness and count rate or counts and time	**1**
		Appropriate units on both columns dop	**1**
		either repeat readings **or** background count readings shown	**1**
			MAX 2

(c) Graph

Axes labelled HVT/Half value thickness and density/D allowing either orientation **1**

Straight line or curve showing ρ increasing, HVT decreasing **dop** **1**



Graphs of other variables score 0/2.

Do not penalise lines incorrectly reaching either axis or inappropriate units.

Total 20 marks

Total for paper: 100 marks