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Mark Scheme Summer 2007

IGCSE

IGCSE Physics (4420)

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Contents

PHYSICS 4420, MARK SCHEME

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

Paper 1F

Question 1

Qu part	Answer(s)	Extra Information	Mark(s)
a (i)	A		**1**
a (ii)	B		**1**
b(i)	frequency		**1**
b(ii)	period		**1**
c(i)	any two of: • gamma • X-rays • ultra violet • (visible) light • infra red • microwaves • radio waves • rope/slinky spring waggled side to side •	Allow 'electromagnetic' for 1 mark but do not award another mark for a part of the electromagnetic spectrum or words to that effect, but not just 'slinky spring'	**2**
c(ii)	longitudinal (waves)	allow sound waves or slinky spring pushed and pulled	**1**
			7 marks

Question 2

Qu part	Answer(s)	Extra Information	Mark(s)
a (i)	case/plug is damaged/broken/has piece missing	fuse/earth exposed	**1**
a (ii)	could touch inside/live wire/fuse		**1**
	get (an electric) shock		**1**
a(iii)	fuse		**1**
a(iv)	any two of: • get hotter • melt • fail to conduct/breaks/switches off	accept 'get hot' accept 'switch off' ignore effects on glass	**2**

b(i)	insulator/non-conductor		**1**
	will not get a shock (if you touch it)	ora	**1**
(b)(ii)	any two of has an earth wire /connection/it is earthed if there is a fault, electricity will go to earth/metal will not be live will not get a shock if touch it	but not if already credited in (b)(i)	**2**

10 marks

Question 3

Qu part	**Answer(s)**	**Extra Information**	
A	all points correct	to the nearest mm in any direction and not 'blobs' (more than 1 mm across) deduct (1) for each wrong point to a minimum of zero	**3**
(b)(i)	answer in range 67 to 68 inclusive	or correct from candidate's graph	**1**
(b)(ii)	answer in range 2.3 to 2.4 inclusive	or correct from candidate's graph allow 2 hr 18 m – 2 hr 24 m	**1**
c	(average) speed = distance (moved) ÷ time (taken)	or correctly transposed version allow use of letters e.g. a = d/t	**1**

6 marks

Question 4

Qu part	Answer(s)	Extra Information	Mark(s)
a	insulation		**1**
	conduction		**1**
b	… cold … down	both correct for the mark	**1**
	… warm .. up	may be reversed with the pair above allow 'hot' for 'warm'	**1**
	… cold … warm **no ecf**	order must be correct but allow 'hot' for 'warm'	**1**
	convection		**1**
			6 marks

Question 5

Qu part	Answer(s)	Extra Information	
a	density = mass ÷ volume	or any correctly transposed version do not accept 'weight' for 'mass' allow use of letters	**1**
b(i)	(volume) = length x thickness x width	or any correctly transposed version accept 'breadth' for 'width' allow use of letters	**1**
b(ii)	millimetres/mm		**1**
c	none/no change	accept 'the same'	**1**
d	2.7 (g/cm^3)	accept 'the same'	**1**
			5 marks

Question 6

Qu part	Answer(s)	Extra Information	
a	Z X A	all three correct allow (1) for one or two correct	**2**
b(i)	proton(s)		**1**
	nucleus		**1**
(b)(ii)	neutron(s)		**1**
(b)(iii)	proton(s) (1)		**2**

	neutron(s) (1)		
(b)(iv)	… electron(s) … proton(s)	either order	**1**
b(v)	alpha/α		**1**
	beta/ß	order of α and ß may be reversed	**1**
	gamma/γ		**1**

11 marks

Question 7

a	negatively	accept 'negative'	**1**
	electrons		**1**
	… comb … hair	both in correct order	**1**
b	any two of		
	• plastic/comb is an insulator/non-conductor	do not credit 'positive charges cannot move through the comb'	**1**
	• charges cannot pass through the comb/cannot leak away/be discharged/go to earth		**1**
	• charge cannot pass through (dry) air		**1**

(5 marks)

Question 8

a(i)	attract		**1**
a(ii)	curved line from one end to the opposite end (1)	do not credit if lines cross	**1**
	arrow from N to S (1)	do not credit if arrows contradict	**1**
b	steel (1) iron (1)	order must be correct	**2**

(5 marks)

Question 9

Qu part	Answer(s)	Extra Information	Mark(s)
a(i)	C		**1**
a(ii)	sloping downwards	slowing down	**1**
a(iii)	constant	less than acceleration / decreases slowly / takes a longer time than the acceleration / (area) A is less than (area) C / (train) travels a greater distance while decelerating than when accelerating	**1**
b(i)	area (under graph)	A + B + C	**1**
b(ii)	horizontal non zero line below line on graph for the correct time	 dop independent	**1** **1** **1**
			7 marks

Question 10

Qu part	Answer(s)	Extra Information	Mark(s)
a(i)	resistor/resistance/rheostat power supply/battery/cell		**1** **1**
a(ii)	= 0.4 × 20 = 8 (C)		**1** **1**
b	lamp in parallel switch in series with second lamp	 dop	**1** **1**
			6 marks

Question 11

Qu part	Answer(s)	Extra Information	Mark(s)
a	angle of incidence equals angle of reflection	(angle) i = (angle) r $\hat{i} = \hat{r}$ <i = <r	**1**
b(i)	correct ray striking window any ray reflected off at		**1**

	correct angle	independent	**1**
b(ii)	cover <u>outside</u> of window	open/close/tilt window/fit shutters (outside)	**1**
c(i)	infra-red	i.r ignore heat / radiation	**1**
c(ii)	ultraviolet	u.v	**1**
d	(same) speed / velocity	transverse	**1**

7 marks

Paper 2H

Question 1

Qu part	Answer(s)	Extra Information	Mark(s)
a(i)	C		**1**
a(ii)	sloping downwards	slowing down	**1**
a(iii)	constant	less than acceleration / decreases slowly / takes a longer time than the acceleration / (area) A is less than (area) C / (train) travels a greater distance while decelerating than when accelerating	**1**
b(i)	area (under graph)	A + B + C	**1**
b(ii)	horizontal non zero line		**1**
	below line on graph	dop	**1**
	for the correct time	independent	**1**
			7 marks

Question 2

Qu part	Answer(s)	Extra Information	Mark(s)
a(i)	resistor/resistance/rheostat		**1**
	power supply/battery/cell		**1**
a(ii)	= 0.4 × 20		**1**
	= 8 (C)		**1**
b	lamp in parallel		**1**
	switch in series with second lamp	dop	**1**
			6 marks

Question 3

Qu part	Answer(s)	Extra Information	Mark(s)
a	<u>angle</u> of incidence equals <u>angle</u> of reflection	(angle) i = (angle) r <i = <r	**1**
b(i)	correct ray striking window any ray reflected off at correct angle	independent	**1** **1**
b(ii)	cover <u>outside</u> of window	open/close/tilt window/fit shutters (outside)	**1**
c(i)	infra-red	i.r ignore heat / radiation	**1**
c(ii)	ultraviolet	u.v	**1**
d	(same) speed / velocity	transverse	**1**
			7 marks

Question 4

Qu part	Answer(s)	Extra Information	Mark(s)
a	50 000J of <u>chemical</u> <u>30 000 J</u> of <u>heat / thermal</u> energy	 ignore sound / chemical	**1** **1** **1**
b	= 700 × 2 (000) convert km to m = 1 400 000 (J)	 1400 (J) scores 2	**1** **1** **1**
			6 marks

Question 5

Qu part	Answer(s)	Extra Information	Mark(s)
a	magnetic field / flux (in coil) changes	dop	**1**
	voltage / current <u>induced</u> / electromagnetic induction / emi		**1**
			1
b	pedal faster	more wire on coils use <u>stronger</u> magnet reduce gap(s)	**1**
			4 marks

Question 6

Qu part	Answer(s)	Extra Information	Mark(s)
a	diffraction	accept phonetic spelling	**1**
b(i)	correct shape		**1**
	same wavelength		**1**
	two more wavefronts		**1**
b(ii)	increase wavelength	or decrease frequency	**1**
	decrease size of gap	ignore speed do not credit 'make equal'	**1**
c(i)	outside audible range	frequency too high or it/25 000 (Hz) is ultrasound or range of (human) hearing is 20 to 20 000 (Hz) ignore reference to gap	**1**
c(ii)	$v = f \lambda$	recall in any form	**1**
	$\lambda = 340 / 25\,000$	manipulation and	**1**
	$= 0.0136$ (m)	substitution or 0.014 (m)	**1**
			10 marks

Question 7

Qu part	Answer(s)	Extra Information	Mark(s)
a(i)	left : analogue right : digital		**1**
a(ii)	analogue – continuous	allow continual / has any value / values / has many values	**1** **1**
	digital – on and off	1 or 0 / only two values or allow two reasons for either analogue or digital	
b	one advantage	clearer/less prone to interference can be reproduced / repaired / restored do not credit just 'can be amplified' 'zero interference'	**1**
c	telecommunications	allow any feasible response e.g. CD players	**1**

5 marks

Question 8

a	for equilibrium/balance (1) (total) clockwise moment = (total) anticlockwise moment (1)	allow 'turning effect' for moment	**2**
b	40 (newtons) (2)	allow 'load x 0.12 = 8 x 0.60' for (1)	**2**

4 marks

Question 9

a	(a cathode ray) oscilloscope/ CRO		**1**
b	(the) frequency (of vibration/the wave)	(number of) cycles per second	**1**
c	amplitude (of vibration/the wave)	accept 'its energy' / intensity not 'volume'	**1**

3 marks

Question 10

a	293 (K)	allow 293 °(K)	not -293 (K) nor 293 °C (K)	**1**
b	910 (kPa)		**or** 850 ÷ 293 = pressure ÷ 313 (1) **or** correctly transposed version (1) **or** 908.xxx (2) or error carried forward from part (a) no credit for working in °C	**3**

4 marks

Question 11

a	any two of • renewable/no fuel required • no (chemical/air) pollution • lake (behind dam) may be used for fishing/recreational purposes • lake may be used as a source of water • can be stored		these are examples other appropriate points may also be credited	**2**
b	any two of • valley flooded • villages/farmland/habitats destroyed • not suitable if low (annual) rainfall • not suitable for lowland location • may be a long way from demand • may not operate in time of drought • eyesore		these are examples other appropriate points may also be credited credit 'can result in flooding'	**2**

4 marks

Question 12

Qu part	Answer(s)	Extra Information	Mark(s)
a (i)	*F* (is larger) because the lorry is accelerating	**or** B is smaller because…… not just '*F*''	**1**
a (ii)	(unbalanced) force = mass x acceleration / F = ma	or any correctly transposed version	**1**
a (iii)	1.2 (2) m/s^2 or ms^{-2} or N/Kg	or = 15 000 ÷ 12 500 (1)	**2** **1**
b	direction changes only two of: • (because) acceleration is (rate of) change of <u>velocity</u> • (and) velocity is speed in a particular direction • acceleration / velocity is a vector / not a scalar	allow any specific direction change e.g. goes round a bend e.g. goes uphill	**1** **2**
c(i)	(driver) has consumed alcohol/taken drugs/is tired/inexperienced/elderly	accept '… has been drinking' do not credit factors which may only affect the time before the driver reacts e.g. poor weather/ visibility /eyesight/ hearing/ lack of concentration accept 'high speed' but not just 'speed'	**1**
c(ii)	poor brakes/ slippery road/ worn tyres	must be qualified, do not credit just 'brakes' for example accept 'high speed' but not just 'speed' note 'high speed' may be credited for d(i) and again for d(ii) do not credit any unqualified response e.g. just 'friction'	**1**
			10 marks

Question 13

Qu part	Answer(s)	Extra Information	Mark(s)
a(i)	direct current		**1**
a(ii)	loudspeaker / speaker	do not accept a vague response such as 'in a radio'	**1**
b	(magnetic) field (1) north … south (1) (electric) current (1) positive … negative (1) motion/movement/force (1)	allow north (pole)…south (pole) or + and -	**5**
c	increase the strength/intensity of the magnetic field (1) increase the current (1)	accept 'use a more powerful magnet' accept 'increase the voltage/p.d.' do not credit references to 'resistance' or 'number of coils/turns'	**2**
			9 marks

Question 14

Qu part	Answer(s)	Extra Information	Mark(s)
a(i)	normal	do not accept 'perpendicular' or 'vertical'	**1**
a(ii)	(angle) e / E		**1**
a(iii)	(angle of) refraction	accept phonetic spelling but not anything which could be taken for refelction	**1**
a(iv)	refractive index = sine of angle of incidence ÷ sine of angle of refraction	$n = \frac{\sin i}{\sin r}$	**1**
a(v)	continues in the same direction / does not bend	allow 'it's a straight line'	**1**
a(vi)	any one of • ray is on the normal • angle of incidence = 0° • angle of refraction = 0° • at 90° / right angles to the boundary / perpendicular		**1**
b(i)	refraction towards normal (1) then refraction away from normal at the opposite face (1) emergent ray appears to be parallel to incident ray (1)		**3**
b(ii)	ray continues in a straight line to back force (1) reflects down and straight out at right angles (1)	dop	**2**
			11 marks

Question 15

Qu part	Answer(s)	Extra Information	Mark(s)
a	gravitational/potential (1) kinetic/movement (1)	correct order essential ignore energy	**2**
b(i)	(some) energy transferred as thermal energy/heat	or some energy transferred as internal kinetic energy or friction (between/with ….) or energy changes not 100% efficient	**1**
b(ii)	higher the waterfall then the higher the temperature increase	allow ('temperature increase is directly) proportional (to the height' of the waterfall)	**1**
(c) (i)	axes labelled speed and kinetic energy / ke (1) with linear scales (1) both axes labelled with units (1) **either** all points correct (2) **or** four points correct (1) smooth curve of best fit to candidate's points (1)	to the nearest mm in any direction and not 'blobs' (more than 1 mm across) not dot-to-dot or tram-lined or thicker than 1 mm ignore 0 to 3 m/s	**6**
c(ii)	answer in range 3.7 to 4.0 inclusive	or correct from candidate's graph	**1**
			11 marks

Question 16

a	fast random	both required with no additions allow any clear and unambiguous method of indication	**1**
b	hit/collide with it/the inside / walls	or words to that effect	**1**
	creates/exerts a force		**1**
	on the surface/area (not walls)	or pressure = force ÷ area or P = F/A	**1**
c(i)	270 (2)	accept 150 x 90 = pressure x 50 for (1)	**2**
c(ii)	mass remains constant / the same (1) temperature remains constant / the same (1)	**or** no gas escapes either order	**2**
c(iii)	kilopascal(s)	accept phonetic spellings	**1**
			9 marks

Question 17

a	230 and 90 for thorium (1) 4 and 2 for helium (1)	any change to thorium symbol cancels this mark any change to helium symbol cancels this mark any change to uranium deduct (1) from positive total	**2**
b(i)	to allow/give/produce a (narrow) beam /in one direction (of alpha particles/radiation)	'so that they go straight to the gold (foil)' not 'all go straight…..	**1**
b(ii)	<u>most</u> of the (gold) atom is empty space	do not credit just 'there is space in the gold'	**1**
b(iii)	<u>repelled</u> by the <u>centre/nucleus</u> (of an atom) (1) (as) both have positive / +ve / same charge (1)	**or** affected by electrostatic force (1) between the nucleus and the (alpha) particles (1)	**2**
b(iv)	centre/nucleus <u>very</u> small/tiny	not just '… small'	**1**
b(v)	(these were) further away from the centre/nucleus (1) (these were) moving faster (1)	either order or more (kinetic) energy	**2**
b(vi)	(tiny) spark/flash (of light)/scintillation	do not credit 'there was a colour change' ignore references to sound/noise	**1**

10 marks

Paper 3

Question 1

Qu part	Answer(s)	Extra Information	Mark
(a)	*x* = 11-12 mm		**1**
(b)(i)	two diagonals (part of)	or from centres of opposite sides	**1**
	where they cross indicated **dop**	G does not have to be labelled	**1**
	vertical lines (by eye)		**1**
(b)(ii)	through pin through candidate's G or dot		**1**
(b)(iii)	x = 22-23 mm		**1**
(b)(iv)	anticlockwise	down/down(ward)s/falls/falls to the right/rotates to the right	**1**
	G left of vertical through pin	do not accept moving/goes to the right do not credit answer to (b)(v) here	**1**
(b)(v)	G vertically/ below pin	As in Diag 2 pin above G	**1**
(c)	not regular/not symmetrical/not uniform/asymmetric/uneven/not equal/irregular/non uniform	ignore: no corners or straight lines or edges or the sides are not equal	**1**
(d)	1. clamp pin		**1**
	2. pin through card	1.use pin	**1**
	3. plumb line on pin	2. balance card max 2	**1**
	4. plumb line to draw vertical line	clamp card max 2	**1**
	5. repeat through another part of card		
	6. point where lines cross	max 4	
(e)	to be able to swing freely (about pinhole) sharp pencil no draughts card of uniform thickness	repeat for more holes/third hole not repeat and take average *credit where seen* or balance on pin	**1**
			15 marks

Question 2

Qu part	Answer(s)	Extra Information	Mark(s)
(a)	40 scores 3 37-43 scores 1 39-41 scores 2 values below 37 score 0 values above 43 score 0		**1** **1** **1**
(b)(i)	95 / 2 x their area = 1.2 **ecf/ecf** sig fig 2 or 3 only	factor of 2 errors in *F* or *A* lose 1st mark only	**1** **1** **1**
(b)(ii)	explain sig.fig.	must refer to sig fig in *F* or *A* or raw data independent of (b)(i)	**1**

37	38	39	40	41	42	43
1	1	2	3	2	1	1

Pressure for one shoe

A/cm^2	35	36	37	38	39	40	41	42	43	44	45
P/N/cm^2	2.71	2.64	2.57	2.5	2.44	2.38	2.32	2.26	2.21	2.16	2.11

7 marks

Question 3

Qu part	Answer(s)	Extra Information	Mark(s)
(a)	*Series circuit showing* ;		
	Fuse	see	**1**
	power supply – any symbol		**1**
	ammeter	Any 3	**1**
	means of changing current		**1**
	switch		**1**
			1
			MAX 4
	Values		
	Suitable values of voltage and resistance to give appropriate current		**1**
	1-10A ammeter	range at least 1A – 4 A '10 A' means 0 – 10A	**1**
			MAX 1
	Method		
	1. Switch on circuit		**1**
	2. Adjust current (to a certain value)	adjust voltage or resistance – must mention current	**1**
			1
	3. Record current		**1**
	4. Start stopwatch	measure time scores 1	**1**
	5. Stop stopwatch when fuse blows		**1**
			1
	6. Repeat for same current		
	7. Repeat for other currents	circuit switched on, current varied until fuse blows score 1. 3. 4. only	**MAX 4**
(b)	ammeter : 3.5 A		**1**
	stopwatch : 28.02 s		**1**
			11 marks

Question 4

Qu part	Answer(s)	Extra Information	
(a)	(lead) container/surrounding of source		**1**
	(lead)		
(b)	24		
(c)	78 – 24 = 54		
(d)(i)	Correct plotting ± 1mm	blobs > 2mm -1 once	**2**
	Curve		**1**
(d)(ii)	procedure for reading off time axis	Allow fraction e.g. 6½	**1**
	6 - 7 minutes	Can be up to 8 min for lower values of count rate	**1**
(e)(i)	54 - 55		
(e)(ii)	4 .6 – 5.0 min	read off for 55 do not allow greater than 5	
	mention 24		**1**
	correct use of 24 and graph		**1**
	55-24 = 31 leading to 10-12 min regardless of working	55+24 = 79 1.5 min (2)	
(f)	count from source decreasing (quickly)/changing (not increasing)	source decaying/only time	
	not appropriate to average	for one result readings will be different	**1**
(g)			**1**
	read incorrect scale/wrong reading		
	not in counts per minute		**1**
	not corrected for background		**1**
	not 5 minutes after start of experiment	different starting time max 3	**1**
			17 ma

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