

Edexcel IGCSE

Physics

4420: 1F, 2H & 03

November 2006

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Mark Scheme

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IGCSE PHYSICS 4420, NOVEMBER 2006 MARK SCHEME

Paper 1F

Question 1

Qu part	Answer	Extra information	Mark
(a)	distance time		1
(b)(i)	B and D		1
(ii)	C		1
(iii)	A	E	1
(c)	ANY THREE: going backwards same speed as A ends up back at start constant speed	 reverse direction 4 m/s <i>- 4 m/s score 1st 2 marks</i> constant velocity	 1 1 1

(Total 7 marks)

Question 2

Qu part	Answer	Extra information	Mark
(a)(i)	chemical		1
	electrical		1
(ii)	electrical		1
	heat		1
(iii)	voltage	potential difference	1
	resistance	resistor/other components	1
(b)(i)	three points plotted to within ½ mm	-1 for each misplot up to a maximum of two	2
	smooth curve		1
(ii)	34.5 °C	credit response in range 34 °C – 36 °C	1
(iii)	below		1

(Total 11 marks)

Question 3

Qu part	Answer	Extra information	Mark
(a)	point		1
	weight		1
(b)(i)	centre of gravity higher	X is higher	1
	X (horizontally) nearer to A	X on other side of A	1
(ii)	pot : wider/shallower/thicker base		1
(iii)	stove : wider		1

(Total 6 marks)

Question 4

Qu part	Answer	Extra information	Mark
(a)		ignore whatever may be written in the boxes above unless no lines are drawn then refer to the boxes for possible credit	1 1 1 1
(b)	G		1
(c)	cancer	mutations	1
(d)	heating	night vision	1

(Total 7 marks)

Question 5

Qu part	Answer	Extra information	Mark
(a)	transverse		1
(b)	wavelength		1
	(size of) gap	in either order	1
(c)	same wavelength		1
	less curvature		1

(Total 5 marks)

Question 6

Qu part	Answer	Extra information	Mark
(a)(i)	magnetised	or other way round	1
	demagnetised		1
(ii)	iron		1
(b)(i)	induced		1
(ii)	N		1
	S		1
(iii)	lines go from north to south		1

(Total 7 marks)

Question 7

Qu part	Answer	Extra information	Mark
(a)	8		1
	9		1
	8		1
(b)	beryllium/Be	both and no other(s)	1
(c)	unstable		1
	random		1

(Total 6 marks)

Question 8

Qu part	Answer	Extra information	Mark
(a)	decreases	reduces / lessens or words to that effect	1
(b)	becquerel		1
(c)(i)	tracer		1
(c)(ii)	4 hours		1
(iii)	4 s : too short to get information		1
	4 y : stays active (in body) too long		1

(Total 6 marks)

Question 9

- (a)(i) $F_1 + F_2 = 500$ or any rearranged version **1**
- (a)(ii) $F_1 + F_2 = 500$ or any rearranged version **1**
- (a)(iii) $F_1 = 250$ (N) and $F_2 = 250$ (N) both required **1**
*if (i) and (ii) are blank can credit
 $F_1 + F_2 = 500$ if seen here*
- (a)(iv) the beam has no weight **ANY ONE** **1**

the weight of the beam (and
hooks) is negligible

the beam (itself) has no effect on
the walls
- (b) ..clockwise....anticlockwise both required in either order **1**

(Total 5marks)

Question 10

- (a)(i) (in) parallel **1**
- (a)(ii) can be switched on (and off) separately otherwise they would all be switched together/ they are like the lights in a house OWTTE **1**
- (a)(iii) 1 / one **1**

8 / eight **1**
- (b)(i) variable resistor / variable resistance / rheostat / resistance box Not 'resistor' **1**
- (b)(ii) use/ adjust X / (variable) resistor remove or increase resistance scores 0 **1**

to reduce resistance scores both marks **1**

(Total 7 marks)

Question 11

- | | | | |
|----------|---|--|---|
| (a) | (triangular) prism | not rectangular | 1 |
| (b)(i) | line from top prism down centre of periscope tube reflected from back surface of bottom prism | allow minor imperfections if the intention is clear | 1 |
| (b)(ii) | <u>total internal reflection</u> | | 1 |
| (c)(i) | line from top mirror down centre of periscope tube reflected from centre of bottom mirror | allow minor imperfections if the intention is clear | 1 |
| (c)(ii) | reflection | not 'total internal reflection'
accept 'partial reflection' | 1 |
| (c)(iii) | (plane) mirror | | 1 |

(Total 6 marks)

Question 12

- | | | | |
|---------|---|--|---|
| (a)(i) | E | | 1 |
| (a)(ii) | line from watch down centre of tube reflected from surface up centre of tube <u>E</u> | allow minor imperfections if the intention is clear | 1 |
| | correct direction indicated | need not show more than one arrow but do not credit if more than one shown and they contradict
<i>if (i) is incorrect can score 2nd mark in (ii)</i> | 1 |
| (b) | reflected | | 1 |
| | ...incidence...reflection | both required in either order | 1 |
| (c) | to block out the (other) sound | OWTTE | 1 |
| | coming (directly) from the watch | dop
'which could distract/confuse'

'which would be louder than tube A' | 1 |

(Total 7 marks)

Question 13

- | | | | |
|-----|-----------|---|---|
| (a) | increases | | 1 |
| (b) | weight | or gravity/gravitational | 1 |
| (c) | friction | not air friction | 1 |
| (d) | decreases | or returns to normal/atmospheric (pressure) | 1 |
| (e) | increase | faster/ more kinetic energy | 1 |

(Total 5 marks)

Question 14

- | | | | | |
|---------|--------------------------|---------------|---|---|
| (a) | liquid | solid | both correct | 1 |
| | gas | solid | both correct | 1 |
| (b)(i) | vibration (only) | no ecf | do not credit if any suggestion that particles are moving about | 1 |
| (b)(ii) | <u>no</u> movement | | OWTTE | 1 |
| (c) | -273 °C (unit essential) | | 0 K
allow 0 °K or absolute zero | 1 |

(Total 5 marks)

Question 15

- | | | | |
|-----|--|---|---|
| (a) | connect input to side B or output to side A | OWTTE
'secondary has more turns than primary' | 1 |
| (b) | to prevent the electricity going through the iron/core | or 'prevent shorting'
do not credit response in terms of preventing shocks or of heat insulation | 1 |
| (c) | 12 (V) | appropriate equation which will solve to give 12 scores 1 | 2 |
| (d) | (alternating) magnetic field/flux magnet / magnetisation | electromagnetic induction
<u>induced</u> voltage
<u>induced</u> current | 1 |

(Total 5 marks)

Question 16

- | | | | |
|---------|---|--|---|
| (a) | Geiger-Müller(tube)/Geiger counter | allow Geiger-Marsden tube/GM tube
accept minor misspellings | 1 |
| (b)(i) | beta/ β or ' β and γ ' | | 1 |
| (b)(ii) | dop
(beta) is not stopped by paper/non-metal

(beta) is reduced /stopped by aluminium/metal | or alpha is stopped by paper/non-metal

or gamma is not stopped/reduced by paper/or aluminium/light or low density metal | 2 |
| (c) | lower reading/ reading (remains at) just <u>background</u> | not 'no reading' | 1 |

(Total 5 marks)

Paper 2H

Question 1

- (a)(i) $F_1 + F_2 = 500$ or any rearranged version **1**
- (a)(ii) $F_1 + F_2 = 500$ or any rearranged version **1**
- (a)(iii) $F_1 = 250$ (N) and $F_2 = 250$ (N) both required **1**
*if (i) and (ii) are blank can credit
 $F_1 + F_2 = 500$ if seen here*
- (a)(iv) the beam has no weight **ANY ONE** **1**

the weight of the beam (and
hooks) is negligible

the beam (itself) has no effect on
the walls
- (b) ..clockwise....anticlockwise both required in either order **1**

(Total 5marks)

Question 2

- (a)(i) (in) parallel **1**
- (a)(ii) can be switched on (and off) separately dop otherwise they would all be switched together/ they are like the lights in a house OWTTE **1**
- (a)(iii) 1 / one **1**

8 / eight **1**
- (b)(i) variable resistor / variable resistance /rheostat / resistance box Not 'resistor' **1**
- (b)(ii) use/ adjust X / (variable) resistor remove or increase resistance scores 0 **1**

to reduce resistance scores both marks **1**

(Total 7 marks)

Question 3

- | | | | |
|----------|---|--|---|
| (a) | (triangular) prism | not rectangular | 1 |
| (b)(i) | line from top prism down centre of periscope tube reflected from back surface of bottom prism | allow minor imperfections if the intention is clear | 1 |
| (b)(ii) | <u>total internal reflection</u> | | 1 |
| (c)(i) | line from top mirror down centre of periscope tube reflected from centre of bottom mirror | allow minor imperfections if the intention is clear | 1 |
| (c)(ii) | reflection | not 'total internal reflection'
accept 'partial reflection' | 1 |
| (c)(iii) | (plane) mirror | | 1 |

(Total 6 marks)

Question 4

- | | | | |
|---------|---|--|---|
| (a)(i) | E | | 1 |
| (a)(ii) | line from watch down centre of tube reflected from surface up centre of tube <u>E</u> | allow minor imperfections if the intention is clear | 1 |
| | correct direction indicated | need not show more than one arrow but do not credit if more than one shown and they contradict
<i>if (i) is incorrect can score 2nd mark in (ii)</i> | 1 |
| (b) | reflected | | 1 |
| | ...incidence...reflection | both required in either order | 1 |
| (c) | to block out the (other) sound | OWTTE | 1 |
| | coming (directly) from the watch | dop
'which could distract/confuse'

'which would be louder than tube A' | 1 |

(Total 7 marks)

Question 5

- | | | | |
|-----|-----------|---|---|
| (a) | increases | | 1 |
| (b) | weight | or gravity/gravitational | 1 |
| (c) | friction | not air friction | 1 |
| (d) | decreases | or returns to normal/atmospheric (pressure) | 1 |
| (e) | increase | faster/ more kinetic energy | 1 |

(Total 5 marks)

Question 6

- | | | | | |
|---------|--------------------------|---------------|---|---|
| (a) | liquid | solid | both correct | 1 |
| | gas | solid | both correct | 1 |
| (b)(i) | vibration (only) | no ecf | do not credit if any suggestion that particles are moving about | 1 |
| (b)(ii) | <u>no</u> movement | | OWTTE | 1 |
| (c) | -273 °C (unit essential) | | 0 K
allow 0 °K or absolute zero | 1 |

(Total 5 marks)

Question 7

- | | | | |
|-----|--|---|---|
| (a) | connect input to side B or output to side A | OWTTE
'secondary has more turns than primary' | 1 |
| (b) | to prevent the electricity going through the iron/core | or 'prevent shorting'
do not credit response in terms of preventing shocks or of heat insulation | 1 |
| (c) | 12 (V) | appropriate equation which will solve to give 12 scores 1 | 2 |
| (d) | (alternating) magnetic field/flux magnet / magnetisation | electromagnetic induction
<u>induced</u> voltage
<u>induced</u> current | 1 |

(Total 5 marks)

Question 8

- (a) Geiger-Müller(tube)/Geiger counter allow Geiger-Marsden tube/GM tube
accept minor misspellings **1**
- (b)(i) beta/ β or ' β and γ ' **1**
- (b)(ii) **dop**
(beta) is not stopped by paper/non-metal or alpha is stopped by paper/non-metal **2**

(beta) is reduced /stopped by aluminium/metal or gamma is not stopped/reduced by paper/or aluminium/light or low density metal
- (c) lower reading/ reading (remains at) just background not 'no reading' **1**

(Total 5 marks)

Question 9

- (a) recall $n = \sin i / \sin r$ **1**

 $\sin 36^\circ / \sin 23^\circ = 1.50$ **1**
- (b)(i) more **1**
- (b)(ii) **dop**
 n greater slows down more **1**
therefore r less for same i r less than 23°
- (c) **Technicians list** **ANY THREE** **3**
raybox/pins/laser torch(0)
paper
board
protractor
rule
set square
pencil/pen

(Total 7 marks)

Question 10

- | | | | |
|---------|--|--|---|
| (a) | acceleration | -1 for every wrong answer | 1 |
| | velocity | | 1 |
| (b)(i) | acceleration/to the right
/backwards/clockwise | | 1 |
| (b)(ii) | $F = 2100 - 1950 = 150$ | | 1 |
| | $a = F/m = 150 / 300 = \underline{0.5}$ | | 1 |
| | m/s ² | | 1 |
| (c)(i) | weight - downwards | gravitational pull/force
gravity(0) | 1 |
| | air resistance - upwards | drag / air friction
upthrust (0) | 1 |
| (c)(ii) | upward force = downward force /
no unbalanced force | | 1 |
| | no acceleration | | 1 |

(Total 10 marks)

Question 11

- | | | | |
|----------|---|----------------------|---|
| (a)(i) | $1.5 \times 0.5 \times 120$ | 90 scores 1 out of 2 | 1 |
| | $\times 60 = 5400 \text{ (J)}$ | | 1 |
| (a)(ii) | d.c. | | 1 |
| (a)(iii) | d.c. current always in same
direction / current constant | dependent on (i) | 1 |
| | a.c. current would go negative /
vary | | |
| (b) | $Q = I \times t$ or $I = \frac{Q}{t}$ | | 1 |

(Total 5 marks)

Question 12

- (a) microphone 1
- (b)(i) $T = 0.1 \text{ s}$ 1
- $f = 1/0.1 = \underline{10}$ 20 Hz or 5 Hz scores 2 1
Hz for any other value look at (i) – must ecf 1
- (b)(ii) outside/below audible range allow TE from calculated value 1

(Total 5 marks)

Question 13

- (a) *advantages:*
takes up little space **ANY TWO** 2
no pollution do not credit answers involving cost.
no greenhouse gases contradictory statements do not score
not dependent on weather
- disadvantages:*
fixed site **ANY TWO** 2
not many sites
brings up hazardous minerals
- (b) top line D C 1
bottom line A B 1
- (c)(i) sensible use of grid and correct orientation 1
axes labelled with quantities and units 1
points plotted correctly to $\pm 1 \text{ mm}$ -1 for each misplot up to a maximum of 2 2
- (c)(ii) smooth curve 1
- (c)(iii) 540 m 520 m –560 m 1

(Total 12 marks)

Question 14

- | | | | |
|---------|--|---|----------|
| (a) | celsius temperature | | 1 |
| (b) | when tyres heat up | | 1 |
| | pressure increases | as pressure is for cold air | 1 |
| | | no credit for 'pressure decreasing' | |
| (c) | $(200 \times 310) / 290$ | | 1 |
| | = 214 (kPa) | 213.8 213.79 | 1 |
| (d)(i) | pressure = force / area | $p = \frac{F}{A}$ or rearranged | 1 |
| (d)(ii) | $A = F/p = 10\,000/200\,000 = 0.05$ | $10\,000 / 4 = 2\,500$ | 1 |
| | <i>formula can score here if stated</i> | | |
| | $0.05 / 4 = \underline{0.0125} \text{ (m}^2\text{)}$ | $2\,500 / 200\,000 = 0.0125 \text{ (m}^2\text{)}$ | 1 |

(Total 8 marks)

Question 15

- | | | | |
|---------|---|---|----------|
| (a) | neutron collides with uranium nucleus | ANY THREE | 3 |
| | uranium splits (into two fission fragments) | | |
| | plus 2 or 3 neutrons | | |
| | releasing (kinetic) energy | small number – no other specified number
heat energy (0) | |
| (b) | top – control rod | one correct response | 1 |
| | middle – fuel rod | all correct | 2 |
| | bottom – moderator | | |
| (c)(i) | <i>control rods</i>
absorb neutrons | | 1 |
| | slow down/stop reaction | control rate of reaction | 1 |
| (c)(ii) | <i>moderator</i>
slow down neutrons | | 1 |
| | encourage fission | | 1 |

(Total 9 marks)

Question 16

- (a)(i) I correctly labelled 1
- (a)(ii) N on left 1
S on right must ecf from (i)
- (a)(iii) 2
move magnets closer together **ANY TWO**
more turns on coil stronger magnets
increase current

reduce value of variable
resistance
- (b)(i) recall $GPE = m \times g \times h$ 1

 $0.080 \times 10 \times 0.70 = \underline{0.56}$ (J) 1
- (b)(ii) 0.56 (J) 1
ecf
- (b)(iii) $= 0.56 / 4 = 0.14$ 1
ecf from (ii)
- W 1
J/s

(Total 9 marks)

Question 17

- (a)(i) joule 1
coulomb
- (a)(ii) $20 / 0.5 = 40$ (V) 1
- (b) metal(lic) 1
electrons 1

(Total 4 marks)

Question 18

- | | | |
|----------|---|---|
| (a)(i) | some (of the remainder) were deviated through large angles | 1 |
| (a)(ii) | concept of a nucleus | 2 |
| | positive charges confined to the nucleus | |
| | negative charges around the outside of the atom/outside nucleus | |
| (b)(i) | detect (alpha) particles/show flashes of light | 1 |
| (b)(ii) | direct alpha particles at foil/protect operator | 1 |
| (b)(iii) | avoid collisions between alpha particles and air (gas) particles/so they reach gold foil/avoid ionisation | 1 |

ANY TWO
2nd mark scores 2

(Total 6 marks)

TOTAL FOR PAPER : 120 MARKS

Paper 3

Question 1

Part	Answer(s)	Extra Information	Mark(s)
(a)	34 (cm ³)		1
(b) (i)	appropriate headings (1)	example	3
	all in order (1)	number of marbles	
	no 'unit' given for marbles and cm ³ or ml for volume (1)	1 39 2 50 3 61 4 72 5 91 6 94	
		allow consequential credit thereafter if, for example, one or more pairs are not listed	
(ii)	both axes labelled with quantity and unit (1)	allow error carried forward	3
	all points correctly plotted to within 1 mm in any direction (2)	deduct (1) for up to each of two points which is incorrect or a blob	
(iii)	5, 91	or otherwise correctly identified	1
(iv)	straight line of best fit	a ruler has been used and the anomalous result has been disregarded	1
(v)	28 (cm ³ /ml)	or correct from candidate's line	1
(vi)	105 (cm ³)		1

- (c) use scales/(top pan) balance
(1)
to find the mass of the marbles
(1)

do not credit 'weight ...'

do not credit if this is done at
the end when the marbles are
wet

put water in the measuring cylinder
and note its volume

(1)

use enough water so that (you judge)
it will cover the marbles (when they
are added)

(1)

but not too much so that it will/is
likely to overflow

(1)

add marbles, note volume then
difference in volume = volume of
marbles

(1)

do not credit if it is stated or
implied that only one marble
is used

(Total 17 marks)

Question 2

Part	Answer(s)	Extra Information	Mark(s)
(a) (i)	newtonmeter	or newton balance or spring balance	1
(ii)	17	do not credit '23'	1
(iii)	(clamp/retort) stand	do not credit 'holder'	1
(b) (i)	ruler	allow 'metre rule' allow 'tape measure'	1
(ii)	22 (mm)	allow any value between 21- 22 mm inclusive	1
(c)	130 (mm)		1
(d) (i)	75 (mm)		1
(ii)	all four points 'correct' (2) just three points 'correct' (1)	correct means not 'blobs' and centre correct to 1 mm any direction	2
(iii)	straight line of best fit through the origin	a ruler has been used	1
(iv)	either extension is (directly) proportional to (the) load (2) or spring obeys Hooke's Law (2)	allow converse (2) or just 'as load gets bigger so does the extension' (1)	2
(v)	valid suggestion (1) appropriate explanation (1)	examples more readings/ results/ measurements to improve reliability measure extension as unloaded to check that (elastic) limit has not been exceeded repeat readings to check (accuracy)	2

(Total 14 marks)

Question 3

Part	Answer(s)	Extra Information	Mark(s)
(a)	88 (°C)		1
(b)	measure the diameter of the beakers (1) calculate half the difference (1)	accept 'measure across the beakers' or $d =$ half the difference or $d =$ the difference in radii (of the beakers) for both marks	2
(c) (i)	starts at the same point (1) steeper gradient (1) levels out at the same (room) temperature (1)	not just stops at the dashed line	3
(ii)	so that the results can be compared	or so that any difference is due only to the thickness (of the insulation) or so it's a fair test do not credit 'it's a control (experiment)'	1
(d)	suggested improvement (1) appropriate explanation (1)	examples stir the water before taking the temperature (1) to get a better (average) result (1) have an insulated/ better fitting/ non-metal lid (1) to reduce heat loss (through the lid) (1)	2
(e)	cools more quickly (1) either damp sawdust is not such a good insulator (1) (because) (trapped) water is not such a good insulator as (trapped) air (1) or (some of the) water (in the damp sawdust) will evaporate (1) this will cause/increase heat loss (1)	or 'graph line is steeper' for either mark, credit words to that effect in terms of conduction	3

(Total 12 marks)

Question 4

Part	Answer(s)	Extra Information	Mark(s)
(a)	heatproof mat used to protect the bench (1) water in beaker, supported by tripod and gauze, heated by spirit burner (1) thermistor and thermometer in water (1) move/adjust spirit burner to (try to) keep temperature constant/at 60 °C (1)	this and other marks may either be from written response or from candidate's diagram but do not credit if these contradict	4
(b) (i)	0.66 (A)		1
(ii)	4.2(0) (V)		1
(c)	it/resistance will increase because resistance decreases as it gets hotter/ temperature rises	allow '...because resistance (of a thermistor) increases as it gets cooler/ temperature falls' credit '...because less free /available electrons' do not credit '...because resistance is inversely proportional to temperature'	1

(Total 7 marks)

Total for Paper 3 = 50 marks

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