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IGCSE Physics 4420 2H
Mark Scheme (Results)
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IGCSE

IGCSE Physics 4420 2H

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IGCSE PHYSICS 4420-2H MARK SCHEME

Question Number	Correct Answer	Acceptable Answers	Mark
1 (a)(i)	0.8 (seconds)	4/5 second 8/10 second	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Mark
1 (a)(ii)	3.2 (seconds)	3 1/5 allow **ecf** from (i) 4.0 – previous answer	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Mark
1 (a)(iii)	*one line* horizontal line beyond 0.8 less steep slope down (to the *x* axis) **dop**	 *two separate lines or one of these lines* labelled 1 mark for each correct	 **1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(i)	air (resistance) mass of car speed (of the car) brakes tyre pressure area of tyre streamlining	drag weight (force of) gravity size shape velocity (of car)	wind (resistance) temperature	**1** **(1)**

Question Number	Correct Answer	Reject	Mark
1 (b)(ii)	intentionally straight vertical arrow pointing downwards from, above, below or through point X	arrow from middle of car	**1** **(1)**

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(i)	infra red *allow* phonetic spelling	i.r. IR	microwaves ultraviolet	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(ii)	gamma (rays/radiation)	γ gama	X-rays	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(i)	same speed (in a vacuum) same velocity (in a vacuum) *or* (travel at) speed of light (travel at)velocity of light	travel through a vacuum or empty space	transverse	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(ii)	water (waves)/waves on water/tidal waves/sea waves/ocean waves	waves on (slinky) spring shaken/moved up and down or side to side waves on a rope moved up and down or side to side S waves *ignore* 'seismic' mexican wave	P waves analogue wave waves on a CRO	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(iii)	90˚ energy *independent marks*	normal/ perpendicu right angles information or data wavefront/front	 crest/vibration/direction/ pattern	**1** **1** **(2)**

(Total 6 marks)

Question Number	Correct Answer	Acceptable answers	Reject	Mark
3 (a)(i)	voltage = current × resistance *or* current = voltage/resistance *or* resistance = voltage/current	V = IR I=V/R R=V/I	V = C x R	**1** **(1)**
3 (a)(ii)	4.5 **nwn** volts or V or J/C or JC^{-1} or AΩ			**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Mark
3 (b)	decrease increase	Increase decrease scores 1 decrease decrease scores 1 increase increase scores 1	**1** **1** **(2)**

(Total 5 marks)

Question Number	Correct Answer	Reject	Mark
4 (a)(i)	(semiconductor)diode	LED light emitting diode	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(ii)	50 50	both required		**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(iii)	one cell is connected the wrong way some of the voltage is across/used up by diode/component Y/ ammeter(s)/(connecting) wire /switch	two cells cancel one another/not all facing the same way reference to resistance of these components /cells / whole circuit	battery voltage used up by/voltage across *voltmeter/lamp* voltmeter does not have infinite resistance *ignore* reference to current and energy	**1** **1** **(2)**

Question Number	**Correct Answer**	Acceptable Answers	Mark
4 (b)	*any <u>three</u> points* current increases increases temperature increases resistance line or slope becomes less steep	 voltage increases increases heat ***I*** molecular movement non-ohmic / *I* not proportional to *V*/ decrease rate of increase /current levels off	 **1** **1** **1** **(3)**

(Total 7 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(i)	not moving (or vibrating) none zero	no <u>kinetic</u> energy no momentum	a response which suggests any kind of movement	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Mark
5 (a)(ii)	-273 (˚C)	minus 273 -273.15	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(iii)	373 (K)	373.15(K)	373˚C	**1** **(1)**

Question Number	Correct Answer	Reject	Mark
5 (b)	particles knock /jostle /collide smaller/invisible /air/water particles cause a change of direction **dop** only as 3rd mark	diffusion	**1** **1** **1** **(3)**

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Mark
6 (a)(i)	electrons electrons	both required	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(ii)	*points in either order* polythene is an (electrical) insulator (so) slow to discharge /retains charge	 poor / bad (electrical) conductor 'charge (or electrons)leak away /move slowly (to earth)'	 poor conductor of heat	 **1** **1** **(2)**
6 (a)(iii)	copper is an (electrical) conductor (so charge is earthed)		copper is a good conductor of heat	**1** **(1)**

Question Number	Correct Answer	Reject	Mark
6 (b)	spark/sparking	flame	**1** **(1)**

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Mark
7 (a)	clear indication on the graph that a suitable interval has been chosen 1 ½ (hours) 90 (minutes)	 i.e. an interval between a value and half that value 87 93 or 96 **ecf** conversion of previous answer to minutes	**1** **1** **1** **(3)**

Question Number	Correct Answer	Reject	Mark
7 (b)	*any <u>two</u> points* (isotope) ingested / swallowed/eaten /taken in /injected (gamma) radiation emitted trace / track / detect (radiation) / follow progress	 X-rays alpha beta	 **1** **1** **1** **(2)**

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Mark
8 (a)	induced magnetic field responses only in this order	 flux (linkage)	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Mark
8 (b)	(number of) primary turns _____ (number of) secondary turns	primary coils _____ secondary coils $= I_S / I_P$	**1** **(1)**

Question Number	Correct Answer	Mark
8 (c)(i)	Just before the transmission line	**1** **(1)**

Question Number	Correct Answer	Mark
8 (c)(ii)	Just after the transmission line	**1** **(1)**

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
9 (a)(i)	gradient	slope	area	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
9 (a)(ii)	6.0 ÷ 0.25 = 24 m/s^2 or m/s/s or ms^{-2} *ignore minus signs*	 **Nwn** N/kg or Nkg^{-1}		**1** **1** **1** **(3)**
9 (a)(iii)	$F = m \times a$ = 70 × 24 = 1680 (N)	 **ecf** from (a)(ii) **nwn**	 70 x 10 700 x 24 score 0/3	**1** **1** **1** **(3)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
9 (b)	*any <u>three</u> points* same change in velocity (in) more time less acceleration or deceleration **ora** less force **ora**	 comes to a stop over a longer distance 24 ms^{-2} is too high *allow* 'slower deceleration'	 damage to joints effect of area of contact and pressure impact reduced	 **1** **1** **1** **1** **(3)**

(Total 10 marks)

Question Number	Correct Answer	Acceptable Answers	Mark
10 (a)	recall n = sin i ÷ sin r sin i = 1.5 × sin 40° i = 74.6(°) or 75(°)	 $\sin^{-1}$(1.5 sin 40°) 73.7(°) or 74(°) **nwn** (rounding sin 40° to 0.64) i= 40˚ r = 25.3˚ scores 1st mark only	**1** **1** **1** **(3)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
10 (b)(i)	intentional straight line from point of incidence above existing refracted ray		bending away from normal	**1** **(1)**
10 (b)(ii)	n less r is more	less dense/slows down less/less bent turns less to normal refracts less *Calculation of r = 47.9˚scores both marks*	bends away from normal greater refracted 'ray'	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
10 (c)	external normal correctly drawn i correctly marked between incident ray and drawn normal *independent marks*	 **ecf**	arrow(s) on normal	**1** **1** **(2)**

(Total 8 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
11 (a)	fracture energy = initial gpe - final gpe i.e. E = I – F <u>in words</u>	 I = E + F F = I – E <u>in words</u>	division or product of phrases	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Mark
11 (b)(i)	60 × 10 × 0.5 = 300 (J) nwn	60 x 9.81 x 0.5 = 294.3(j) 60 x 9.8 x 0.5 = 294(j)	**1** **1** **(2)**
11 (b)(ii)	300 / same as (i)	**ecf**	**1** **(1)**
11 (b)(iii)	½mv^2 = answer from (i) or (ii) = 3.16 (m/s)	**ecf**	**1** **1** **(2)**
11 (b)(iv)	friction / air resistance /drag not all gpe changed to ke	energy lost to a stated form e.g heat and/or sound	**1** **(1)**
11 (b)(v)	300 – 70 = 230 (J) or 0.230 kJ	allow ecf from b(i) no ecf from (a)	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Mark
11 (c)(i)	metal any metal *ignore* 'spring'	metal spring metal wire	**1** **(1)**

Question Number	Correct Answer	Reject	Mark
11 (c)(ii)	linear region correctly marked		**1** **(1)**
11 (c)(iii)	**<u>dop</u>** <u>proportionality</u> between force(or mass or load or weight) and extension **OWTTE**	elastic behaviour	**1** **(1)**

(Total 12 marks)

Question Number	Correct Answer	Reject	Mark
12 (a)	(Fleming's) left hand (rule)	(Fleming's)right hand left hand grip rule left hand corkscrew rule	**(1)**

Question Number	Correct Answer	Mark
12 (b)(i)	**I** out of page correct direction anywhere in circuit	**1** **(1)**
Question Number	Correct Answer	Mark
12 (b)(ii)	**M** downwards allow B as a label	**1** **(1)**
Question Number	Correct Answer	Mark
12 (b)(iii)	**F** to the right **must ecf from b(i)&(ii)**	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
12 (c)	stronger magnet more current	magnets closer larger voltage/ more batteries	bigger magnets electromagnet bigger battery	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Mark
12 (d)(i)	current/voltage varies about axis pattern repeated **dop** *maximum of 2 marks if no diagram*	diagram with at least 1½ cycles about axis scores 3 'current changes direction' scores 1 single cycle sine wave seen anywhere e.g. on a.c. supply scores 1	**1** **1** **1** **(3)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
12 (d)(ii)	(moves)backwards and forwards (quickly) vibrate (not up and down) at (a frequency of) 50 Hz *independent marks*	(moves)right and left side to side (quickly) at high frequency appears stationary	changes direction	**1** **1** **(2)**

(Total 11 marks)

Question Number	Correct Answer	Mark
13 (a)(i)	n 1 0	**1** **1** **(2)**

Question Number	Correct Answer	Mark
13 (a)(ii)	Be 9 4	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Mark
13 (b)(i)	He	Helium 2 protons & 2 neutrons	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Mark
13 (b)(ii)	electron ignore ß+	symbol **e-** or **β-**	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Mark
13 (c)(i)	same no of protons *ignore* 'electrons' different no of neutrons or N **dop** *exception* : 'same element with different number of neutrons' scores 1	same atomic number or Z different mass number or A different nucleon number	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Mark
13 (c)(ii)	U-238 → Th-234 Th-234 → Pa-234 Pa –234 → U-234 bald answer (2)	 final product has atomic number 92 score 1 if no other mark scored	**1** **1** **1** **(3)**

(Total 11 marks)

Question Number	Correct Answer	Reject	Mark
14 (a)	daughter two/ three/more/ a few/several / some chain speed/velocity/kinetic energy/momentum	 fast / ≥ 4 / **1**	**1** **1** **1** **1** **(4)**

Question Number	Correct Answer	Acceptable Answers	Mark
14 (b)(i)	slow down neutrons/particles (not nuclei) enable fission to occur	absorbs (kinetic) energy of neutrons/particles reaction is more efficient **OWTTE** increase rate of collision	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
14 (b)(ii)	absorb neutrons stop / reduce / control the rate of fission or reaction	stop neutrons		**1** **1** **(2)**

(Total 8 marks)

Question Number	Correct Answer	Mark
15 (a)(i)	p = 100 × 450 / 300 = 150(kPa) nwn *any unit must be correct*	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Mark
15 (a)(ii)	same mass same volume	same amount of gas no gas lost same size (container) 'same density' scores 1 mark if no other mark scored	**1** **1** **(2)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
15 (b)(i)	<u>increased</u> <u>average</u> speed **dop**	faster average (kinetic) energy average velocity speed of most of the molecules sum of speeds total of speeds	'decreased' scores 0/2	**1** **1** **(2)**

Question Number	Correct Answer	Mark
15 (b)(ii)	**(** Kelvin **)** temperature is <u>proportiona</u>l to the (average or total) <u>kinetic</u> energy of its molecules.	**1** **(1)**

(Total 7 marks)

Question Number	Correct Answer	Reject	Mark
16 (a)	energy charge	Joules coulomb	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
16 (b)(i)	$Q = I \times t$ / 0.60 × 2 = 1.2 (C) **nwn**			**1** **1** **(2)**
16 (b)(ii)	1.5 × 1.2 = 1.8 (J) **nwn**	allow **ecf**		**1** **1** **(2)**
16 (b)(iii)	no heat/energy lost in wires or internal resistance or cell	cell has no internal resistance/ all cell's voltage across resistor/wires have no resistance	no heat loss 100% efficient	**1** **(1)**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
16 (c)	double cell voltage quarter resistance value	3V add another cell 0.625 Ω 4 × resistance wire area 2 x diameter or radius ¼ × resistance wire length		**1** **1** **(2)**

(Total 8 marks)

PAPER TOTAL 120 MARKS