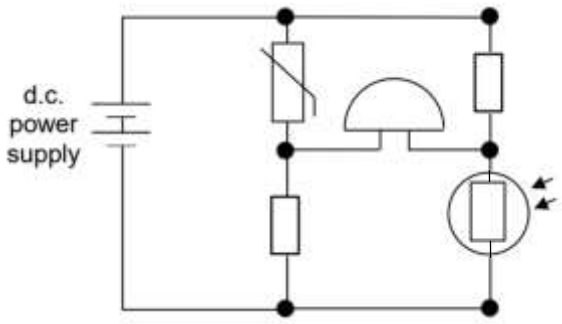
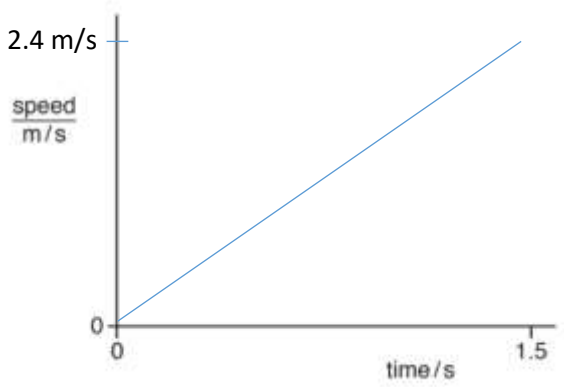
Physics Prelim 2024 P1&2 answers

1	2	3	4	5	6	7	8	9	10
B	A	D	B	D	A	D	C	C	C
11	12	13	14	15	16	17	18	19	20
A	C	A	D	A	D	B	D	A	A
21	22	23	24	25	26	27	28	29	30
D	A	A	C	C	D	C	A	A	D
31	32	33	34	35	36	37	38	39	40
A	C	C	C	A	A	D	D	D	C

1a(i)	0.0 m/s	1
1a(ii)	5.0 m/s.	1
1b	She is correct, since acceleration is the rate of change of velocity/acceleration exist when velocity changes [1] and the direction of the velocity is continously changing[1], and there is acceleration throughout the motion. OR There is a change of direction of movement, thus there is a net force acting on water in wheel. [1] Since resultant force = ma, there is an acceleration. [1]	2
2a(i)	Taking moments about the balance point, Since its in equilibrium, Sum of anticlockwise moments = Sum of clockwise moments $F_1 (d_1) = F_2 (d_2)$ (550)(0.86) = W(1.1) W = <u>430 N</u>	 1 1
2a(ii)	The see-saw rotates anticlockwise/ girl move down while boy moves up. The anti-clockwise moment <u>increases more</u> than the clockwise moment (at any time)./ The total anticlockwise moment is higher than the total clockwise moment.	1 1
2b	1. When displaced, there is a <u>perpendicular distance</u> between the line of action of weight and the pivot. OR line of action of weight falls on the right of pivot. 2. The <u>weight</u> of the toy thus provides a <u>clockwise</u> moment <u>about the pivot</u>. Cannot discuss anticlockwise because not in existence. 3. The toy <u>returns to the original position eventually where the line of action of the weight passes through the pivot OR c.g. is vertically(directly) below pivot.</u> (Either statement 1 + 2 or statement 2+ 3) O level will require all 3.	 2
3a	$P_{trapped\ gas}$= 10 cm Hg + P_{atm} = 86 cm Hg $P_{trapped\ gas}$ = (86/1 000) x 13600 x 10 = 1.17 x 10^5 Pa	1 1
3b	Equal height drawing at 55 cm	1
4ai	Refraction	1
4aii	The wavelength becomes smaller[1] suggesting that the speed of the wave decreases[1] OR The angle of incidence is larger than the angle of refraction/ wave bends towards the normal[1], therefore the speed of the wave slows down.[1]	1 1

4bi	f=0.39/(0.026*2) =7.5 Hz	1 1
bii	Refractive index = sin(45)/sin(33)=0.39/v allow ecf if error is penalized in bi v = 0.30 m/s OR Sin 45 = 0.052 / H Sin 33 = new wavelength / H New wavelength = (0.052 x sin 33) / sin 45 = 0.040 m v = wavelength x frequency = 0.04 x 7.5 = 0.300 m/s	2 1 1 1
5ai	I=P/V=0.90 W/6.0 V =0.15 A I=0.15 + 0.1 = 0.25 A	1 1
5aii	Charge = 0.25*1.5*60*60 allow ecf from ai =1350 C	1 1
5b	Resistance of the LDR decreases as light from the lamp falls on LDR. Current across the branch increase with LDR. Therefore power dissipated by the lamp increases, brightness increases.	1 1
5ci		1
cii	fire leads to hot and bright conditions, therefore resistance of the LDR decreases and resistance of thermistor decreases. low potential difference across the LDR and thermistor High potential difference across bell + Current flows through bell and Bell sounds	 1 1
6a	The permanent magnet causes a changing magnetic field <u>inside the solenoid/coil</u> or there is a change in magnetic flux linkage (<u>with the solenoid/coil</u>), <u>an e.m.f is induced</u> (requires 1st mark to score.) and since <u>there is a closed loop/circuit</u>, current flows in the solenoid.	1 1 1
6b	The ammeter reads a negative current. (Disallow answers that do not address ammeter directly.) This is (due to Lenz law), which says that current flows to oppose the change causing it. Since the change in magnetic flux is now the opposite of the previous case, the current also flows in the opposite direction. Allow polarity explanation.	1 1
7a	Magnet/magnetic field. Do not accept power source, current, complete loop.	1
bi	The current in the coil continually **<u>reverses direction</u>**, do not allow fluctuating, alternating (terms used in question stem cannot be reused as an explanation).	1

	causing the force acting on the coil to change direction also due to attraction or repulsion with permanent magnet. Only right hand grip rule allowed. FLHR cannot use here.	1
bii	The **cone** moves forward to compress/hit the air molecules, (allow cone displaces air molecules)[1] it then moves backwards to suck back the molecules (through low pressure).[1] **This produces a series of compressions and refractions** (or causes the air molecules to vibrate parallel to wave motion) which makes up a sound wave. [1] OR Cone vibrates and hits particles, causing them to vibrate as well.(Note this vibration is NOT random because it is a wave vibration.)[2] **This produces a series of compressions and refractions [1[**	1 1 1
iii	1/0.0025 = 400 times	2
8a	For the (***same power)*** transmitted, high voltage results in ***low current(P=IV)***[1]. Low current results in ***low power loss*** in transmission cables ***since $P=I^2R$[1], (assuming R is constant)***. (1m) Same power or R constant is measured above is additional one point. OR Allow thinner wires can be used since I is low.	3
b	0.9 x 240 x I_p = 20 x 2.3 [1] I_p= 0.21 A [1]	2 1
9a	P = 300 Wm^{-2} x 880 km^2 = 300 Wm^{-2} x 880 x 1000^2 m^2 [1] = 2.64 x 10^{11} W [1]	 1 1
b	Q= Pt x0.6 = 2.64 x 10^{11} W x 12 x 60 x60 x 0.6 = 6.84 x 10^{15} J [1] Q=ml_v 6.84 x 10^{15} = m * 2.4 x 10^6[1] m = 2.85 x 10^9 kg [1]allow ecf from (a)	 1 1 1
c	Volume = h*A = 3 * 880 x1000^2= 2.64 x 10^9 m^3 [1] m=p*V= 1030 x 2.64 x 10^9= 2.72 x 10^{12} kg [1]	1 1
d	Gravitational Potential store [1]	1
e	P=E/t = mgh/(35x365x24x60x60) = (2.72x10^{12}x10x400)/(35x365x24x60x60)[1] allow h= 397m = 9.86 x 10^6 W [1] allow ecf if exact same conversion done wrongly earlier.	1 1
10a	Same number of protons	1
b	One more proton, one fewer neutron[1] and one more electron[1]	2
ci	18 counts per minute	1
ii	74 -18=56 [1] 56/2 +18 = 46 count/min[1] 65 hours correct reading off graph[1]	3
iii	Radioactive decay is random	1
di	Curve downwards.	1

ii	Using Fleming left hard rule. The current (represented by middle finger) is to the right. the magnetic field (represented by index Finger) is out of the paper. The thumb with indicates the direction of the force is downwards.[2] Bonus mark: 1 mark for suggesting that current is to the right for a max of 2.	2
11a	As the swimmer pushes against the wall to the left, the wall exerts a force on the swimmer to the right. This two forces are equal in magnitude by newton's 3rd law, 3 points: direction, magnitude and bodies mention 2 out of 3 =>1 mark, 3 of 3 => 2 mark. hence if he pushes harder against the wall, he will experience a greater force to give a ***greater*** acceleration	2 1
b	The forces are in opposite direction and act on different bodies.	1 1
c	As his speed increases, water resistance on swimmer increases [1], until his forward force is equal to the water resistance[1], there will be no net force[1] and speed will become constant.	1 1 1
d	The gravitational force exerted by the swimmer on the earth. [1] It is equal in magnitude and opposite in direction.[1] "different" is not accepted.	1 1
12a	The weight of the hammer while larger, has to overcome a larger mass to give the hammer an acceleration. The mass of the hammer in the gravitation force and the mass due to inertia will cancel out, thereforce the acceleration of the hammer will be equal to its gravitational field strength. The same applied for the feather, therefore both bodies have acceleration equal to 1.6 m s^{-2}	1 1
bi	a=(v-u)/t 1.6=v/1.5[1] v=2.4 m/s [1]	 1 1
bii	 1 mark if gradient curves to zero and numbers are there.	2
iii	0.5* 2.4 * 1.5 = 1.8 m	1 1
c	Student is correct as when you lift the vehicle, you have to first overcome it's weight (before you can have acceleration).While if you push the vehicle, there is no weight to oppose you, (the acceleration would be higher for the same force applied) OR Lifting force must be greater than weight. When pushing there is no resistance to your pushing force, there it is easier.	1 1 [2]