



**CHIJ SECONDARY (TOA PAYOH)
PRELIMINARY EXAMINATION 2024
SECONDARY 4(EXPRESS)**

PHYSICS

6091/01

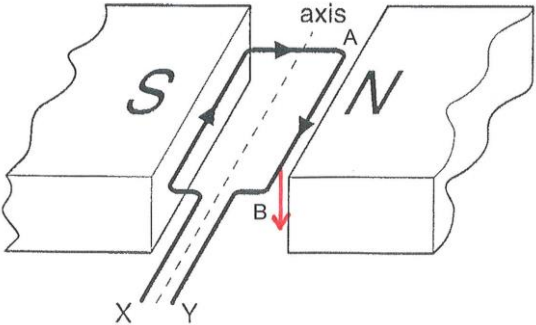
Paper 1

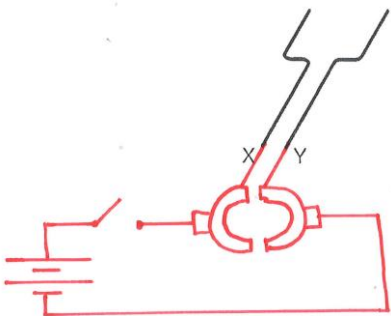
1	A	11	C	21	C	31	C
2	D	12	C	22	B	32	A
3	D	13	C	23	A	33	B
4	B	14	B	24	D	34	D
5	B	15	C	25	B	35	D
6	C	16	B	26	D	36	B
7	A	17	D	27	C	37	C
8	B	18	B	28	A	38	C
9	C	19	C	29	B	39	A
10	B	20	A	30	A	40	C

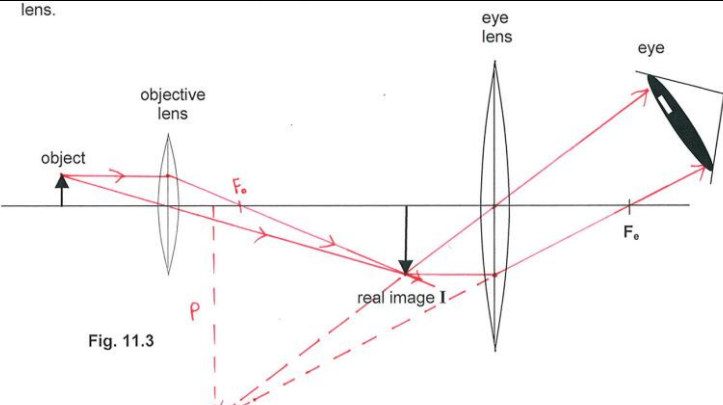
Paper 2

6091/02

Qn	Answers	Mark	
1(a)(i)	Total distance = $40 + 35 + 10 = 85$ m	1	
1(a)(ii)	Average speed = total distance / time Average speed = $85 / 60 = 1.42$ m/s	1 1	
1(b)(i)	Distance is a scalar quantity, velocity is a vector quantity. OR Distance has no direction, velocity has a specific direction.	1	
1(b)(ii)	5m	1	
1(b)(iii)	45 m	1	
1(c)	Velocity is the rate of change of displacement.	1	
1(d)	Velocity = total displacement / total time Average speed = total distance / total time As the time taken is the same (60s), magnitude of the total displacement is much smaller than the total distance. OR First drone travelled a greater distance within the same amount of time as compared with the second drone.	1	
2(a)	Stone is moving with <u>constant acceleration</u> (10 m/s^2).	1	
2(b)	Area under the graph AB represents the original height dropped. Area under the graph CD represents the rebound height. Area under the graph AB is smaller than the area under the graph CD.	1 1	
2(c)	1. $10 - 8 = 2$ m/s 2. $10 - (-8) = 18$ m/s	1 1	
3(a)(i)	The downward force is due to the <u>Earth's gravitational attraction</u> on the lamina.	1	
3(a)(ii)	$W = mg$ $W = 60/1000 \times 10 = 0.6$ N	1 1	
3(b)(i)	Moment = force x perpendicular distance of force from pivot Moment = $0.6 \times 8.0 = 4.8$ Ncm or 0.048 Nm	1 1	

3(b)(ii)	- When released, lamina will swing such that the centre of gravity becomes on the left side of the pivot. This creates anti-clockwise moment and lamina will swing back to its original side.	1	
	- Lamina will continue to swing left and right until it eventually comes to <u>a stop with its centre of gravity directly below the pivot.</u>	1	
4(a)	Chemical potential energy	1	
4(b)(i)	Thermal energy is transferred to the man via <u>radiation</u> .	1	
	Thermal energy is transferred in the form of <u>infrared waves</u> .	1	
4(b)(ii)	Shiny surface is a poor absorber of radiation.	1	
	This helps to reduce energy loss from the heater.	1	
4(b)(iii)	The black pullover acts as a good absorber of radiation.	1	
	OR The pockets of trapped air in the pullover act as a good thermal insulator.		
5(a)(i)	Any one: Infrared, Ultraviolet, visible light, X-rays, gamma rays	1	
5(a)(ii)	- All electromagnetic waves travel at the same speed in vacuum.	1	
	- Since $v = f\lambda$, waves with wavelength shorter than microwaves will have frequency higher than microwaves.	1	
5(b)(i)	Aerials are placed on top of high buildings or tower to avoid any obstruction caused by other buildings or structures.	1	
5(b)(ii)	- Microwaves loses some of its energy as they travel over large distances.	1	
	- Repeater or booster station are needed to increase the energy of the microwaves so that they do not lose the information that they carry.	1	
6(a)	5 : 1	1	
6(b)(i)	$A_2 = [20.0 - 12.0] / 8 = 1 \text{ A}$	1	
	$A_1 = 1 \text{ A} + [8.0 / 2] = 5 \text{ A}$	1	
6(b)(ii)	$R = V / I = 12.0 / 5 = 2.4 \Omega$	1	
6(c)	New effective resistance = 2.4Ω		
	$A_1 = V / R = 20.0 \text{ V} / 2.4 \Omega = 8.33 \text{ A}$	1	
6(d)	$I_1 = 8 - 2 = 6 \text{ A}$		
	Pd across X = $[2 \times 13] - [6 \times 3] = 8 \text{ V}$		
	$I_2 = 8 \text{ V} / 4 \Omega = 2 \text{ A}$	1	
	$I_3 = 6 - 2 = 4 \text{ A}$		
	Resistance of X = $V / I = 8 \text{ V} / 4 \text{ A} = 2 \Omega$	1	
7	- Damaged insulation, cut in insulation will expose the conducting wire and can cause short circuit or electric shock.	1	
	- Overheating of cables, the use of inappropriate wires (thinner wire to carry large current)	1	
	- Damp environment, through the usage of indoor sockets on damp grass.	1	
		1	
		1	
		1	
8(a)		1	

8(b)	- As current flows along from A to B, there is a circular magnetic field around the current carrying conductor. - This circular magnetic field interacts with the magnetic field of the permanent magnet. - A resultant force is produced due to this interaction.	1 1	
8(c)	 Diagram should includes the following: - thickness of carbon brushes should be about same as the gap between the split-ring commutators - positive terminal of battery connected to X - switch in series with battery All 3 correct – 2 m At least 1 correct – 1 m None correct – 0 m	1 1	
9(a)(i)	Force by electric car, $F = ma = (900+80) \times 2.0 = 1960 \text{ N}$. As force remain the same with increased load 1060 kg, $F = ma$ $1960 \text{ N} = (900+160) \times a$ $a = 1.85 \text{ m/s}^2$ Acceleration will not be halved. OR Mass increased from [900+80] kg to [900+160] kg. Mass increased from 980 kg to 1060 kg. As mass did not increase 2 times, acceleration will also not decrease by half.	1 1	
9(a)(ii)	When car reaches its maximum speed, this indicates that there is no resultant force. The opposing forces, frictional force & air resistance, are equal to the forward driving force of the engine.	1 1	
9(b)(i)	time = distance / speed = $49\,000 \text{ m} / 10.9 \text{ ms}^{-1} = 4500 \text{ s}$	1	
9(b)(ii)	Energy = Power x time = $4.24 \times 1000 \text{ W} \times 4495 \text{ s}$ = 19058800 J = 19.1 MJ	1	
9(b)(iii)	Energy in battery = Electric Power x time taken to charge 19058800 J = $95 \text{ A} \times 48 \text{ V} \times \text{time taken}$ Time taken = $4179 = 4180 \text{ s}$	1 1	
9(b)(iv)	No energy such as heat is lost during the process of charging.	1	
9(c)	Electric car cause less pollution as compared to the conventional cars that operate using petrol. [1]	1	
10(a)	Beta-particles cannot penetrate metal.	1	
10(b)(i)	Number of particles detected in a minute will not show any significant difference. This is because the distance moved is too small.	1 1	
10(b)(ii)	Number of particles detected in a minute will be significantly reduced. This is because moving the source more than a metre away, the beta-particles will not have the sufficient energy to travel and reach the detector.	1 1	

10(c)	${}_{90}^{234}\text{Th} \rightarrow {}_{91}^{234}\text{Pa} + {}_{-1}^0\beta$	1 1	
10(d)(i)	Nuclear fusion is a process in which two light atomic nuclei combine to form one heavier atomic nucleus and release a huge amount of energy. Nuclear fission is a process where the nucleus of an atom splits (usually into two parts) and release a huge amount of energy.	1 1	
10(d)(ii)	- High temperature - High pressure	1 1	
11(a)	Place empty kettle on an electronic balance. -Pour 500 g of water into kettle. -Switch on the kettle. - <u>Start stop-watch once the water starts to boil.</u> - <u>Stop the stop-watch</u> once the reading on the electronic balance decreases by 10 g. Record t in seconds. - Record time as t s. Energy supplied = energy absorbed <u>Power x time = 10 x lv</u> <u>Power = 22600 / t</u>	1 1 1 1	
11(b)(i)	Electrical energy in Joules = Power x time = 1800 x 5 x 60 = 540 kJ	1 1	
11(b)(ii)	Electrical energy in kWh = 1.8kW x 5/60 h = 0.15 kWh	1	
11(b)(iii)	0.15 kWh = 540 kJ 1 kWh = 1 x 540 000/0.15 = 3.6 MJ	1	
11(c)	The more energetic molecules will leave the surface of water leaving behind the less energetic molecules. Hence, the average kinetic energy of the remaining molecules decreases.	1 1	
12(a)	 Fig. 11.3 A microscope arrangement is shown in Fig. 11.3. The objective lens creates a real image I. - A pair of correct rays - F_o indicated correctly	1 1	
12(b)	- A pair of correct rays - Image P indicated correctly	1 1	
12(c)	Two other characteristics: - Virtual - Upright	1 1	
12(d)	1. At the point of incident, the normal, the incident ray and the refracted ray all lies on the same plane. 2. For 2 given media, the ratio $\sin i / \sin r$ is a constant, where i is the angle of incidence and r is the angle of refraction.	1 1	