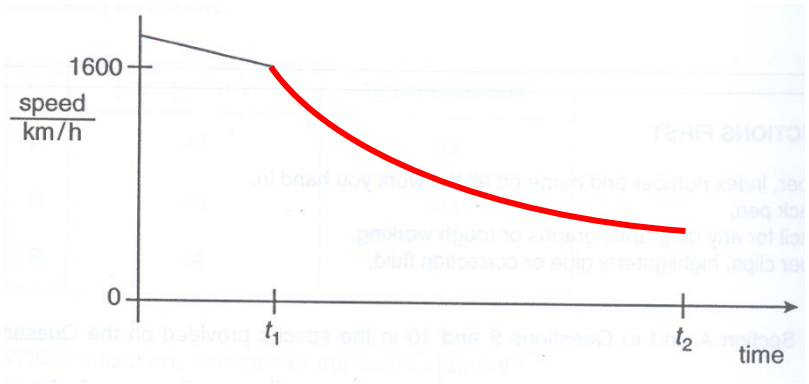
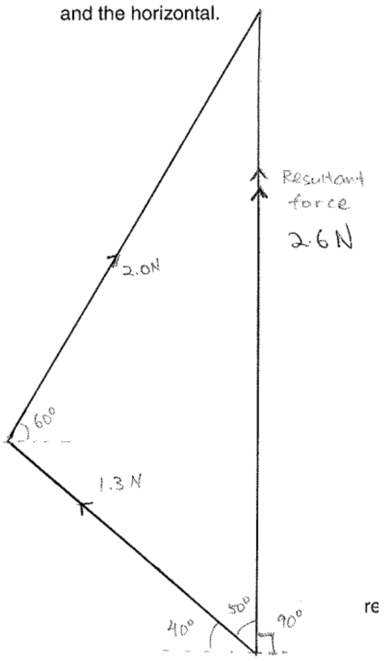
CHIJ SECONDARY (TOA PAYOH)
PRELIMINARY EXAMINATION 2025
SECONDARY 4(EXPRESS)

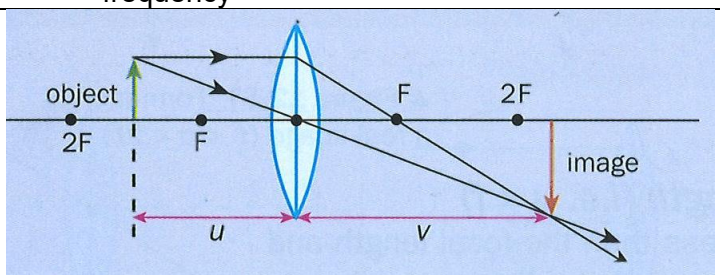
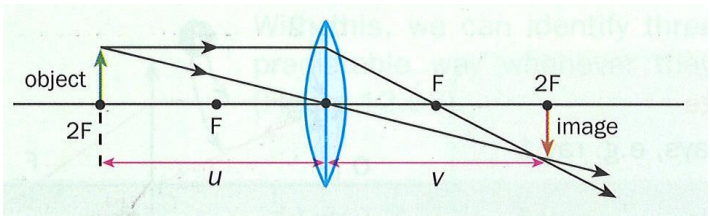
PHYSICS
6091/01
Paper 1

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

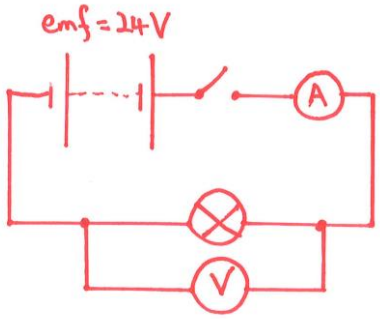
Paper 2
6091/02

Qn	Answers	Mark	
1(a)	 - Correct curve - Horizontal straight line towards t_2	 1 1	
1(b)	A gravitational field is a region where a mass experiences a force due to gravity (gravitational attraction).	1	
1(c)(i)	W = mg W = 65 x 3.0 = 195 N	1	
1(c)(ii)	Resultant force = 500 – 195 = 305 N	1	
1(c)(iii)	F = ma 305 = 65 x a a = 4.69 m/s^2	1 1	

2(a)	 - Appropriate scale - Tension A = 1.3 N - Tension B = 2.0 N - Correct addition of vectors	1 1 1 1	
3(a)	KE = ½ mv^2 KE = ½ x 2000 x 35^2 KE = 1.23 MJ	1 1	
3(b)	KE at X + GPE at X = KE at Y KE at X = 1.23 MJ – [2000x10x50] KE at X = 225 kJ ½ mv^2 = 225 000 J ½ x 2000 x v^2 = 225 000 v = 15 m/s	1 1 1	
3(c)	KE at Y = KE at Z + GPE at Z + work done against friction 1.23 MJ = [1/2 x 2000 x 4.0^2] + [2000x10x20] + [friction x 40] friction = 20.2 kN	1 1	
4(a)	Atmospheric pressure + pressure due to cylinder = pressure of gas Pressure due to cylinder = Pressure of gas – Atmospheric pressure = 2.0 x 10^5 – 1.0 x10^5 = 1.0 x 10^5 Pa Pressure = force / area 1.0 x 10^5 = weight / 4.0 x 10^{-4} Weight = 40 N W = mg m = 40 / 10 = 4 kg	1 1 1	
4(b)(i)	- Pressure of gas decreases. / AP decreases. - Volume of gas increases, piston will move upwards.	1 1	
5(a)	4200 J of energy is required for 1 kg of water to change its temperature by 1 ºC.	1	
5(b)	Let the time be t energy lost = energy gained power x time = $m_1c\theta + m_2l_v$ 2500 x t = [1.50 x 4200 x (100 – 27)] + [0.50 x 2260 000] t = 636 s or 10.6 minutes	 1 1 1	

5(c)(i)	- During evaporation, the faster moving particles at the surface have enough energy to break away from the other liquid particles to escape into the air. - The remaining particles left behind have a slightly lower average speed. As temperature decreases with the average kinetic energy of the particles, water is slightly cooler.	1 1	
5(c)(ii)	- Internal kinetic energy remains the same - Internal potential energy is increased	1 1	
6(a)	x-rays, ultraviolet, infrared, microwaves 1 marks for every 2 correct positions	 2	
6(b)	Any 2: - Remote control for electrical appliances - Data transfer between devices such as mobile phones and laptops - Camera auto-focusing function - Contactless Thermometers - Intruders alarm	2	
6(c)	Any 1: - All obey the wave equation, $v = f\lambda$ - All travel at 3×10^8 m/s in vacuum - All transfer energy - All undergo reflections and refractions - All are transverse	 1	
7(a)	speed OR wavelength	1	
7(b)	frequency	1	
7(c)	 - Object placed between F and 2F away from lens Correct pair of rays drawn	 1 1	
7(d)	 - Object placed exactly at 2F away from lens Correct pair of rays drawn	 1 1	
8(a)(i)	If carbon brushes touch both halves of the split-ring, the circuit will be short-circuited. There will be no current flowing into the coil.	 1	
8(c)(ii)	Motor will not start if the initial positions of both halves of the split-rings are not touching any of the carbon brushes. OR The coil is not connected to the circuit even if the switch is closed.	1	
8(b)(i)	downwards	1	
8(b)(ii)	- When current flows through the coil along AB and CD, a circular magnetic field forms around the current carrying conductor. - This circular magnetic field interacts with the magnetic field between the poles to produce a resultant force along AB and CD.	1 1	

8(c)(i)	Maximum moment = 2 x [force x perpendicular distance of force from pivot] Maximum moment = 2 x [5.0 x 0.070/2] = 0.35 Nm	1 1	
8(c)(ii)	When the coil is horizontal, the perpendicular distance of the force from the pivot is maximum.	1	
9(a)(i)	As wavelength increases, speed of the wave also increases.	1	
9(a)(ii)	In deeper water, speed of wave can increase up to 30.6 m/s but in shallower water, maximum speed of wave is only 9.9 m/s.	1	
9(b)(i)	speed = 30.6 m/s (from table) speed = distance/time 30.6 = 2000 000/time time = 18.2 hours	1 1	
9(b)(ii)	$v = f\lambda$ 30.6 = f x 600 f = 0.051 Hz	1 1	
9(b)(iii)	time taken = 4 + 18.2 = 22.2 hours speed = distance/time = 2000 000/[22.2x60x60] = 25.0 m/s From the table, wavelength is 400 m	1 1	
9(b)(iv)	1. As the first wave hits the ship, the ship will move up and down once returning back to its original position after the first wave leaves. 2. As frequency of the wave is increased, the ship will move up and down more over a same period of time.	1 1	
10(a)	Geiger-Muller counter OR GM counter	1	
10(b)	A β particle is a fast-moving electron ejected from a radioactive nucleus.	1	
10(c)	When a full carton of juice goes past the detector, the juice will absorb some of the β particles.	1	
10(d)	Source emitting alpha particles is not used because alpha particles cannot penetrate through the carton. No alpha particles will be detected at detector. OR Alpha particles are highly ionizing. They will cause mutation of cells in the juice. Source emitting gamma radiation is not used because gamma radiation can have ionizing effect on the juice, causing the juice to spoil. OR Gamma rays have high penetration power. Radiation received at the detector will be almost the same regardless of the juice level in carton.	1 1	
10(e)(i)	220 – 86 = 134 neutrons	1	
10(e)(ii)	$^{220}_{86}\text{Rn} \rightarrow {}^{216}_{84}\text{Po} + {}^{4}_{2}\alpha$	1 1	
10(f)(i)	The half-life of a radioactive nuclide is the time taken for half the nuclei of that nuclide in any sample to decay.	1	
10(f)(ii)	$7.68 \times 10^{12} \times ½ \times ½ \times ½ \times ½ \times ½ \times ½ \times ½ \times ½ = 3 \times 10^{10}$ Total = 8 half-life = 8 x 1.5 minutes = 12 minutes	1 1	
11(a)	- Circuit diagram showing power supply, lamp and ammeter in series - Voltmeter across lamp - Ensure voltage is 24 V in some way e.g. power supply 24 V - Power = voltmeter reading x ammeter reading	1 1 1 1	

			
11(b)(i)	Current at P = V / R = 240 / 380 = 0.632 A Current at Q = 0.632 + [240/190] = 1.89 A	1 1	
11(b)(ii)	Effective resistance of A and B = 1/ [1/190 + 1/380] = 127 Ω	1 1	
11(c)	- When one lamp blows, it will not affect the others - Same correct voltage 240 V is applied to all lamps when in parallel.	1 1	
12(a)	- Set metal sheet swinging freely **and** come to rest - Use of plumbline from hole - Trace plumbline onto sheet - Repeat from another hole and line intersection is centre of gravity	1 1 1 1	
12(b)	Distance measured = 2.5 cm (1 dp) Moment = force x perpendicular distance of force from pivot Moment = 0.10 N x 2.5 cm = 0.25 Ncm	1 1 1	
12(c)(i)	Due to the clockwise turning effect of its weight	1	
12(d)(ii)	Weight acting within its base area	1	
12(d)(iii)	Thicker more stable	1	
	END OF PAPER 2		