JSS 2024 Graduation Examination
Secondary 4E Pure Physics (6091)
MARKING SCHEME

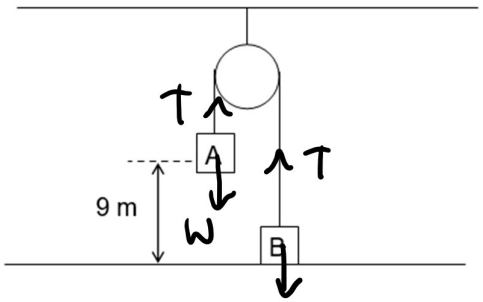
Paper 1

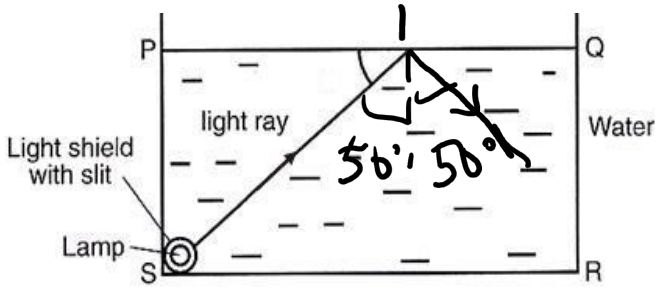
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
B	**D**	**D**	**D**	**A**	**B**	**C**	**B**	**B**	**C**	**A**	**C**	**A**	**B**	**A**	**C**	**D**	**B**	**C**	**C**

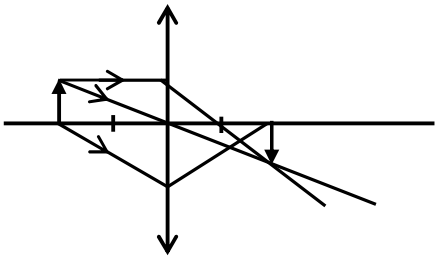
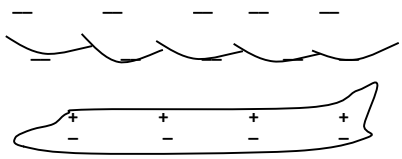
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
C	**D**	**C**	**B**	**B**	**B**	**A**	**A**	**D**	**A**	**C**	**B**	**D**	**A**	**C**	**B**	**A**	**D**	**D**	**A**

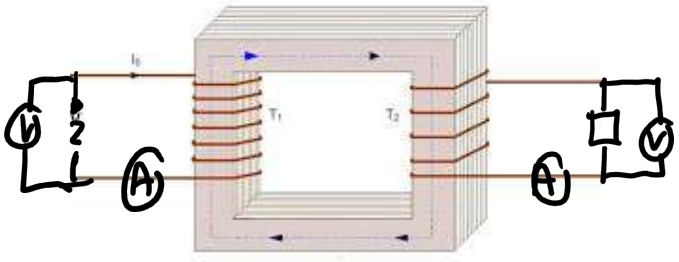
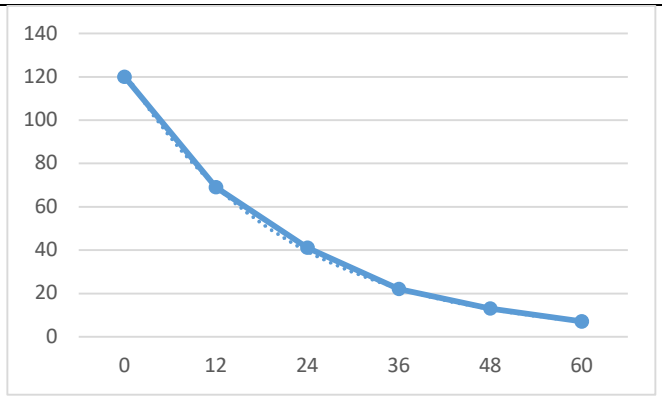
Paper 2

Section A

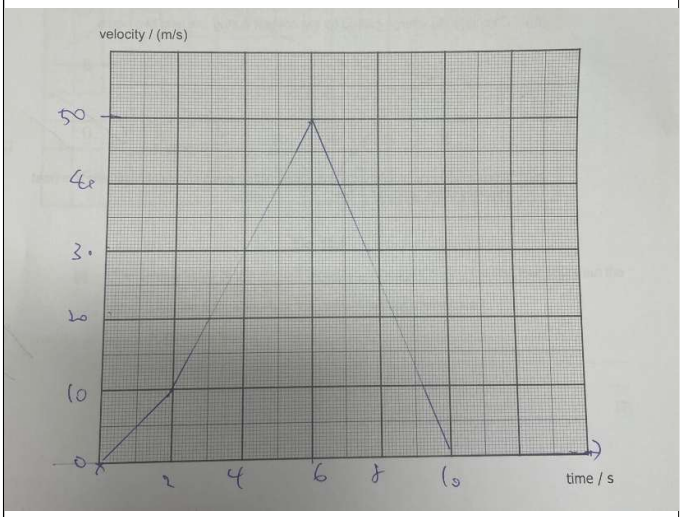
Question		Answer	Marks	Markers' Comments
1	**(a)**	random error	B1	
	(b)	Digital vernier calliper. Degree of accuracy is 0.01 mm	B1 B1	
	(c)	volume =mass ÷ density = 1380 ÷ 7.65 = 180 cm^3	 A1	
2	**(ai)**		B1 B1	Correct labeling/Direction of forces
	(aii)	30 – T = 3a T – 20 = 2a a = 2 m/s^2	M1 A1	
	(b)	Applying Principle of Energy Conservation, $m_a g h_a = ½ m_a v^2 + m_b g h_b$ h_b = 10.8 m	M1 A1	
3	**(a)**	moment of weight = weight × perpendicular distance of weight from pivot = 150 × 1.8 = 270 Nm	A1	
	(bi)	The Principle of Moments states that when a body is balanced, the total clockwise moment about a point equals the total anticlockwise moment about the same point.	B1	

Question		Answer	Marks	Markers' Comments
	(bii)	• By M = Fd → Higher perpendicular distance → increase ACW moment • By POM → for the same distance of the weight of the barrier → an additional force is needed to increase the CW moment to balance thr barrier.	B1 B1	
4	**(a)**	Choose two factors: density of water/ gravitational field strength/depth of water		Accept temperate and humidity of air
	(b)	$P = h\rho g + P_{atm}$ $3x10^5 = h(1030)(10) + 1x10^5$ h = 19.4 m	M1 A1	
	(ci)	Correct arrangement of LDR and light bulb (Parallel)	B1	0 mark if no labelling
	(cii)	Deeper → darker → brightness decreases → resistance of LDR increases → Voltage of LDR increase due to potential dividing Light bulb parallel to LDR → voltage increases → P increases → brighter	B1 B1	
5	**(a)**	from elastic potential store to kinetic store and gravitational potential store	B1	
	(b)	kinetic store and gravitational potential store to gravitational potential store and elastic potential store	B1	
6	**(a)**	Cooling Evaporated ethanol gain latent heat in the form of PE to change state → remove thermal energy from skin	B1 B1	
	(b)	Rate increases. Moving air remove evaporated ethanol particles so that other ethanol particles can leave the body easily	B1 B1	
7	**(a)**	ultraviolet rays, X-rays	B1	
	(b)	detection and treatment of cancer OR imaging/gamma photography OR telescopes OR sterilisation of food/medical equipment	B1	
	(c)	• radiations arrive) at same time. • because they have same speed in a vacuum	B1 B1	
8	**(a)**	sin c = 1 / refractive index c = 48.8°	A1	
	(b)		B1	Correct path of light / angles labelled correctly

Question		Answer	Marks	Markers' Comments
	(c)	i > c and light travels from optically denser to less dense medium → TIR occurs	B1	
9	**(a)**	• Correct ray A and B drawn with arrows • Image drawn correct at 2F 	B1 B1	
	(b)	Correct ray C drawn with arrows	B1	
10	**(a)**	two points labelled C and R at the centre of the one compression and rarefaction	B1	
	(b)	Measured wavelength = 5 cm = 0.05 m f = V/λ = 330/ 0.05 = 6600 Hz	M1 A1	
11	**(a)**		B1	
	(b)	• The negative charges on the cloud <u>repels</u> the negative electrons to the lower part of the aircraft due to <u>electrostatic force of repulsion</u>. • The upper part of the aircraft now has an induced positive charge while the lower part an induced negative charge.	B1 B1	
12	**(a)**	work done by the source in <u>driving a unit charge</u> around a complete circuit <u>is 12 J</u>	B1	
	(bi)	current in R = 4 A, V in R = 9 V R = V/I = 9/4 = 2.25 Ω	M1 A1	
	(bii)	resistance proportional to length (so twice length twice resistance) + resistance inversely proportional to area (so twice diameter decreases resistance by factor of 4) R = 2.25x2/4= 1.13 Ω	M1 A1	
13	**(a)**	• Current in the coil creates a magnetic field, this <u>magnetises the iron core</u> into an <u>electromagnet</u>. • The iron bar → <u>magnetic material</u> → <u>attracted</u> to the core → movable <u>pivot to move to the right</u> and pulls the steel bolt out of the door	B1 B1	

Question		Answer	Marks	Markers' Comments
	(b)	Current upwards Core left – North, Core Right –South, Bar left – North	B1	
14	**(a)**		B1 B1	Transformer/a. suppy/load Ammeter/voltmeter -1 mark if no labelling
	(b)	Setup 3. No of secondary turns are more than no of primary turns	B1 B1	
	(c)	Using $N_s/N_p = V_s/V_p$ V_{s1} = 2 V, V_s = 6 V, V_{s3} = 12 V	M1 A1	
	(di)	Setup 1 efficiency = 4.61/7.2 x 100 = 64%	B1 A1	
	(dii)	Internal resistance of the wire Since highest current → Power loss = I^2R (highest)	B1 B1	
15	**(a)**	α-emissions (helium nucleus, +2) β- emissions (electron, -1) • γ-emissions (EM radiation, 0)	B1 B1	
	(b)	• $^{226}_{86}Ra = ^{222}_{84}Rn + ^{4}_{2}He$	A2	Correct mass no, proton no
	(ci)		B1 B1	Plot Best fit line
	(cii)	half life = 15 hour (+/- 1 hour)	A1	
	(di)	• Gamma. Passes through paper and alumnium, absorbed by concrete	B1 B1	
	(dii)	Cause cancer/ stunt children growth	B1	

Section B

Question		Answer	Marks	Markers' Comments
16	(a)		B1 B1 B1	
	(bi)	the change of velocity per second is contant	B1	
	(bii)	Stage 2. Gradient = acceleration = steeper	B1 B1	
	(ci)	t = Q/ I = (3400/1000)(3600) / 10 = 1224 s	M1 A1	
	(cii)	W = VQ = 12 (3400/1000)(3600) = 146880 J	M1 A1	
17	(a)	• Air which is a bad conductor is trapped in woolly fibre → Prevent heat gain in the pipe through conduction • Aluminium is shiny, a bad absorber of infra-red radiation → Prevent heat gain in the pipe through radiation.	B1 B1	
	(bi)	• The coolant changes its state from solid to liquid. • Heat (PE) absorbed is used to break the intermolecular bonds	B1 B1	
	(bii)	Q = mlf = (0.3)(2x105) = 60000J	M1 A1	
	(biii)	Q = mcθ = (0.3)(4000)(9) = 10 800 J	M1 A1	
	biv)	Energy lost by food = energy gained by coolant 70800 / (20 – 4) 4425 J °C-1	M1 A1	

Subtract from the total score if incorrect [up to 4 marks]:

- s.f. [up to 2 marks]
- units [up to 2 marks]