Marking scheme for 2024 Physics Prelim

Paper 1

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

Paper 2

Section A

Qn	Mark Scheme	Marks	Sub-total
[-1] *per section* for any errors in sig. fig. or unit.			
1(a)	a = F/m OR 28000 / 25000 1.1 m/s^2	B1 A1	[2]
(b)	The forward force is equal to the air resistance / opposing forces acting in the opposite direction. Resultant force is zero, hence acceleration is zero.	B1 B1	[2]
2(a)	mass and weight of hammer is larger than feather weight equals resultant force which is the product of mass and acceleration (F_R = ma, W = ma) acceleration is equal since F_{hammer} / m_{hammer} = $F_{feather}$ / $m_{feather}$	B1 B1 A1	[3]
2(b)(i)	v = u + at OR 1.6 x 1.5 2.4 m/s	B1 B1	[2]
2(b)(i)	Straight line from origin with positive gradient with v = 2.4 m/s at t = 1.5s indicated	B1	[1]

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Qn	Mark Scheme	Marks	Sub-total
2(b)(iii)	½ x 1.5 x 2.4 OR distance travelled = area under the graph 1.8 m	C1 A1	[2]
3(a)	The principle of moments states that the sum of clockwise moments about a pivot is equal to the sum of anticlockwise moments **about the same pivot** When object is in equilibrium	B1 B1	[2]
3(b)	The body is in equilibrium, Taking moments about point P, Anti clockwise moment = Clockwise moment *F* X 150 = 70 X 15 *F* = 7.0 N	 B1 A1	[2]
3(c)	Weight of chair acting from centre of gravity passes through pivot No resultant moment produced OR line of action of weight acting slightly to the left of pivot, producing anticlockwise restoring moment	C1 A1	[2]
4(a)	Pressure is the force acting per unit area	A1	[1]
4(b)	$P_{gas} + P_{mercury} = P_{atm}$ $P_{mercury} = h\rho g$ OR $0.16 \times 1.4 \times 10^4 \times 10$ $1.0 \times 10^5 - (0.16 \times 1.4 \times 10^4 \times 10)$ = 77600 =78000 Pa	B1 B1 A1	[3]
4(c)(i)	8.0cm	A1	[1]
4(c)(ii)	Gas molecules move faster and gain kinetic energy as the gas is heated Gas molecules collide against the mercury surface more frequently with greater force, increasing pressure exerted on the right column of mercury Mercury column on right falls and mercury column on left rises until gas pressure is equal to atmospheric pressure, i.e. equilibrium	B1 C1 A1	[3]
5(a)	sin i / sin r = 1.5 OR sin 60 / sin r = 1.5 35º	M1 A1	[2]
5(b)	n = 1/sin c	M1	

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Qn	Mark Scheme	Marks	Sub-total
	critical angle = 41.8 = 42º	A1	[2]
5(c)	The angle of incidence of the light ray at KL is more than the critical angle and undergoes total internal reflection. The angle of incidence of the light at LM is less than the critical angle and undergoes refraction, bending away from the normal.	B1 B1	[2]
6(a)	Brownian motion is due to the random continuous motion of invisible air molecules moving a high speed colliding against the illuminated smoke particles	B1 B1	[2]
6(b)	Large particles have greater inertia More difficult to move the larger particles as the force exerted by invisible air molecules is not large enough	B1 B1	[2]
6(c)	The smoke particles rise in a zig zag motion as the surrounding air is heated and becomes less dense, and sinks in a zig zag motion when the surrounding air is cooler and denser.	B1	[1]
7(a)	I = V/R OR 6.0/15 0.40 A	B1 A1	[2]
7(b)	Current in B = 0.25A R = 6 / 0.25 24Ω	B1 A1	[2]
7(c)	As the lamps are non-ohmic, lamp Q has a smaller potential difference across it when connected in series, hence smaller resistance.	B1	[1]
8(a)	The fuse melts and breaks the circuit when current exceeds the fuse rating.	B1	[1]
8(b)(i)	I = P/V =1500/240 6.3A	 A1	[1]
8(c)(ii)	7.0A	A1	[1]
9(a)	Electrons are transferred from the cloth to the plastic due to charging by friction. Cloth loses electrons to become positively charged, plastic gains electrons to become negatively charged.	B1 B1	[1] [1]
9(b)	Metals have free electrons and can move within the metal easily OR good conductor of electricity	B1	[1]
9(c)	$E = Pt = 100 \times 5.0 \times 10^6 = 5.0\ 5.0 \times 10^8$ J e.m.f. = $E/Q = (5.0 \times 10^8 / 4.0) = 1.3 \times 10^8$ V	B1 B1	[1] [1]

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Qn	Mark Scheme	Marks	Sub-total
10(a)(i)	Ammeter connected in series Voltmeter connected in parallel	B1 B1	[2]
10(a)(ii)	E = IVt OR 6.0 x 2.0 x 5.0 60J	B1 A1	[2]
	E = mgh = 0.10 x 10 x 0.80 0.8 J	B1 A1	[2]
10(b)(i)	Change in magnetic flux linking the coil Induced emf / voltage according to Faraday's Law	B1 B1	[2]
10(b)(ii)	The induced current flows in a direction to produce an opposing magnetic field and a force in the opposite direction of motion thereby creating an opposing moment and causing the coil to turn slower as the mass falls.	B1 B1	[2]
11(a)	● Lamp A ● For same length, tungsten wire has a higher resistance per unit length of 1.8×10^{-2} Ω/m compared to that of Copper (2.8×10^{-3} Ω/m) ● A is coiled and is longer and has smaller cross-sectional area of 3.1×10^{-6} m^2 , hence largest resistance	C1 B1 B1	[3]
11(b)	Principle of conservation of energy states that energy cannot be created or destroyed but only transferred from one store to another. All the energy from the internal (thermal) store of the filament is transferred by propagation of waves in the form of light AND by heating to the internal (thermal) store of the surrounding air molecules.	B1 B1 B1	[3]
11(c)(i)	E = P t = 50 W x 0.18 s = 9.0 J	 M1 A1	[2]
11(c)(ii)	Energy supplied to filament = energy gain by filament (Copper) $9.0 = m\ c_r \Delta\theta$ $9.0 = m\ (378)\ (1085 - 30)$ $m = 2.3 \times 10^{-5}$ kg	 M1 A1	[2]

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Section B

Qn	Mark Scheme	Marks	Sub-total
[-1] *per section* for any errors in sig. fig. or unit.			
12(a)(i)	Current flows through the solenoid and it becomes magnetized. Solenoid attracts the iron armature by magnetic induction. Contacts touch, forming a closed circuit for current to flow through motor.	B1 B1 B1	[3]
(a)(ii)	Iron can be magnetized and demagnetised easily, making it suitable for an electromagnet. Steel is difficult to magnetize and demagnetize. (iron can be magnetized and demagnetized more easily than steel)	B1 B1	[2]
(b)	N-pole marked on right side	A1	[1]
(c)(i)	The alternating current in the primary coil produces a changing magnetic field The changing magnetic field causes a change in the number of magnetic field lines going through the secondary coil to change with time continuously and an induced emf in the secondary coil. The induced current lights up the bulb.	B1 B1	[2]
(c)(ii)	Ns / Np = Vs / Vp = Ip / Is 4/12 = 3/9 = 0.25 / Is 0.75A	M1 A1	[2]

13(a)(i)	Sound waves with a frequency of higher than audible range (more than 20 kHz)	B1	[1]
13(a)(ii)	Some of the sound waves are reflected at the boundary. (some pass through or are absorbed)	B1	[1]
13(a)(iii)	t = 0.03/1000 s s = 2d/t OR 1500 = 2d / (0.03 /1000) d = 0.023 m	B1 B1 A1	[3]

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13(a)(iv)	Sound is transmitted from the emitter as a longitudinal wave in which the surrounding air molecules and the human tissuevibrate in a series of compressions and rarefactions	B1 B1	[2]
13(b)(i)	Transverse wave / travel at 3.0 x 10^8 m/s in a vacuum / more penetrating / ionising	B1	[1]
13(b)(ii)	**v = f** λ OR $3.0 \times 10^8 = f \times 2.0 \times 10^{-9}$ f = 1.5 x 10^{17}Hz	B1 A1	[2]

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