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PHYSICS **0625/42**

Paper 4 Theory (Extended) **May/June 2024**

MARK SCHEME

Maximum Mark: 80

Published

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 [Turn over

Question	Answer	Marks
1(a)	0.077 kg **OR** 77 g	**A2**
	$g = W / m$ **OR** $(m =) W /$ g **OR** 0.75 / 9.8	C1
1(b)	2 vectors at right angles **OR** use of Pythagoras' theorem e.g. $a^2 + b^2 = c^2$ **OR** (force =) $\sqrt{(1.2^2 + 0.75^2)}$	**B1**
	1.4 (N)	**B1**
	58(°)	**A2**
	resultant force including correct direction of arrow **OR** use of trigonometry to find angle e.g. $\tan\theta = 1.2 / 0.75$	C1
1(c)	any **two** from: • velocity • speed • direction • acceleration / deceleration • moment	**B2**

Question	Answer	Marks
2(a)	change in velocity per unit time **OR** rate of change of velocity **OR** (a =) $\Delta v / \Delta t$	**B1**
2(b)(i)	12 s	**A2**
	(Δt =) Δv / a **OR** 13 / 1.1	C1
2(b)(ii)	570 000 N	**A2**
	$F = ma$ **OR** (F =) ma **OR** (F =) 520 000 × 1.1	C1
2(b)(iii)	(additional force is needed to overcome) friction **OR** air resistance **OR** drag	**B1**

Question	Answer	Marks
3(a)	gravitational (potential) energy (store before / as the ball falls)	**B1**
	kinetic energy (store) increases (as the ball falls) **OR** energy transferred to kinetic energy (store as the ball falls)	**B1**
	(energy transferred from) kinetic energy (store) to internal / thermal energy (store)	**B1**
3(b)	5.9 m / s	**A3**
	(Δ)E_p = (Δ)E_k **OR** E_p lost = E_k gained **OR** gravitational potential energy lost = kinetic energy gained **OR** $mg(\Delta)h = ½mv^2$	C1
	$v^2 = 2g(\Delta)h$ **OR** v^2 = 2 × 9.8 × 1.8 **OR** v^2 = 35(.28)	C1

Question	Answer	Marks
4(a)	(evaporation:) (only) at the surface **OR** boiling: happens throughout the liquid	**B1**
	(evaporation:) takes place at any temperature **OR** boiling: takes place at a specific temperature / boiling point	**B1**
4(b)(i)	113 (K)	**B1**
4(b)(ii)	conduction	**B1**
	convection	**B1**
4(c)	particles collide with the walls / container	**B1**
	(particles) exert a force on the walls **OR** collision with walls produces a change in momentum (of particles)	**B1**
	pressure is force per unit area **OR** $p = F / A$ **OR** pressure is rate of change of momentum per unit area	**B1**

Question	Answer	Marks
5(a)	ray travels along the normal **OR** angle of incidence = 0(°)	**B1**
5(b)(i)	$n = 1 / \sin c$ **OR** (n =) $1 / \sin c$ **OR** (n =) $1 / \sin 42$ (°)	**M1**
	1.5	**A1**
5(b)(ii)	ray reflected at BC **AND** no refracted ray	**M1**
	ray hits AC with angle of incidence = 0 °	**A1**
	correct refraction of candidate's ray into air at AC	**B1**

Question	Answer	Marks
5(c)	any **two** from: • high rates (of data transmission) / fast (data transmission) • carry large amounts (of data / information) • secure • little signal / data loss • glass is transparent to (some) infrared	**B2**

Question	Answer	Marks
6(a)(i)	C marked and labelled at a peak of the sine wave	**B1**
	R marked and labelled at a trough of the sine wave	**B1**
6(a)(ii)	graph / it does not show (variation with) displacement	**B1**
6(a)(iii)	(amplitude) increases **AND** (frequency) decreases	**B1**
6(b)	0.12 m	**A3**
	$v = f\lambda$ **OR** ($\lambda =$) v / f **OR** (λ) = 1500 / 13 000	C1
	1500 / 13 000 **OR** 1.2×10^{N}	C1
6(c)	330 m / s $\leqslant$ speed $\leqslant$ 350 m / s	**B1**

Question	Answer	Marks
7(a)	(end of) one piece of steel brought close to (the end of) another piece owtte	**B1**
	look to see if there is repulsion/attraction **AND** test between different ends/poles owtte	**B1**
	any **two** from: • repeat a valid test between the other pieces • only magnets repel each other **OR** the pieces that repel are magnets • attractions at both ends indicates one of them is unmagnetised **OR** the piece that only attracts is unmagnetised **OR** the piece that does not repel (at both ends) is unmagnetised	**B2**
7(b)(i)	0.19 A	**A3**
	$I_p V_p = I_s V_s$ **OR** (I_p =) $I_s V_s / V_p$ **OR** (I_p =) 45 / 240 **OR** $I_p V_p$ = 45 **OR** power in primary = power in secondary	C1
	(I_p=) 45 / 240	C1
7(b)(ii)	labelled diagram showing: • (soft) iron core • copper (coils) • primary and secondary (coils) labelled **AND** fewer coils on secondary than on primary	**B3**

Question	Answer	Marks
8(a)(i)	correct voltmeter symbol connected across LDR	**B1**
8(a)(ii)1	(resistance) increases	**B1**
8(a)(ii)2	(p.d.) increases because resistance of parallel combination of LDR and LED increases	**B1**
	greater proportion of (total) p.d. across LDR / LED / parallel combination of LDR and LED	**B1**

Question	Answer	Marks
8(b)	960 Ω	**A3**
	current in each bulb = 0.25 **OR** $R = V / I$ **OR** (R =) V / I	C1
	resistance = 240 / 0.25 **OR** 1 / 480 = 1 / R + 1 / R	C1

Question	Answer	Marks
9(a)(i)	any **two** from: • reduce exposure time **AND** low(er) amount of radiation absorbed • increase distance between source and hospital staff **AND** lower amount of radiation reaches staff • use of shielding (e.g. walls, lead etc.) **AND** radiation absorbed by shielding / cannot penetrate through shielding • use isotopes with short half-life **AND** lower amount of radiation emitted from patient / radiation (above background) emitted for a shorter period of time • use of film badge / dosimeter **AND** manage individuals exposure owtte • restrict pregnant staff / patient in hospital **AND** radiation may harm foetus owtte	**B2**
9(a)(ii)	high ionisation (within body)	**B1**
	radiation would not reach detector (outside body)	**B1**
9(b)	$^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + {}^{0}_{-1}\beta$	
	$^{24}_{11}$Na on LHS	**B1**
	$^{0}_{-1}\beta$ on RHS	**B1**
	$^{24}_{12}$Mg on RHS	**B1**

Question	Answer	Marks
10(a)	any **two** from: • minor planets **OR** dwarf planets • comets • asteroids	**B2**
10(b)	elliptical	**B1**
10(c)	kinetic energy (store) decreases **AND** potential energy (store) increases (as object moves from A to B)	**B1**
	energy is conserved	**B1**
10(d)	2.6×10^3 s	**A2**
	$v = s / t$ **OR** ($t =$) s / v **OR** $7.8 \times 10^{11} / 3.0 \times 10^8$	C1
11(a)	Milky Way	**B1**
11(b)	Big Bang (Theory)	**B1**
11(c)(i)	shortly after the Universe was formed	**B1**
11(c)(ii)	Universe has expanded	**B1**
	(radiation) has been redshifted (to the microwave region of the electromagnetic spectrum)	**B1**