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Mark Scheme Standardisation Version
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GCE

GCE Physics (6736/01)

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General Marking Guidance

These instructions should be the first page of all mark schemes

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

6736 Unit Test PHY5

Question Number	Answer	Mark
1 (a)	to detect flaws in metal objects / railway lines (1) to investigate the flow of blood in veins / arteries (1) A or B scans / cleaning / range finding (1)	**Max 2**
(b)	estimate of speed of sound in air 300 m s^{-1} - 400 m s^{-1} (1) transform $c = f\lambda$ into $\lambda = c/f$ (1) substitution of their *c* <u>and</u> 20 × 10^3 Hz (1) explanation as to why λ is a maximum (1)	**3**
(c) (i)	wave speed is independent of λ <u>or</u> f / waves refract by same amount on entering a new medium (1)	
(ii)	sound / wave energy is dissipated / transferred (1) (*not* amplitude down)	
(iii)	waves carried by / passed on by particles (1) whose motion is parallel to wave propagation / travel / motion (1)	**4**
(d) (i)	magnetic field line straight through centre (1) symmetrical curved	**Max 2**
(ii)	*either* a_0 = $f)^2x_0$ *or* υ_0 fx_0 <u>and</u> a_0 $f\upsilon_0$ (1) = 2.5 × 10^6 m s^{-2} (c.a.o. for both) (1)	**2**
(iii)	a series of nodes N and /or antinodes A (1) does not transmit energy / between Ns which all points move in phase (1) (alternative to above: accept how a stationary wave is formed for 1 for mark)	**2**
(iv)	because each end is an antinode (1) link between 30mm / length of nod (1)	**2**
(e) (i)	*either* attempt at 2 halvings measured starting at different values of *x* (1) (e.g. 0 - 2.5 m, 1.0 m - 3.5 m) good values (1) *or* attempt at 2 values of ratio $I_1 \div I_2$ at fixed intervals of *x* (1) (e.g. 1000 ÷ 760, 760 ÷ 570, 570 ÷ 430) good values (1) *or* use of $I = I_o e^{-kx}$ (1)	

	to give to values of k (1) in each case measured / calculated values equal (1)	3
(ii)	LHS: $W\ m^{-2}$ (1) any one of $W \equiv J\ s^{-1}$ $J \equiv N\ m$ $N \equiv kg\ m\ s^{-2}$ (1) RHS: $m^2\ s^{-2}$ (1) ($\rightarrow$ k has units $kg\ m^{-2}\ s^{-1}$ no mark) k depends on c / the speed of the wave / speed of molecules (1)	**Max 4**
(f)	ripple tank / light / sound / (not microwaves) (no mark) wave source, e.g vibrating dipper / lamp *or* laser / loud-speaker / diffracting slit (1) how wavelength is changed (1) how the diffraction effect is detected (1) experimental set-up with source slit / gap etc (1) (could all be done on a labelled diagram - ignore diagrams simply showing effect) alternative: 2- slit/ diffraction grating max (1)	3
(g)	qowc (1) (do not award for a list of formulae) measure and compare with from star / galaxy (*not* planet) (1) / to find speed (1) measure distance d (1) use $v = Hd$ to find H (no mark) $t=d/v$ or $1/H$ is (approx) age of the Universe (1)	5
	Total	32

Question Number	Answer	Mark
2 (a) (i)	electron charge negative / current anticlockwise / current against electron flow (1) reference to Fleming / LHR (1)	**2**
(ii)	$mv^2/r = Bev$ (1) (leads to $r = mv/Be$ no mark) $v = \quad r/T$ (1) $v = r\omega$ (1) $\rightarrow T = \quad m/Be$ (1)	**5**
(iii)	substitute into $½mv^2 = eV$ with a correct mass (1) $\rightarrow v = 7.5 \times 10^6 \text{ m s}^{-1}$ (1)	**2**
(iv)	lines for ground states and $\geq$ two excited states labelled (1) up / down arrows between any two excited states / ground and excited state (1) emerging photon from down arrows / squiggles labelled (1)	**3**
(b) (i)	magnet / electromagnet / S - N (1) magnetic field lines (1) (high frequency) a.c. / p.d. / current / power (accept ~) (1) *E* - field between Dees / in gap where protons are given energy / accelerated	**Max 3**
(ii)	*either* use of 1 MeV ≡ 1.6×10^{-13} J (1) $E = c^2 \; m$ / $E = mc^2$ (1) correctly $\rightarrow \; m$ *or* $m = 1.67 / 1.7 \times 10^{-29}$ kg (1) or use of 1 u ≡ 930 MeV (1) → 9.4 MeV ≡ u/100 (1) but m_p = 1u (1) gain of energy mass is 1% of m_p / 1.66×10^{-27} kg / $m_p/100$ / not significant (1)	**4**
	Total	**17**

Question Number	Answer	Mark
3 (a) (i)	380 km h^{-1} = 105 / 106 m s^{-1} (1) use of $v^2 = 2as$ (no mark) → a = 3.3 / 3.28 m s^{-2} (1)	
(ii)	use of $ma = F$ with m = 85 kg (1) → F = 255 N [3 m s^{-2}] and between 278 / 281 N (1)	
(iii)	on landing mass is much less / there is much less fuel (1) so a ↑ as m ↓ / air resistance drag helps a (1)	**6**
(b) (i)	three arrows: W / weight / arrow down / <u>and</u> P / thrust forward and L /lift up or upthrust = 210 kN (1) ignore numbers on W and L)	
(ii)	qowc (1) air is thrown backwards (beware pushes *against* anything) (1) so air throws Concorde forwards / ref Newton's third law (1)	**5**
(c)	either use of pV/T = constant / $pV = nRT$ / $\rho \propto p/T$ (1) using temperatures in Kelvin (i.e 223 K and 298 K) (1) use of $\rho \propto 1/v$ *or* $\rho = m/V$ so density take-off : density cursing = 9.4 / 9.5 (1) *or* use of $\rho = 1/\ 3\ \rho<c^2>$ (1) $<c^2>$ / average k.e of (air) molecules proportional to T (1) with temperatures in Kelvin i.e 223 K and 298 K (1) so destiny take-off: density cruising = 9.4 / 9.5 (1) assuming air is an ideal gas / has same molecular content (1)	**5**
	Total	**16**

Question Number	Answer	Mark
4(a) (i)	*solution for full marks*: use of area under graph (1) attempt to count squares / use a triangle/ trapezium rule (1) $\rightarrow$ 6 - 7 × 10^{-5} C (no mark) $Q = CV \rightarrow C = Q/V$ (1) C = their value of charge ÷ 3.0 V (1) = 20 - error) *other solutions max 2*: any approach that makes use of RC (1) e.g $\tau = RC$ or $t_{1/2} = RC\ln 2$ or $I = I_0\, e^{-t/RC}$ with the correct answer 20 - 25 μF (1)	Max 4
(ii)	p.d. across / charge on C is (initially) zero / C is not (initially) charged (1) so $I = V/R$ = 3.0 V ÷ 100 = 0.03 A / 30 mA (no mark)	2
(iii)	V_R/V 3.0 1.2 0.4 - 0.5 0.1- 0.2 (2) (i.e. -1 each error)	2
(iv)	vertical axis 0 - 3.0 V plus a raising line / curve (1) convex curve starts at 0 ends below 3.0 V (1) intermediate points V_C/V 1.8 e.c.f from the table (1) If the table in (iii) is inverted : e.c.f. each stage of (iv) i.e rising curve, starts at 3.0, intermediate point V_c/ V : 1.2	3
(b) (i)	connect alarm across C / in parallel with C (1)	
(ii)	between 20 s and 100 s (1) any attempt to use the product RC suitable values of RC to match above time provided C	4
	Total	**15**
	Total for paper	**80**