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Mark Scheme

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GCE

GCE Physics (6PH04/01)

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These instructions should be the first page of all mark schemes

General Marking Guidance

- 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.

Question Number	Answer	Mark
1	B	**1**
2	A	**1**
3	D	**1**
4	C	**1**
5	C	**1**
6(i)	B	**1**
6(ii)	C	**1**
7(i)	C	**1**
7(ii)	A	**1**
7(iii)	D	**1**

Question Number	Answer	Mark
8	QWC i and iii – Spelling of technical terms must be correct and the answer must be organised in a logical sequence Observations: Most alpha went straight through **(1)** Some deflected **(1)** (Very) few came straight back/large angle **(1)** Conclusions: Atom mainly (empty) space **(1)** Nucleus contains most of the mass **(1)** (Nucleus) very small/tiny **(1)** (Nucleus) charged /positive **(1)**	**QWC** **5 max**
	Total for question	**5**

Question Number	Answer	Mark
9	Current in coil generates magnetic field **(1)** Current drops/decreases **(1)** Change of flux [accept flux cut] **(1)** Rapid/quick/short time **(1)**	

	Large emf / 200 V <u>induced</u>**(1)** Field / flux linkage large due to many turns **(1)**	**4 max.**
	Total for question	**4**

Question Number	Answer	Mark
10(a)	Use of $E = V/d$ **(1)** Answer = 1.5×10^{5} V m^{-1} or N C^{-1} **(1)** Eg $E = 1.5 / 10 \times 10^{-6}$	**2**
10(b)	Opposite forces (act on either end of molecule) **(1)** Molecule rotates / aligns with field **(1)** - at top / + at bottom **(1)**	**3**
	Total for question	**5**

Question Number	Answer	Mark
11(a)	Straight lines (at least 4) touching proton **(1)** Equi spread (by eye) **(1)** Arrow on at least one pointing away from proton **(1)**	**3**
11(b)	Use of $F = k\,QQ/r^{2}$ [requires 2 subs to qualify as use] **(1)** Know $Q_p = 1.6 \times 10^{-19}$ (C) eg $QQ=(1.6 \times 10^{-19})^{2}$ **(1)** Answer = 7.9×10^{-8} N **(1)** Eg F = $8.99 \times 10^{9} (1.6 \times 10^{-19})^{2} / (5.4 \times 10^{-11})^{2}$	**3**
	Total for question	**6**

Question Number	Answer	Mark
12(a)	Use of $F=mv/t$ or $F = ma$ **(1)** Answer = 2.0×10^{5} N **(1)** Eg F = 12000 x 57 / 3.5	**2**
12(b)	Arrow down labelled mg / W **(1)** Arrow up labelled eg R /reaction / force from seat **(1)** Equal length vertical arrows from a clear single point **/** centre of mass and “bottom” **(1)**	**3**
12(c)	$4mg - mg$ OR $3mg$ **(1)** $(m)v^{2}/r$ seen **(1)** Answer = 110 (m) **(1)**	**3**

	Eg $3mg = mv^2 / r$ $r = (57)^2 / 3g$	
12(d)	Use of KE / PE conservation **(1)** Answer = 23 (m s^{-1}) **(1)** Eg ½ $m(57)^2$ = ½ $mv^2 + mg139$ v^2 = ½ $(57)^2 - 9.81 \times 139$	**2**
12(e)	Using (m)g only **(1)** Answer r = 54 m [allow ecf] **(1)** **Eg** $mg = mv^2 / r$ $r = (23)^2 / 9.81$	**2**
	Total for question	**12**

Question Number	Answer	Mark
13(a)	Charges **(1)** Movement of electrons from one plate to the other OR one plate becomes + the other – OR until pd across C equals V_{supply} **(1)**	**2**
13(b)(i)	Use of $Q = It$ (both 0.74 and 0.1/0.2) **(1)** Recognition of milli and Δt =0.1 **(1)** Eg $Q = 0.74 \times 10^{-3} \times 0.1 = 74 \times 10^{-6}$ C	**2**
13(b) (ii)	Use of $V = Q/C$ **(1)** Explains unit conversion **(1)** Eg $V = 278 \times 10^{-6} / 100 \times 10^{-6} = 2.78$ [accept μ/μ]	**2**
13(c)(i)	Recall of RC **(1)** Answer = 0.3 (s) **(1)** Eg $T = 3000 \times 0.0001$ **plus either** 1/e or 37% of initial **(1)** =0.23 - 0.27 (s) **(1)** **or** sub in formula $I = Io e^{-t/RC}$ **(1)** = 0.23 - 0.27 (s) **(1)** **or** Initial Tangent drawn **(1)**	

	Time constant = 0.2-0.3 (s) **(1)**	**4**
13(c)(ii)	Plot Ln *I* / Log *I* **(1)** Against *t* **(1)** (dependent on first mark) or Gradients of graph (1) Against I (1) (dependent on first mark) should be straight line **(1)** (dependent on previous 2)	**3**
	Total for question	**13**

Question Number	Answer	Mark
14(a)	$u\bar{d}$ identified **(1)**	**1**
14(b)	Conversion of G **(1)** Conversion of either eV or divided by c^2 **(1)** 2.5×10^{-28} (kg) **(1)** eg $m = 0.14 \times 10^9 \times 1.6 \times 10^{-19} / 9 \times 10^{16}$	**3**
14(c)	QWC i and iii – Spelling of technical terms must be correct and the answer must be organised in a logical sequence Electric fields: Electric field provides force on the charge/proton **(1)** gives energy to /work done / $E = qV$/ accelerate protons **(1)** Magnetic fields: Force on moving charge/proton **(1)** Produces circular path/centripetal force **(1)** labelled diagram showing Dees with E field indicated across gap OR B field through Dees (1) E field is reversed/alternates (1)	**QWC** **4** **1 max**
14(d)	QWC i and iii – Spelling of technical terms must be correct and the answer must be organised in a logical sequence	**QWC**

	momentum **(1)** Zero / negligible momentum before **(1)** To conserve momentum **(**fragments go in all directions) **(1)**	**3**
	Total for question	**12**

Question Number	Answer	Mark
15(a)(i)	measured thickness of lead 4-5 mm **(1)** measured radius 32 - 38 mm **(1)** Value between 38 – 57 mm **(1)** Eg actual radius = 35 mm x 6 mm/4.5 mm	**3**
15(a)(ii)	Use of $p = Bqr$ [any two values sub] **(1)** Answer range 9.1 x 10^{-21} - 1.4 x 10^{-20} N s or kg m s^{-1} [allow ecf]**(1)**	**2**
15(b)	Track gets more curved above lead / r smaller above lead **(1)** Must be slowing down / less momentum / loses energy **(1)** Up [dependent on either answer above] **(1)**	**3**
15(c)	Into page **(1)** [ecf out of page if down in b]	**1**
15(d)(i)	Division by 9.11 x 10^{-31} kg **(1)** Answer range 1.0 – 1.6 x 10^{10} m s^{-1} **(1)**	**2**
15(d)(ii)	greater than speed of light **(1)** (impossible) so mass must have increased **(1)**	**2**
	Total for question	**13**