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Exam Preparation and Free Resources

Name of the Student:_____

Max. Marks : 23 Marks   **Time : 23 Minutes**

Mark Schemes

Q1.

Question Number	Answer		Mark
(i)	Outward spiral from centre in either direction, minimum of two complete loops	(1)	1
(ii)	Direction consistent with diagram: Clockwise path, field out of page Anticlockwise path, field into page	(1)	1
(iii)	Electric field/p.d. between dees causes (resultant) force/acceleration	(1)	
	Proton makes half a revolution in half a cycle of the a.c. **Or** facing dee (always) negative when proton reaches gap. **Or** whenever the proton gets to a gap, the p.d. has reversed	(1)	
	k.e./speed (only)increases each time the proton crosses the gap **Or** work done by the field in the gap increases the k.e.	(1)	3
(iv)	$Bev=mv^2/r$ **Or** $r = p/Be$ $v = 2\pi r/T$ $T=1/f$ (seeing $f = v/(2\pi r)$ scores MP2 & 3) **Or** $Bev = mr\omega^2$ $v = r\omega$ $\omega = 2\pi f$ (seeing $v/r = 2\pi f$ scores MP2 & 3)	(1) (1) (1) (1) (1) (1)	3
(v)	Use of $B= 2\pi fm/e$ with mass of proton $f =1.8 \times 10^4$ Hz Example of calculation $f= eB/ 2\pi m$ $f= (1.6 \times 10^{-19}$ C $\times 1.2 \times 10^{-3}$ T)/ $(2\pi \times 1.67 \times 10^{-27}$kg) $f =1.8 \times 10^4$ Hz	(1) (1)	2

Q2.

Question Number	Acceptable answers		Additional guidance	Mark
(i)	• Charge: $-1 = -1 + 0$	(1)		
	• Baryon number: needs to be stated as 0	(1)		
	• Lepton number: $0 = +1 + (-1)$	(1)		(3)
(ii)	• Mass difference $= 34$ (MeV/c^2)	(1)	alt to $E = \Delta mc^2$ to show unit $\frac{MeV}{c^2} \times c^2$	(2)
	• $E = \Delta mc^2$ so $E = 34$ MeV	(1)		
(iii)	• Mass - energy	(1)		
	• Momentum	(1)		(2)

Question Number	Acceptable answers	Additional guidance				Mark

Question Number	Acceptable answers	Additional guidance	Mark
*(iv)	This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning. Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning. The following table shows how the marks should be awarded for indicative content.	<table><tr><th>IC points</th><th>IC mark</th><th>Max linkage mark</th><th>Max final mark</th></tr><tr><td>6</td><td>4</td><td>2</td><td>6</td></tr><tr><td>5</td><td>3</td><td>2</td><td>5</td></tr><tr><td>4</td><td>3</td><td>1</td><td>4</td></tr><tr><td>3</td><td>2</td><td>1</td><td>3</td></tr><tr><td>2</td><td>2</td><td>0</td><td>2</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr></table> Alternative for ic 2 and 3 Calculates height of atmosphere = 653 m Compares with 10 km which is larger Example of calculation: Time = 10000(m)/0.99×3×10^8(ms^{-1})	
	Indicative content: • Uses velocity = distance/time • Calculates a time = 3 ×10^{-5}s • Compares with 2.2 ×10^{-6}s which is (15 times) smaller • Identifies relativistic speed/effects (as velocity close to c) • Time (between events is much) slower/longer Or mentions time dilation • So increase in muon lifetime		(6)