

Revision Sheet

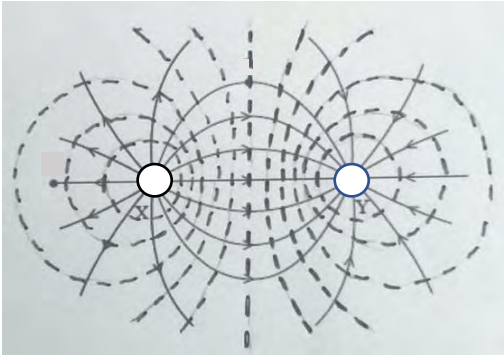
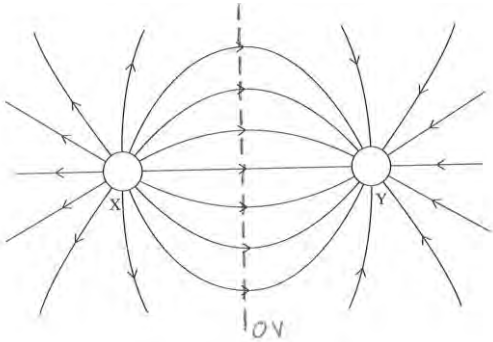
Pearson Edexcel · International A-Level · Physics · Unit 4 Further Mechanics,
Fields and Particles

12 vocabulary items · 26 marks of exam questions (4 questions)

Part 1 · Vocabulary review answer key. Section A wants the exact English spelling.

Question	Answer	Marks
1	Angular velocity	1
2	electric field	1
3	Electric field strength	1
4	capacitor	1
5	Capacitance	1
6	time constant	1
7	Magnetic flux density	1
8	Magnetic flux	1
9	cyclotron	1
10	baryon	1
11	meson	1
12	lepton	1

13	A is the only correct answer because the force is down the page using FLHR B is not correct because it does not show the force down the page C is not correct because it does not show the force down the page D is not correct because it does not show the force down the page	1
14	C is the only correct answer because the area under a force-time graph is the change in momentum A is not correct because the area under a force-time graph is not acceleration B is not correct because the area under a force-time graph is not force D is not correct because the area under a force-time graph is not distance	1

15(a)(i)	Central straight line equidistant from spacecraft and satellite and at least one of the diverging lines between spacecraft and the central line and at least one of the diverging lines between the central line and satellite (1) At least one line looping spacecraft and one line looping satellite (1) Line spacing between spacecraft and satellite smaller than line spacing to the left of spacecraft and to the right of satellite (1) <u>Example of diagram</u> 	3
15(a)(ii)	Straight line equidistant from spacecraft and satellite and labelled 0 V. (1) <u>Example of diagram</u> 	1
15(b)(i)	Use of $V = Q / 4\pi\epsilon_0 r$ Or Use of $V = kQ / r$ (1) Use of $W = QV$ (1) Minimum energy = 1.7×10^{-15} (J) (1) <u>Example of calculation</u> $V_{\text{spacecraft}} (= V_{\text{satellite}}) = 1.5 \times 10^{-6} \text{ C} / 4 \times \pi \times 8.85 \times 10^{-12} \text{ F m}^{-1} \times 2.5 \text{ m}$ $= 5400 \text{ V}$ $W = 2 \times 5400 \text{ V} \times 1.6 \times 10^{-19} \text{ J} = 1.7 \times 10^{-15} \text{ J}$	3

15(b)(ii)	Use of $F = Q_1 Q_2 / 4\pi\epsilon_0 r^2$ (1) Or Use of $F = k Q_1 Q_2 / r^2$ Use of $F = ma$ Or Use of $Fs = \frac{1}{2} mv^2$ (1) Use of suitable <i>suvat</i> equation(s), e.g. $s = ut + \frac{1}{2} at^2$ (1) Correct value for s (270 km) or t (62.5 days), comparison and consistent conclusion (1) <u>Example of calculation</u> $F = 1.5 \times 10^{-6} \text{ C} \times 1.5 \times 10^{-6} \text{ C} / 4 \times \pi \times 8.85 \times 10^{-12} \text{ F m}^{-1} \times (20 \text{ m})^2$ $= 5.1 \times 10^{-5} \text{ N}$ $a = 5.1 \times 10^{-5} \text{ N} / 2500 \text{ kg} = 2.0 \times 10^{-8} \text{ m s}^{-2}$ $300\,000 \text{ m} = \frac{1}{2} \times 2.0 \times 10^{-8} \text{ m s}^{-2} \times t^2$ $t = 5.4 \times 10^6 \text{ s}$ $t = 5.4 \times 10^6 \text{ s} / (24 \times 60 \times 60 \text{ s})$ $t = 62.5 \text{ days}$ is approximately 60 days, so the estimate is correct	4
15(c)	A reasonable suggestion, such as • Some of the electrons / beam misses (1) • Some of the electrons are deflected (1) • The spacecraft is already charged from use on a previous satellite (1) • The spacecraft emits further electrons in another direction as a fine control on the electrostatic force (1) • UV (from Sun) leads to photoelectric emission (1)	1
Total for question 15		12

16(a)	Use of GeV to J conversion (1) Use of $E_k = \frac{1}{2} mv^2$ (1) $v = 1.5 \times 10^{11} \text{ m s}^{-1}$ which is greater than the speed of light (so particle speed relativistic) (1) <u>Example of calculation</u> $(60 \times 10^9 \text{ eV} \times 1.6 \times 10^{-19} \text{ V}) = 9.6 \times 10^{-9} \text{ J}$ $9.6 \times 10^{-9} \text{ J} = \frac{1}{2} \times 9.11 \times 10^{-31} \text{ kg} \times v^2$ $v = 1.5 \times 10^{11} \text{ m s}^{-1}$ which is greater than the speed of light, which is impossible, so they must be travelling at relativistic speeds	3																																								
*16(b)	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> The following table shows how the marks should be awarded for structure and lines of reasoning. <table><tr><td></td><td>Number of marks awarded for structure of answer and sustained line of reasoning</td></tr><tr><td>Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout</td><td>2</td></tr><tr><td>Answer is partially structured with some linkages and lines of reasoning</td><td>1</td></tr><tr><td>Answer has no linkages between points and is unstructured</td><td>0</td></tr></table> Indicative content IC1 The electrons are accelerated by an <u>electric field</u> between the drift tubes IC2 The (a.c) polarity changes (when the electrons are in the tubes) so the (electric) field is in the same direction when the particle is in the gaps Or The (a.c.) polarity changes so it is always accelerating the particles IC3 The a.c. frequency is constant IC4 The length of the drift tubes increases (along the Linac) so the electrons spend the same time in the tubes / gaps Or The length of the gaps increases (along the Linac) so the electrons spend the same time in the tubes / gaps IC5 The tubes have constant length at the end IC6 As the electrons approach (but do not achieve) the speed of light their speed no longer increases	IC points	IC mark	Max linkage mark	Max final mark	6	4	2	6	5	3	2	5	4	3	1	4	3	2	1	3	2	2	0	2	1	1	0	1	0	0	0	0		Number of marks awarded for structure of answer and sustained line of reasoning	Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2	Answer is partially structured with some linkages and lines of reasoning	1	Answer has no linkages between points and is unstructured	0	6
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16(c)	(High energy particles have) large momentum	(1)	3
	(So) the (de Broglie) wavelength is small		
	Or to make (de Broglie) wavelength the size of proton	(1)	
	(This produces) better resolution (for small objects)		
	Or (This results in) more detailed observations		
	Or allows the electrons to penetrate the protons	(1)	
Total for question 16			12