

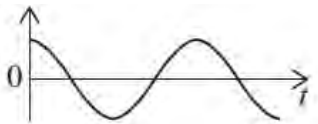
Revision Sheet

Pearson Edexcel · International A-Level · Physics · Unit 5 Thermodynamics,
Radiation, Oscillations and Cosmology

16 vocabulary items · 24 marks of exam questions (4 questions)

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

Question	Answer	Marks
1	Specific heat capacity	1
2	Specific latent heat	1
3	binding energy	1
4	Nuclear fission	1
5	Gamma radiation	1
6	Radioactive decay	1
7	Activity	1
8	Simple harmonic motion	1
9	Natural frequency	1
10	gravitational field	1
11	Gravitational potential	1
12	Luminosity	1
13	Trigonometric parallax	1
14	standard candle	1
15	main sequence	1
16	Hubble constant	1

17	C is the only correct answer 	1
18	EITHER $(V_{\text{grav}} = \frac{-GM}{r}, \text{ so) gravitational potential } \propto \frac{1}{r}$ (1) Or $V_{\text{grav}} = \frac{-GM}{r}$ and G and M are constant [Allow a graph or a description in words to describe an inverse relationship as long as potential equation is given] The equipotential surfaces become further apart with increasing distance (from Earth) (1) OR Equal work needed to transfer a body from X to Y and from Y to Z (1) (Mean) gravitational force is larger between X and Y, so distance moved must be smaller (1)	2
Total for question 18		2

19(a)	The alpha radiation will not penetrate the lead Or The lead will absorb the alpha radiation	(1)	1
19(b)	EITHER Determine the background count (rate) (1) Subtract background count (rate) from the recorded count (rate) to eliminate <u>systematic</u> error Or Subtract background count from the recorded count to prevent the count rate being overestimated (1) OR Record the count for a longer time interval Or Record the count more than once and calculate a mean value (1) This will reduce the effect of random variation on the count rate Or this will decrease the percentage uncertainty (1)		2
19(c)	EITHER One pair of values read from <u>curve</u> (1) Use of $R = 60e^{-\mu x}$ with values read from graph (1) $\mu = 0.30 \text{ cm}^{-1} \rightarrow 0.36 \text{ cm}^{-1}$ (1) OR Tangent drawn at $x = 0$ (1) $1/(x\text{-intercept of tangent})$ determined Or gradient of tangent divided by y-intercept (R_0) (1) [MP2 dependent on MP1] $\mu = 0.30 \text{ cm}^{-1} \rightarrow 0.39 \text{ cm}^{-1}$ (1) [Accept μ in m^{-1}] <u>Example of calculation</u> $\ln R = \ln 60 - \mu x$ $\therefore \mu = \frac{\ln 60 - \ln R}{x} = \frac{4.094 - \ln 43}{1.0} = 0.333 \text{ cm}^{-1}$		3
Total for question 19			6

20(a)(i)	Mass defect calculated (1) Conversion between u and kg (1) Use of $\Delta E = c^2 \Delta m$ (1) $\Delta E = 4.27 \times 10^{-12}$ (J) (1) <u>Example of calculation</u> Mass defect = $(4 \times 1.0078 \text{ u}) - 4.0026 \text{ u} = 0.0286 \text{ u}$ Mass defect = $0.0286 \text{ u} \times 1.66 \times 10^{-27} \text{ kg u}^{-1} = 4.75 \times 10^{-29} \text{ kg}$ $\Delta E = (3.00 \times 10^8 \text{ m s}^{-1})^2 \times 4.75 \times 10^{-29} \text{ kg} = 4.27 \times 10^{-12} \text{ J}$	4
20(a)(ii)	Use of 10% with mass, energy or power [or in final comparison] (1) Energy released per fusion used (ecf from (a)(i)) (1) Use of $1 \text{ u} = 1.66 \times 10^{-27} \text{ kg}$ to obtain mass of 4 protons (1) Use of $1 \text{ year} = 3.15 \times 10^7 \text{ s}$ (1) $t = 7 \times 10^9 \text{ year}$, which is less than $9 \times 10^9 \text{ year}$ so claim inaccurate Or $P = 3.13 \times 10^{26} \text{ W}$, which is less than $3.83 \times 10^{26} \text{ W}$ so claim inaccurate Or $E = 8.87 \times 10^{43} \text{ J}$, which is less than $1.09 \times 10^{44} \text{ J}$ so claim inaccurate Or 12% of hydrogen used, which is greater than 10%, so claim is inaccurate (1) [Must see unit for calculated value somewhere in the solution] <u>Example of calculation</u> $L = (\text{energy released per helium nucleus formed}) \times (\text{rate of fusion})$ (rate of fusion) = $\frac{3.83 \times 10^{26} \text{ W}}{4.27 \times 10^{-12} \text{ J}} = 8.97 \times 10^{37} \text{ s}^{-1}$ mass per second = $8.97 \times 10^{37} \text{ s}^{-1} \times 4 \times 1.0078 \times 1.66 \times 10^{-27} \text{ kg}$ $= 6.00 \times 10^{11} \text{ kg s}^{-1}$ time = $\frac{0.1 \times 1.39 \times 10^{30} \text{ kg}}{6.00 \times 10^{11} \text{ kg s}^{-1}} = 2.32 \times 10^{17} \text{ s}$ time = $\frac{2.32 \times 10^{17} \text{ s}}{3.15 \times 10^7 \text{ s year}^{-1}} = 7.35 \times 10^9 \text{ year}$ [“show that” value gives $7.35 \times 10^9 \text{ year}$]	5

*20(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 Hydrogen fusion occurs in the core of the (main sequence) star IC2 Hydrogen (in the core) runs out IC3 The rate of fusion decreases and the star contracts IC4 The temperature rises (in the core) and fusion of helium begins IC5 The star expands (and cools) to form a red giant star IC6 (Helium) fusion stops and the star collapses to a white dwarf star Or helium runs out and the star collapses to a white dwarf star	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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Total for question 20		15																																								