

Revision Sheet

A-Level Physics · Unit 13 Gravitational fields

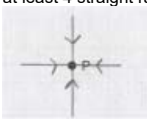
6 vocabulary items · 39 marks of exam questions (4 questions)

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

Question	Answer	Marks
1	gravitational field strength	1
2	gravitational potential	1
3	test mass	1
4	field line	1
5	point mass	1
6	geostationary	1

Question	7(a)	1(b)	1(c)	Question	2(a)	2(b)(i)	2(b)(ii)	2(c)(i)
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8(a)(i)	work (done) per unit mass work (done on mass) in moving mass from infinity (to the point)
8(a)(ii)	$E_P = \phi m$ $E_P = (-GM/r) \times m = -GMm/r$ or $\phi = -GM/r$ and $E_P = \phi m = -GMm/r$
8(b)(i)	$\Delta E_P = 6.67 \times 10^{-11} \times 1.99 \times 10^{30} \times 2.20 \times 10^{14} \times [1 / (6.38 \times 10^{10}) - 1 / (8.44 \times 10^{11})]$ $= 4.23 \times 10^{23} \text{ J}$
8(b)(ii)	(gravitational) force is attractive so decrease or (gravitational) force does work so decrease
8(b)(iii)	$\Delta E_P = \frac{1}{2} m (v_2^2 - v_1^2)$ $4.23 \times 10^{23} = \frac{1}{2} \times 2.20 \times 10^{14} \times (v^2 - 34\,100^2)$ $v (= 70\,800 \text{ m s}^{-1}) = 70.8 \text{ km s}^{-1}$
8(c)	both PE and KE equations include m , so path is unchanged

9(a)	at least 4 straight radial lines to P  all arrows pointing along the lines towards P
9(b)	Any 2 from: gravitational force provides the centripetal force (centripetal or gravitational) force has constant magnitude (centripetal or gravitational) force is perpendicular to velocity (of moon) / direction of motion (of moon)
9(c)(i)	$\frac{GMm}{r^2} = m r \omega^2$ $M = \frac{r^3 \omega^2}{G}$ and gradient = $r^3 \omega^2$ hence $M = \frac{\text{gradient}}{G}$ or $r^3 = GM \times 1/\omega^2$ so gradient = GM hence $M = \frac{\text{gradient}}{G}$
9(c)(ii)	$M = 4.1 \times 10^{23} / (6.0 \times 10^7 \times 6.67 \times 10^{-11}) = \mathbf{1.0 \times 10^{26} \text{ kg}}$

9(c)(iii)	$\frac{GMm}{r^2} = \frac{mv^2}{r}$
	$\frac{GM}{r} = v^2$
	$v^2 = \frac{6.67 \times 10^{-11} \times 1.0 \times 10^{26}}{1.2 \times 10^8}$
	$v^2 = 5.6 \times 10^7 \text{ m s}^{-1}$
	$v = 7500 \text{ ms}^{-1}$

10(a)	(gravitational) field strength equals (gravitational) potential gradient
	reference to minus sign
10(b)(i)	potential is zero at infinity
	(gravitational) force is attractive
	(test) mass getting closer (from infinity) loses potential energy
10(b)(ii)	<ul style="list-style-type: none"> potential at (surface of) planet is smaller than at (surface of) moon potential gradient at (surface of) planet is smaller than at (surface of) moon magnitude of potential varies inversely with distance from centre near the spheres (point of) maximum potential is nearer to moon than planet <i>Any two points, 1 mark each</i>
10(b)(iii)	sketch: one curve, starting with gradient of decreasing magnitude at $2R$ and finishing with gradient of increasing magnitude at $D - R$
	field strength shown as zero (only) near the point of maximum potential
	negative field strength near one sphere and positive field strength near the other