A-Level Physics: **s25 41**

1(a)	work done per unit mass
	work (done in) moving mass from infinity (to the point)
1(b)(i)	evidence of addition of 3.4×10^6 to 1.7×10^6 **or** 6.8×10^6
	$GM \times 122 / (5.1 \times 10^6)$ **or** $GM \times 122 / (10.2 \times 10^6)$
	$6.67 \times 10^{-11} \times M \times 122 \times [(5.1 \times 10^6)^{-1} - (10.2 \times 10^6)^{-1}] = 5.1 \times 10^8$ leading to $M = 6.4 \times 10^{23}$ kg
1(b)(ii)	$\phi = (-)\,(6.67 \times 10^{-11} \times 6.4 \times 10^{23}) / (3.4 \times 10^6)$
	$= -1.3 \times 10^7\ \text{J kg}^{-1}$
1(c)(i)	Mars takes (just under) 25 hours to rotate once on its axis
1(c)(ii)	orbit is equatorial **or** orbit is in same direction as direction of rotation of Mars

A-Level Physics: **s25 43**

1(a)	work done per unit mass
	work (done in) moving mass from infinity (to the point)
1(b)(i)	evidence of addition of 3.4×10^6 to 1.7×10^6 **or** 6.8×10^6
	$GM \times 122 / (5.1 \times 10^6)$ **or** $GM \times 122 / (10.2 \times 10^6)$
	$6.67 \times 10^{-11} \times M \times 122 \times [(5.1 \times 10^6)^{-1} - (10.2 \times 10^6)^{-1}] = 5.1 \times 10^8$ leading to $M = 6.4 \times 10^{23}$ kg
1(b)(ii)	$\phi = (-)\,(6.67 \times 10^{-11} \times 6.4 \times 10^{23}) / (3.4 \times 10^6)$
	$= -1.3 \times 10^7\ \text{J kg}^{-1}$
1(c)(i)	Mars takes (just under) 25 hours to rotate once on its axis
1(c)(ii)	orbit is equatorial **or** orbit is in same direction as direction of rotation of Mars

1(a)	(gravitational) force is (directly) proportional to product of masses
	force (between point masses) is inversely proportional to the square of their separation
1(b)(i)	(gravitational) force acts perpendicular to direction of motion
	gravitational force provides centripetal acceleration
1(b)(ii)	(F =) $GMm / x^2 = mx\omega^2$ **and** $\omega = 2\pi / T$ **or** $GMm / x^2 = 4\pi^2 mx / T^2$
	completion of algebra leading to $x^3 = GMT^2 / 4\pi^2$
	clear indication that B = radius of planet **and** that A = mass (of planet)
1(b)(iii)	gradient = $\sqrt[3]{(4\pi^2 / GA)}$
	e.g. $(1280 - 360) / (12 \times 10^6) = \sqrt[3]{(4\pi^2 / [6.67 \times 10^{-11} \times A])}$
	$A = 1.3 \times 10^{24}$ kg
	intercept = gradient × B
	e.g. $360 = ((1280 - 360) \times B) / (12 \times 10^6)$ $B = 4.7 \times 10^6$ m

1(a)	(gravitational) force is (directly) proportional to product of masses
	force (between point masses) is inversely proportional to the square of their separation
1(b)	$GMm / R^2 = mR\omega^2$
	$\omega = 2\pi / T$ <u>and</u> algebra leading to $4\pi^2 R^3 = GMT^2$
	or
	$GMm / R^2 = mv^2 / R$
	$v = 2\pi R / T$ <u>and</u> algebra leading to $4\pi^2 R^3 = GMT^2$
1(c)	$4\pi^2 \times R^3 = 6.67 \times 10^{-11} \times 5.98 \times 10^{24} \times (24 \times 60 \times 60)^2$ ($R = 4.22 \times 10^7$ m)
	$h = R - (6.37 \times 10^6)$
	$h = (4.22 \times 10^7) - (6.37 \times 10^6)$ $= 3.6 \times 10^7$ m
1(d)(i)	$\omega = 2\pi / T$
	$= 2\pi / (24 \times 60 \times 60)$ $= 7.3 \times 10^{-5}$ rad s^{-1}
1(d)(ii)	orbit is from east to west
	orbit is not equatorial / orbit is polar