Chapter 4 Gravitational fields. Revision Questions page 133-135 – Multiple Choice Answers

Q	Ans	Explanation
1	A	Field should point towards the mass. The direction of a gravitational field is defined as the direction of the net gravitational force
2	A	$\frac{g_K}{g_J} = \left[\frac{\frac{GM_K}{r_K^2}}{\frac{GM_J}{r_J^2}}\right]$ $= \frac{GM_K}{r_K^2} \times \frac{r_J^2}{GM_J}$ $= \frac{M_K}{r_K^2} \times \frac{r_J^2}{M_J}$ $= \frac{0.433}{(1.614)^2} \times \frac{1^2}{1}$ $= 0.17$
3	C	$F = \frac{Gmm}{r^2}$ $F_2 = \frac{G(2m)m}{r^2}$ $F_2 = 2F$
4	B	There is a gravitational force pulling on the Moon that acts towards Earth. This provides the centripetal force that keeps the Moon in orbit. There is only one force (F_g) but it is equal in magnitude and direction to F_c. We can eliminate A as F_c points the wrong way. We can eliminate D as F_c points the wrong way and is a different magnitude. Option C has both forces pointing the right way and equal in size but because there is only one force (not two) it is wrong.
5	B	This is the definition of field strength (force per unit mass). Options C and D are about work and that is wrong. Option A fails to define field strength in terms of unit (1 kg) mass.
6	D	$g_P = \frac{GM}{r_P^2}$ $g_h = \frac{GM}{(r_P + 4r_P)^2} = \frac{GM}{(5r_P)^2} = \frac{GM}{25 \times r_P^2} = \frac{g_P}{25}$

7	C	$F_E = \frac{Gm_E m}{r_E^2} = \frac{Gm_E \times 1}{r_E^2} = 9.8\,N$ $F_S = \frac{Gm_S m}{r_S^2} = \frac{G \times 100m_E \times 1}{(10r_E)^2} = \frac{G \times 100m_E \times 1}{100r_E^2} = \frac{Gm_E \times 1}{r_E^2} = F_E = 9.8\,N$ $F_S = 9.8\,N \approx 10N$
8	D	$F_E = \frac{Gm_E m}{r_E^2}$ $F_{AE} = \frac{Gm_E m}{\left(\frac{r_E}{2}\right)^2} = \frac{Gm_E m \times 4}{r_E^2} = 4F_E = 4 \times 600 = 2400\,N$
9	B	$g = \frac{GM_1}{r_1^2} = \frac{GM_2}{r_2^2}$ $\frac{M_1}{r_1^2} = \frac{M_2}{r_2^2}$ $\frac{r_1^2}{M_1} = \frac{r_2^2}{M_2}$
10	B	$\frac{g_X}{g_Y} = \left[\frac{\frac{GM_X}{r_X^2}}{\frac{GM_Y}{r_Y^2}}\right]$ $= \frac{M_X}{r_X^2} \times \frac{r_Y^2}{M_Y}$ $= \frac{M}{R^2} \times \frac{(4R)^2}{10M}$ $= \frac{M}{R^2} \times \frac{16R^2}{10M}$ $= 1.6$