Assess Quizzes from the o-book – Explanations for the answers.

Chapter 4 Review – Support

Q	Reason
1	By definition, all mass is concentrated at the centre. See dot point 4 on page 118 of NCPQ text.
2	The formula $F_g = \frac{GMm}{r^2}$ shows that the force is proportional to the **product of the masses** (M×m)
3	The formula $F_g = \frac{GMm}{r^2}$ shows this to be true.
4	Weight is defined as "a measure of the force of gravity acting on an object". See page 66.
5	$F_g = \frac{GMm}{r^2}$ $F_2 = \frac{GMm}{(2r)^2} = \frac{1}{4} \times \frac{GMm}{r^2}$ $= \frac{1}{4} \times F_g$ $= \frac{1}{4} \times 200$ $= 50\,N$
6	$F_g = \frac{GMm}{r^2}$ $F_2 = \frac{GMm}{(2r)^2} = \frac{1}{4} \times \frac{GMm}{r^2}$ $= \frac{1}{4} \times F_g$ $= \frac{1}{4} \times 600$ $= 125\,N$
7	Planets and stars are considered to behave as point masses. See dot point 4 on page 118 of NCPQ text.
8	This is explained on page 130 of the NCPQ text. The astronauts and the Space Station are continually falling towards the Earth together, but because they are in a circular orbit they never actually reach the Earth.
9	The acceleration is constant for two objects dropped together in the absence of air in the same gravitational field. (A) is wrong as the force of gravity is greater for the heavier body, but the heavier

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	body is harder to accelerate as it has a greater mass (inertia). (B) is wrong as the acceleration on the Moon is less. (D) is wrong as the gravitational force is proportional to the mass (F_g = mg) so the heavier object experiences a greater force.
10	For an object at the equator, some of the object's weigh is used to provide the centripetal force so the scales at the equator have to supply a force to equal the weight minus the centripetal force. For a 60 kg person, their weight is about 590 N and about 20 N of this is used to supply the centripetal force. The scales would read 570 N or 57 kg scale reading. At the poles, the weight is not reduced because the weight force is not used in any way to provide centripetal force. Hence, the scales would just read 590 N as a scale reading o 59 kg. Hence, if the Erath stopped rotating the person's scale reading would rise from 57 kg to 59 kg.

Chapter 4 Review – Consolidate

Q	Reason
1	$g_E = \frac{F_{g(E)}}{m_E} = \frac{GM_E}{r_E^2}$ $g_P = \frac{GM_P}{r_P^2} = \frac{G\times\frac{1}{2}M_E}{(\frac{1}{2}r_E)^2} = \frac{2GM_E}{r_E^2} = 2g_E$ $= 2\times 9.8$ $= 19.6\,m\,s^{-2}$
2	$g = \frac{GM}{r^2}$ $M = \frac{gr^2}{G} = \frac{9.8\times(6400\times10^3)^2}{6.67\times10^{-11}}$ $= 6.0\times10^{24}\,kg$
3	$F_g = mg$ As mass and the gravitational field strength (g) are the same on land as in water, they are the same.
4	$F_g = mg$ As mass and the gravitational field strength (g) are the same whether at rest or in free-fall, they are the same.
5	Mass is invariant (doesn't change anywhere in the universe), hence mass stays at 10.0 kg

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Chapter 4 Review – Extend

Q	Reason
1	$g_E = \frac{F_{g(E)}}{m_E} = \frac{GM_E}{r_E{}^2}$ $g_P = \frac{GM_P}{r_P{}^2} = \frac{G \times \frac{1}{2} M_E}{(5r_E)^2} = \frac{GM_E}{50r_E{}^2} = \frac{1}{50} g_E$ $= \frac{g}{50}$
2	$\frac{g_A}{g_B} = \frac{GM}{R^2} \div \frac{GM_B}{r_B{}^2}$ $= \frac{GM}{R^2} \times \frac{r_B{}^2}{GM_B}$ $= \frac{GM}{R^2} \times \frac{(4R)^2}{G \times 10M} = \frac{16}{10}$ $= 1.6$
3	***g*** varies as an inverse square relationship with distance. Starts at 9.8 m s^{-2} at the surface of the Erath and decreases in an inverse square shape. Graph C does this.
4	$a_1 = \frac{GM}{(2R)^2} = \frac{1}{4} \times \frac{GM}{R^2}$ $\frac{GM}{R^2} = 4a_1$ $a_2 = \frac{GM}{(4R)^2} = \frac{1}{16} \times \frac{GM}{R^2}$ $\frac{GM}{R^2} = 16a_2$ $4a_1 = 16a_2$ $a_1 = 4a_2$ $a_2 = \frac{a_1}{4}$

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5	$F_{g(E)} = \frac{GM_E m}{r_E^{\ 2}} = 800\,N$ $F_{g(P)} = \frac{GM_P m}{r_P^{\ 2}} = \frac{G(2M_E)m}{(2r_E)^2} = \frac{GM_E m}{2r_E^{\ 2}} = \frac{1}{2}F_{g(E)}$ $F_{g(P)} = 2F_{g(E)}$ $= \frac{1}{2} \times 800$ $= 400N$