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

Chapter 1 Review – Support

Q	Reason
1	0° means the projectile is fired vertically so will have zero horizontal range; 45° achieves the maximum range as you may know from Experiment 1, or by calculating the range of a given projectile at $40^\circ, 45^\circ \textit{ and } 50^\circ$. An angle of 45° will give the biggest range. I'd just learn that 45° give maximum range and be done with it. My tip.
2	Elevation angle will affect range. As the range increases up to 45° the range will increase and then decrease after 45°. Secondly, the greater the initial velocity the greater the time of flight and thus the greater the range. Thirdly, the weaker the gravitational force the greater the time of flight and thus the greater the range. On the Moon, where g = -1.6 m s^{-2}, range is greater than on Earth (g = - 9.8 m s^{-2}).
3	$u_x = u\cos\theta = 60 \times \cos 37^\circ = 48\, m\, s^{-1}$. Note, this formula is not in the QCAA formula book but is in our NCPQ text. See page 41.
4	$u_x = u\cos\theta$ $55 = 120 \times \cos\theta$ $\theta = \cos^{-1}(120/55)$ $= 63^\circ$ Make sure you can do these simple questions. There is bound to be one on the external exam.
5	$s_y = u_y t + \frac{1}{2} g t^2$ $= 0 + -4.9 \times 4.0^2$ $= 78.4\, m$ $\approx 78\, m$
6	Acceleration does not change. It stays at –9.8 m s^{-2} near the surface of the Earth. Because the pull of gravity is constant, the net force is constant, and so the acceleration is constant. Don't be fooled into saying a = 0 at the top of flight (highest point). It isn't, not even for just a moment.
7	Path A is correct as the box keeps the same horizontal velocity but will undergo vertical acceleration downwards. It will therefore follow the path of a parabola (see page 50). (B) is wrong as that wouldn't allow for increasing speed in the downwards direction. (C) would only be true if the plane was hovering (stationary) like a helicopter.

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8	$s_y = u_y t + \frac{1}{2}gt^2$ $0 = u_y t + \frac{1}{2}gt^2$ $-u_y t = \frac{1}{2}gt^2$ $-u_y = \frac{1}{2}gt$ $-u\sin\theta = -4.9t$ $-60\sin 30^\circ = -4.9t$ $-30 = -4.9t$ $t = \frac{30}{4.9} = 6.1\,s\,(closest\ to\ 6.0\,s)$ Note: I will get this fixed so that the four options are 5 s, *6 s, 10 s and 12 s.
9	Air resistance reduces the vertical acceleration, and also provides a retarding force on the horizontal motion. Thus, the projectile will not go as high or as far (range). See the lovely diagram I drew (Figure 11, page 58) of our NCPQ text.
10	***u*** is initial velocity, ***v*** is final velocity. Hence, $\boldsymbol{v_y}$ is the y (or vertical) component of the final velocity. Trap: don't forget that $v_x = u_x$ as the horizontal velocity doesn't change.

Chapter 1 Review – Consolidate

Q	Reason
1	The plane will continue with the same horizontal velocity, and so will the package. Remember you are ignoring air resistance. Thus, the package will continue the same forward motion as the plane but it will just accelerate downwards at the same time. Recall that the vertical velocity and horizontal velocity are independent. That's in the syllabus and you should know that. See Key Ideas statement at the top of page 50.
2	The plane will continue with the same horizontal velocity, but the package will experience a retarding force due to air resistance. Thus, the package will continue forward motion but be slower than that of the plane – so it will land behind where the plane will be when the package lands.
3	$s_x = u_x t$ $u_x = \frac{s_x}{t} = \frac{60}{3}$ $= 20\,m\,s^{-1}$

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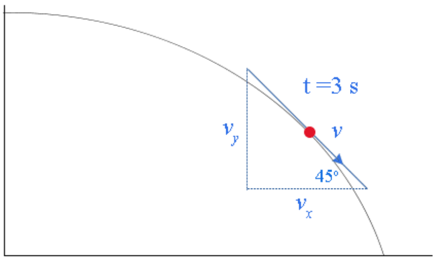
4	$u_y = u\sin\theta$ $4.9 = 8.5\sin\theta$ $\theta = \sin^{-1}\dfrac{4.9}{8.5}$ $= 35.2^\circ$ $u_x = u\cos\theta$ $= 8.5\cos 35.2^\circ$ $= 6.9\,m\,s^{-1}$
5	$v_y^2 = u_y^2 + 2gs_y$ $0 = 4.9^2 + 19.8s_y$ $s_y = \dfrac{4.9^2}{19.8} = 1.2\,m$

Chapter 1 Review – Extend

Q	Reason
1	 $v_y = u_y + gt$ $= 0 + 9.8 \times 3$ $= 29.4\,m\,s^{-1}$ Because the angle is 45°, at 3 seconds, $v_x = v_y$ (isosceles triangle), thus $v_x = 29.4\,m\,s^{-1}$ Using Pythagoras's theorem: $v = \sqrt{29.4^2 + 29.4^2}$ $v = 41.6\,m\,s^{-1}$
2	$v_y^2 = u_y^2 + 2gs_y$ $2gs_y = v_y^2 - u_y^2$ [answer] Then let $v_y = 0$ at maximum height.

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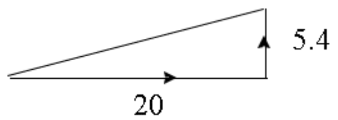
3	$s_y = u_y t + \frac{1}{2}gt^2$ $0 = u_y t + \frac{1}{2}gt^2$ $-u_y t = \frac{1}{2}gt^2$ $u_y = -\frac{1}{2}gt$ $u_y = \frac{1}{2}gt\,(ignore\ the -)$ $t = \frac{2u_y}{g}$ $= \frac{2u\sin\theta}{g}$
4	After 2 s, the horizontal speed will remain at 20 m s^{-1}, but the vertical speed will have slowed from 25 m s^{-1} to 5.4 m s^{-1}: $v_y = u_y + gt$ $= {}^{+}25 + {}^{-}9.8 \times 2$ $= {}^{+}5.4\,m\,s^{-1}$ $\approx 5\,m\,s^{-1}\,upwards\,(+\text{ direction})$ v_x is constant at 20 m s^{-1} 
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