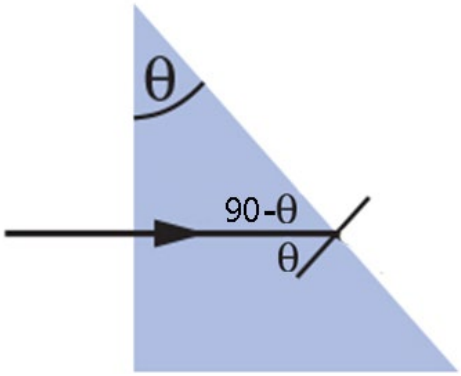
Cumulative test Unit 2. Worked solutions to the multiple choice questions.

Q	Ans	Explanation
1	B	$v_{speed} = \frac{d}{t} = \frac{10+20}{1.0+3.0} = \frac{30}{4} = 7.5\,m\,s^{-1}$ $\bar{v} = \frac{\vec{s}}{t} = \frac{+10+(-20)}{1.0+3.0} = \frac{-10}{4} = 2.5\,m\,s^{-1}$ to the left
2	C	$a = \frac{\Delta v}{\Delta t} = \frac{20-40}{5-0} = -4\,m\,s^{-2}$ $[gradient]$ $s = area = (5\times 20) + \frac{1}{2}(5\times 20) = 150\,m$
3	B	$s = ut + \frac{1}{2}\times 9.8\times t^2$ $s = 2t + 4.9t^2$
4	A	$\vec{F}_{net} = -5.0N + (+15.0)$ [taking S direction as negative] $= 10.0N\ North$ $\vec{F}_{net} = m\vec{a}$ $\vec{a} = \frac{\vec{F}_{net}}{m} = \frac{10.0}{5.00} = 2.00\,m\,s^{-2}\ North$ $a = 2.00\,ms^{-2}$ Note the question says 'magnitude' so no direction needs to be stated. It should have said "Determine the magnitude and direction of the acceleration of the mass". Note to self – fix.
5	B	$p_i = p_f$ $m_1u_1 + m_2u_2 = (m_1+m_2)v$ $4\times 5 + 2\times 0 = (4+2)v$ $20 = 6v$ $v = \frac{20}{6} = 3.3\,m\,s^{-1}$
6	B	This is called the 'wave height' and is twice the amplitude (which is the distance from the equilibrium line and the crest or a trough).
7	C	As the frequency of a wave decreases (eg from 10000 Hz to 3000 Hz, the wavelength of the wave increases, assuming the velocity stays the same. These are related by the wave equation v = fλ. We also know that ss the wavelength increases, the amount of diffraction also increases. Thus, diffraction is greater for the 3000 Hz wave. See Figure 6 page 402 NCPQ U1&2).
8	A	$\lambda = \frac{v}{f} = \frac{340\,m\,s^{-1}}{340\,Hz} = 1.00\,m$ $L = (2n-1)\frac{\lambda}{4} = (2\times 1-1)\frac{1.00m}{4}$ $[n=1\ for\ shortest\ pipe]$ $= 0.25\,m\,(25\,cm)$

9	A	As the object is at a position u > f, it will be a real image and thus inverted. As far as the size of the image goes, if u > 2f it is diminished, if u = 2f it is the same size, and if u<2f but >f, it is enlarged (magnified). In this case the object is between f and 2f so the image is diminished.
10	C	The angle of incidence on the light on the right hand side of the block is also θ as you can see from the geometry in the diagram.  As θ is less than the critical angle from glass-air, the ray will refract out of the boundary and move away from the normal as the ray is going from more optically dense to a less optically dense medium.