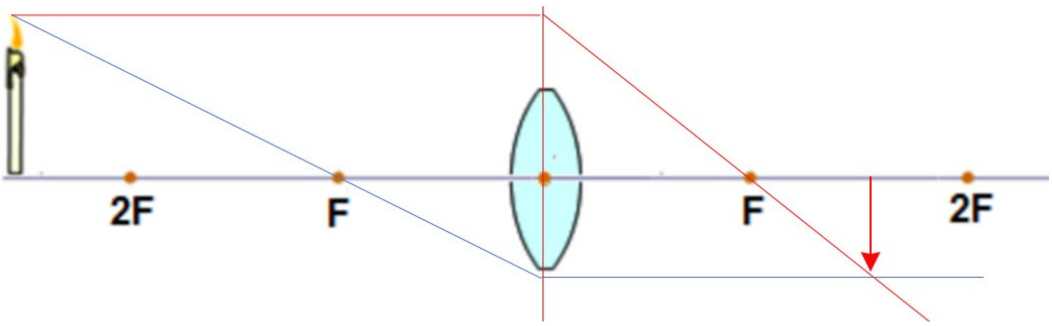
Assess Quizzes from the o-book – Explanations for the answers.

Chapter 16 Review – Support

Q	Reason
1	Only *emr* can travel in a vacuum. All other waves need a physical medium for their transmission.
2	Colour depends on wavelength and frequency. They are related by the wave equation so if colour depends on one (λ) it also depends on the other (f), however, it doesn't depend on speed. Red light is red whether it is going through a vacuum, air or water even though its speed would be different.
3	If it reflects back into the same medium wavelength, frequency and speed don't change.
4	When you look into a plane mirror you see yourself as being upright and the same size. It is a virtual image as the rays of light don't actually pass through the image but only appear to (as they are really reflected off the mirrored surface. You could also add that the image is as far behind the mirror as you are in front.
5	For light going from glass (a dense medium) to air (a less dense medium) the light ray bends (refracts) away from the normal. The correct option shows this. However, you may think the figure where the refracted ray skims along the surface could also be correct. The question says 'less than critical angle' and this rules that diagram out. That diagram has the refracted ray at an angle of refraction of 90° which implies that the incident angle in the glass is at the critical angle. So, rule that one out.
6	Converging lenses in air will be the ones thicker at the middle than at the edges. The correct option is II, II, and IV. Note however, if these were glass lenses and were immersed in a liquid of RI higher than glass ($n_g = 1.5$) then they would act as diverging lenses. There are not nay liquids that do this but carbon disulfide ($n_{CS2} = 1.628$) is close. How about arsenic trisulfide – its RI is 1.9 at 20°C. Poisonous but high: NSFW.
7	Goes from low RI (air) to high RI (glass) so bends towards the normal. Thus, its angle of refraction will be less than its angle of incidence. You don't have to learn the RIs of any substance but you should know that air is 1.00 and everything else is higher.
8	The refraction is best explained by considering its velocity. See Figure 1 page 447 to explain this.
9	You should just learn this. You will definitely need to recall this for Unit 3 on Light. The option 'particles of light energy' would be correct if we were talking about the particle model and not the wave model.
10	Only light whose electric field is oscillating in the same direction as the 'picket fence' polariser can pass through. See diagrams on page 437.

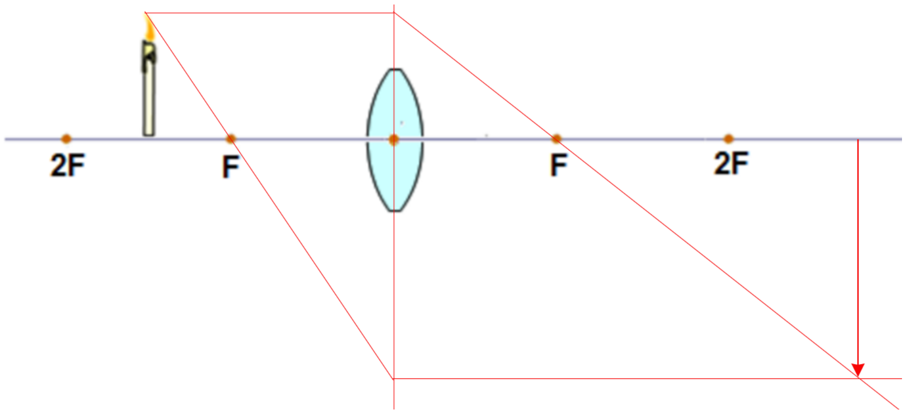
Assess Quizzes from the o-book – Explanations for the answers.

Chapter 16 Review – Consolidate

Q	Reason
1	The intensity formula can be found on page 440. $I \propto \frac{1}{r^2} \Rightarrow I = \frac{\text{constant}}{r^2}$ $I_1 r_1^2 = I_2 r_2^2 = \text{constant}$ $1\,\text{bulb} \times (1.0\,\text{m})^2 = I_2\,\text{bulbs} \times (3.0\,\text{m})^2$ $1 \times 1^2 = I_2 \times 3.0^2$ $I_2 = \frac{1}{9}$ As the intensity at 3 m is 1/9th the intensity at 1 m, you will need 9 bulbs. If we substitute in 9 as the initial intensity you can see that the intensity at 3.0 m is now equal to 1.0, which is what one bulb produces at 1.0 m. $I_1 r_1^2 = I_2 r_2^2 = \text{constant}$ $9\,\text{bulbs} \times (1.0\,\text{m})^2 = I_2\,\text{bulbs} \times (3.0\,\text{m})^2$ $9 \times 1^2 = I_2 \times 3.0^2$ $I_2 = 1$
2	Complete the ray diagram and you'll see: 
3	The smaller the gap compared to the wavelength the greater the diffraction. See page 402. The biggest difference is 2 cm wavelength going through a gap half that size.
4	They all can. Remember this for Unit 4.
5	The smaller the gap compared to the wavelength the greater the diffraction. See page 402. So, you want a large wavelength (λ) with a small gap (d).

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

Chapter 16 Review – Extend

Q	Reason
1	When the mirror rotates by θ, the new angle of incidence is α + θ. That means the new angle of reflection is also α + θ. The angle between the two rays is now (α + θ) + (α + θ) = 2α + 2θ. The difference is (final) – initial = (2α + 2θ) – (2α) = 2θ.
2	$\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$ (formula book, and page 449) $n_1 \sin i = n_2 \sin r$ $n_a \sin \theta_a = n_w \sin \theta_w$ $1 \times \sin 30^\circ = 1.33 \sin \theta_w$ $\theta_w = 22^\circ$ $n_w \sin \theta_w = n_g \sin \theta_g$ $1.33 \sin 22^\circ = 1.5 \sin \theta_g$ $\theta_g = 19.5^\circ$
3	$\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$ (formula book, and page 449) $n_1 \sin i = n_2 \sin r$ $n_g \sin i_c = n_w \sin \theta_w$ $n_g \times \sin 61.7^\circ = 1.33 \sin 90^\circ$ $n_g \times \sin 61.7^\circ = 1.33$ $n_g = 1.51$
4	 Completed ray diagram shows image to be real, inverted, enlarged. You could also add a third line from tip of candle through the centre of the lens and it should meet where the others cross.

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

5	$\dfrac{\sin i}{\sin r} = \dfrac{n_2}{n_1}$ (formula book, and page 449) $n_1 \sin i = n_2 \sin r$ $n_w \sin i_{c(w)} = n_a \sin \theta_a$ $1.33 \times \sin i_{c(w)}{}^{\circ} = 1.0 \sin 90^{\circ}$ $n_g \times \sin i_{c(w)} = \dfrac{1}{1.33}$ $i_c = \sin^{-1} 0.75$ $= 48.75^{\circ}$ This critical angle is 48.75° but the angle of incidence is greater than this (49. 5°) so ‘yes’ there will be total internal reflection.