

## Answers Week 12

12-1 It hits the ceiling at a point 1.45m away from the left corner.

12-3  $d = (2 - 9.8t^2)m$  for  $0 < t < 0.45$  sec.

12-5  $n_{\text{Red}} < n_{\text{Blue}}$

12-7 A real image is formed when the light actually goes through the point where the image is located. On the contrary, the light only appears to come from a virtual image.

A real image can be projected on a screen.

12-9 Convex mirror:  $r$  is negative. All the images are virtual, upright and reduced  
Plane mirror:  $r$  is essentially infinite. All the images are virtual, upright and same size as object.

Concave mirror:  $r$  is positive. As long as  $p$  (object distance) is greater than  $f$  (focal length), all images are real and inverted, the magnification varying from zero ( $p \rightarrow \infty$ ) to very large ( $p = f$ ). If  $p < f$  the image is virtual, upright and enlarged.

12-11  $\frac{1}{P} + \frac{1}{q} = \frac{1}{f}$  and  $f$  is positive.

Smallest  $q$  when  $p \rightarrow \infty$   $\left( \frac{1}{p} \rightarrow 0 \right)$  and therefore  $q_{\text{min}} = f$ .

12-13 You must place the object closer to the mirror than its focal point. Since  $p < f$ ,  $q$  (image distance) is negative and larger than  $p$ , the image is virtual, upright and enlarged so  $m > 1$ .