1 Virtual images may be formed by both plane mirrors and by convex lenses.

Fig. 6.1 shows a plane mirror and a convex lens.

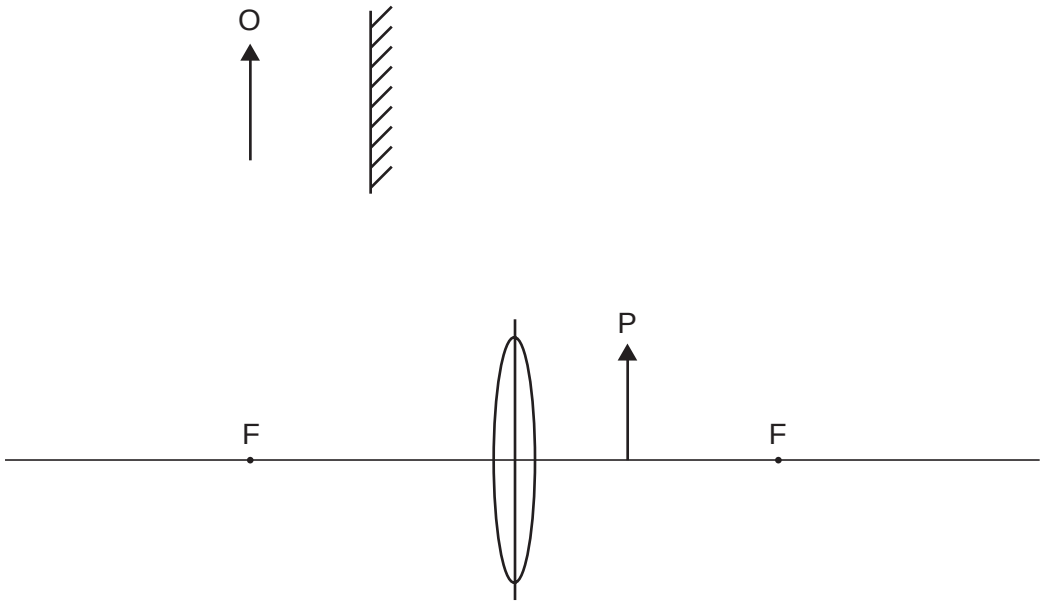

Fig. 6.1

(a) On Fig. 6.1, draw rays to locate the approximate positions of the images of the tops of the two arrow objects O and P.
Label the images. [5]

(b) Both images are virtual.

(i) What is meant by a *virtual image*?

..... [1]

(ii) State **one** other similarity between the two images.

..... [1]

(iii) State **one** difference between the two images.

..... [1]

[Total: 8]

2 Fig. 6.1 shows white light incident at P on a glass prism. Only the refracted red ray PQ is shown in the prism.

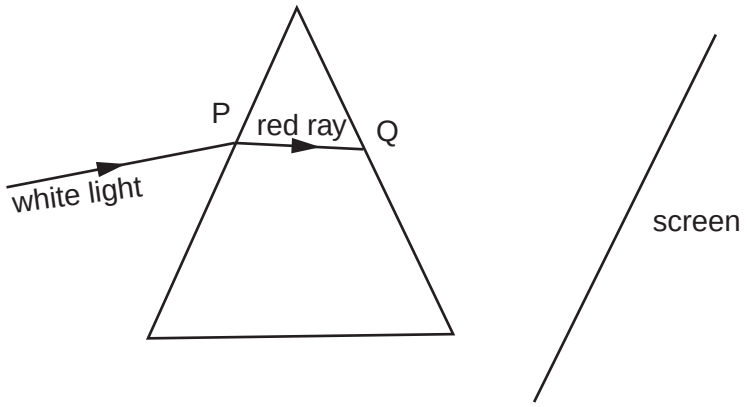

Fig. 6.1

(a) On Fig. 6.1, draw rays to complete the path of the red ray and the whole path of the violet ray up to the point where they hit the screen. Label the violet ray. [3]

(b) The angle of incidence of the white light is increased to 40°. The refractive index of the glass for the red light is 1.52.
Calculate the angle of refraction at P for the red light.

angle of refraction = ...[3]

(c) State the approximate speed of

(i) the white light incident at P, speed = ...[1]

(ii) the red light after it leaves the prism at Q. speed = ...[1]

[Total : 8]

3 Fig. 6.1 shows a ray of light, from the top of an object PQ, passing through two glass prisms.

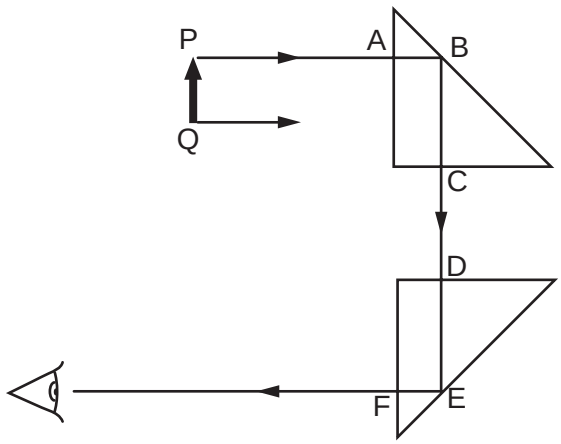

Fig. 6.1

(a) Complete the path through the two prisms of the ray shown leaving Q. [1]

(b) A person looking into the lower prism, at the position indicated by the eye symbol, sees an image of PQ.
State the properties of this image.

.....[2]

(c) Explain why there is no change in direction of the ray from P at points A, C, D and F.

.....

.....[1]

(d) The speed of light as it travels from P to A is 3×10^8 m/s and the refractive index of the prism glass is 1.5.
Calculate the speed of light in the prism.

speed = ...[2]

(e) Explain why the ray AB reflects through 90° at B and does not pass out of the prism at B.

.....

.....

.....[2]

[Total : 8]

4 Fig. 6.1 shows a ray of light OPQ passing through a semi-circular glass block.

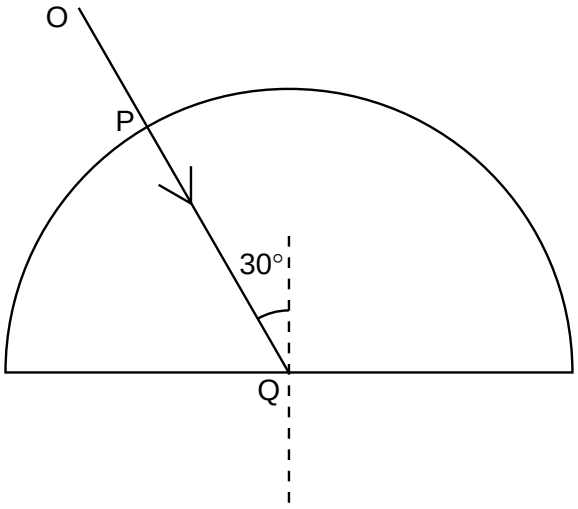

Fig. 6.1

(a) Explain why there is no change in the direction of the ray at P.

.....

..... [1]

(b) State the changes, if any, that occur to the speed, wavelength and frequency of the light as it enters the glass block.

.....

.....

..... [2]

(c) At Q some of the light in ray OPQ is reflected and some is refracted.

On Fig. 6.1, draw in the approximate positions of the reflected ray and the refracted ray. Label these rays. [2]

(d) The refractive index for light passing from glass to air is 0.67.

Calculate the angle of refraction of the ray that is refracted at Q into air.

angle = …… [3]

[Total : 8]

5 **(a)** Fig. 7.1 shows two rays of light from a point O on an object. These rays are incident on a plane mirror.

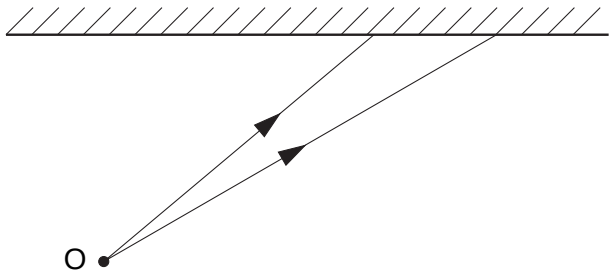

Fig. 7.1

(i) On Fig. 7.1, continue the paths of the two rays after they reach the mirror. Hence locate the image of the object O. Label the image I. [2]

(ii) Describe the nature of the image I.

.....

..... [2]

(b) Fig. 7.2 is drawn to scale. It shows an object PQ and a convex lens.

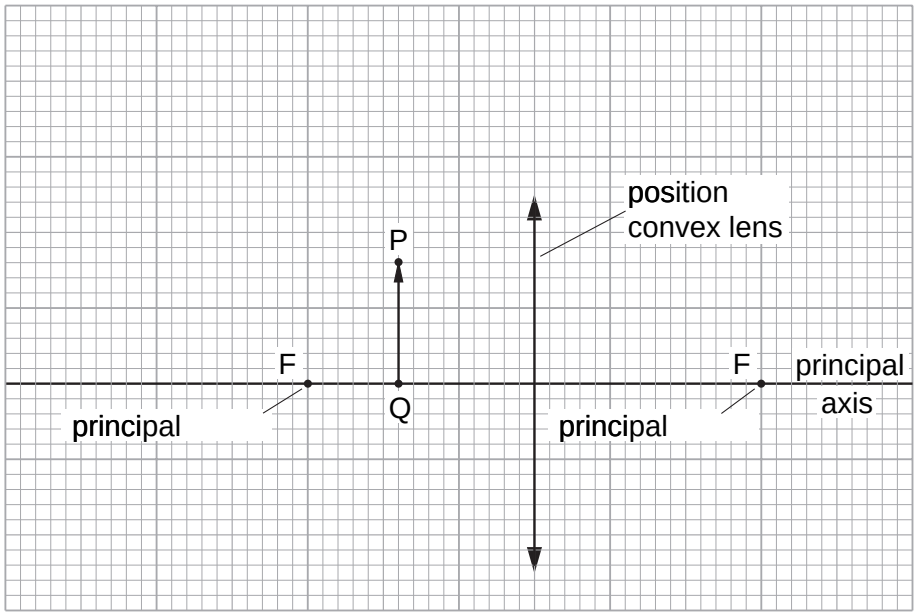

Fig. 7.2

(i) On Fig. 7.2, draw two rays from the top of the object P that pass through the lens. Use these rays to locate the top of the image. Label this point T. [3]

(ii) On Fig. 7.2, draw an eye symbol to show the position from which the image T should be viewed. [1]

[Total : 8]

6 Fig. 6.1 shows a ray PQ of blue light incident on the side of a rectangular glass block.

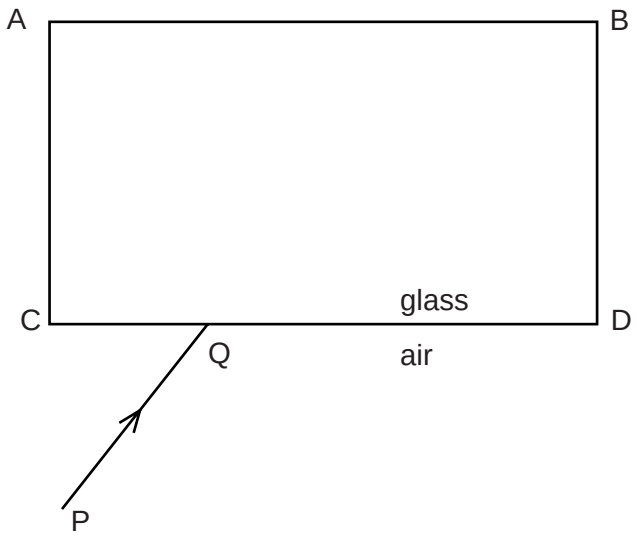

Fig. 6.1

(a) **(i)** By drawing on Fig. 6.1, continue the ray PQ through and beyond the block.

(ii) Mark the angle of incidence at CD with the letter *i* and the angle of refraction at CD with the letter *r*.

[3]

(b) The speed of light in air is 3.0×10^8 m/s and the speed of light in glass is 2.0×10^8 m/s.

(i) Write down a formula that gives the refractive index of glass in terms of the speeds of light in air and glass.

refractive index =

(ii) Use this formula to calculate the refractive index of glass.

refractive index = ……
[2]

(c) The frequency of the blue light in ray PQ is 6.0×10^{14} Hz.
Calculate the wavelength of this light in air.

wavelength = ……[2]

[Total : 7]