Name..... Set..... Don.....

Winchester College
Physics

3rd year Revision Test

Waves and Optics

Common Time 2010

Answer all the questions.
Total 41 marks.

Allow 40 minutes.

Remember to show your working where applicable.
Calculators are allowed.

1 Fig. 7.1 shows the parts of the electromagnetic spectrum.

For Examiner's Use

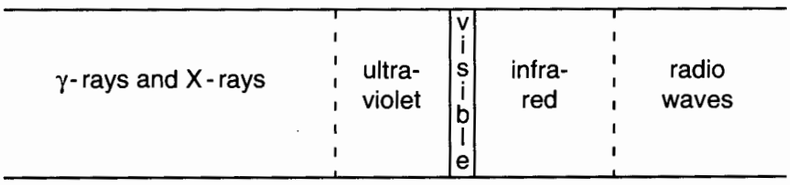

Fig. 7.1

(a) Name one type of radiation that has

(i) a higher frequency than ultra-violet,

..... [1]

(ii) a longer wavelength than visible light.

..... [1]

(b) Some γ-rays emitted from a radioactive source have a speed in air of 3.0×10^8 m/s and a wavelength of 1.0×10^{-12} m.

Calculate the frequency of the γ-rays.

frequency = ... [2]

(c) State the approximate speed of infra-red waves in air.

..... [1]

For Examiner's Use

2 Fig. 6.1 shows the diffraction of waves by a narrow gap.

P is a wavefront that has passed through the gap.

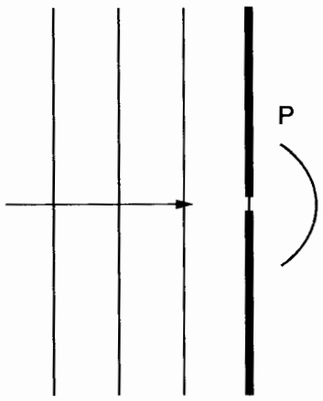

Fig. 6.1

(a) On Fig. 6.1, draw three more wavefronts to the right of the gap. [3]

(b) The waves travel towards the gap at a speed of 3×10^8 m/s and have a frequency of 5×10^{14} Hz. Calculate the wavelength of these waves.

wavelength = ... [3]

For Examiner's Use

3 Fig. 6.1 shows wavefronts of light crossing the edge of a glass block from air into glass.

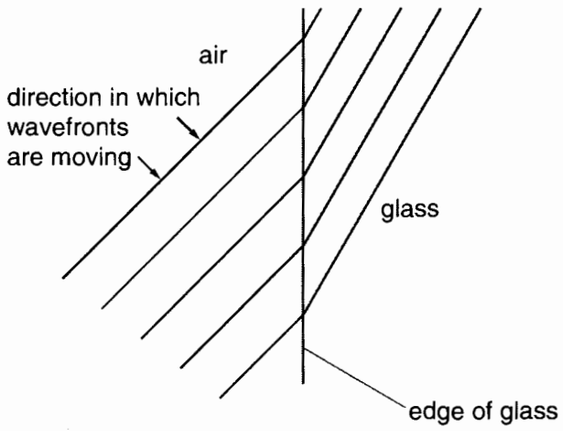

Fig. 6.1

(a) On Fig. 6.1

(i) draw in an incident ray, a normal and a refracted ray that meet at the same point on the edge of the glass block,

(ii) label the angle of incidence and the angle of refraction,

(iii) measure the two angles and record their values.

angle of incidence = ...

angle of refraction = ...

[4]

(b) Calculate the refractive index of the glass.

refractive index = ...[3]

[Turn over

For Examiner's Use

4 Fig. 7.1 shows the cone of a loudspeaker that is producing sound waves in air.
At any given moment, a series of compressions and rarefactions exist along the line XY.

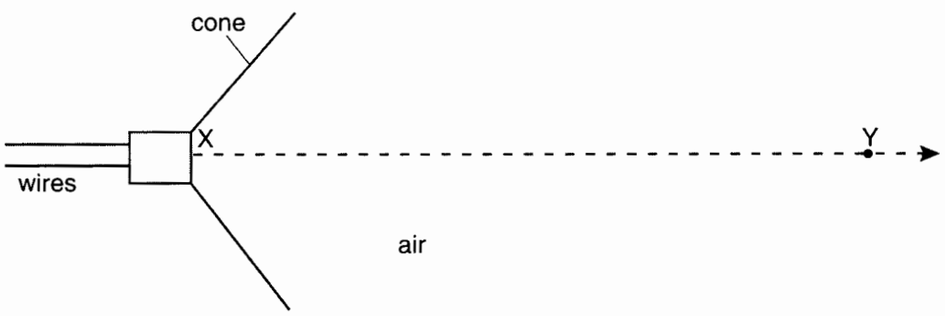

Fig. 7.1

(a) On Fig. 7.1, use the letter C to mark **three** compressions and the letter R to mark **three** rarefactions along XY. [1]

(b) Explain what is meant by

(i) a *compression*,

.....

.....

(ii) a *rarefaction*.

.....

.....
[2]

(c) A sound wave is a longitudinal wave. With reference to the sound wave travelling along XY in Fig. 7.1, explain what is meant by a *longitudinal* wave.

.....

.....[2]

(d) There is a large vertical wall 50 m in front of the loudspeaker. The wall reflects the sound waves.
The speed of sound in air is 340 m/s.
Calculate the time taken for the sound waves to travel from X to the wall and to return to X.

time = ...[2]

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.

For Examiner's Use

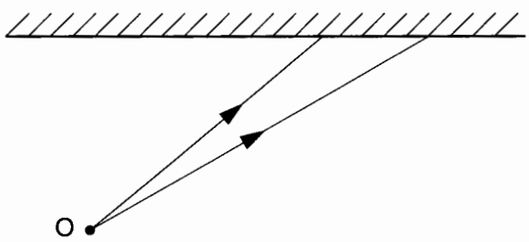

Fig. 7.1

(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.

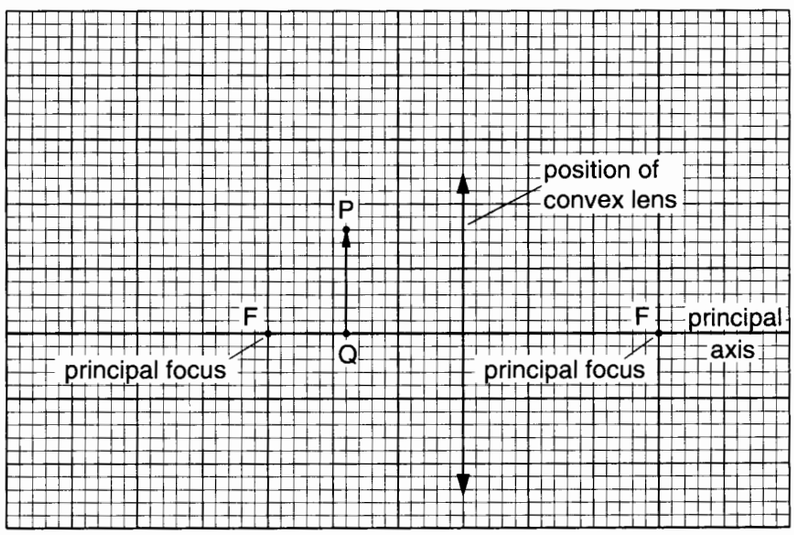

Fig. 7.2

(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]

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

For Examiner's Use

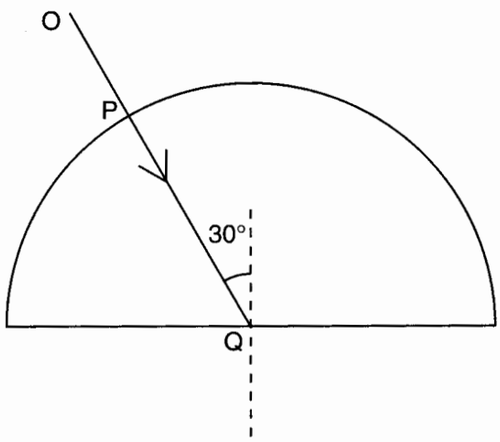

Fig. 6.1

(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]