

Name of the Student: \_\_\_\_\_

Max. Marks : 25 Marks

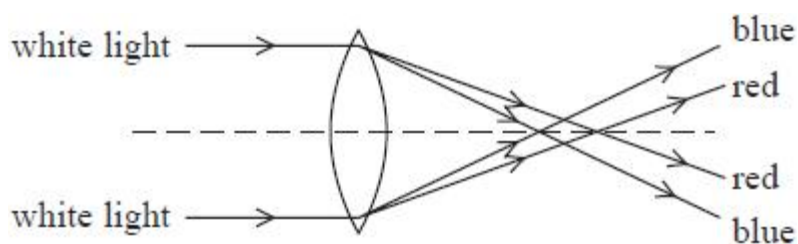
Time : 25 Minutes

**Q1.**

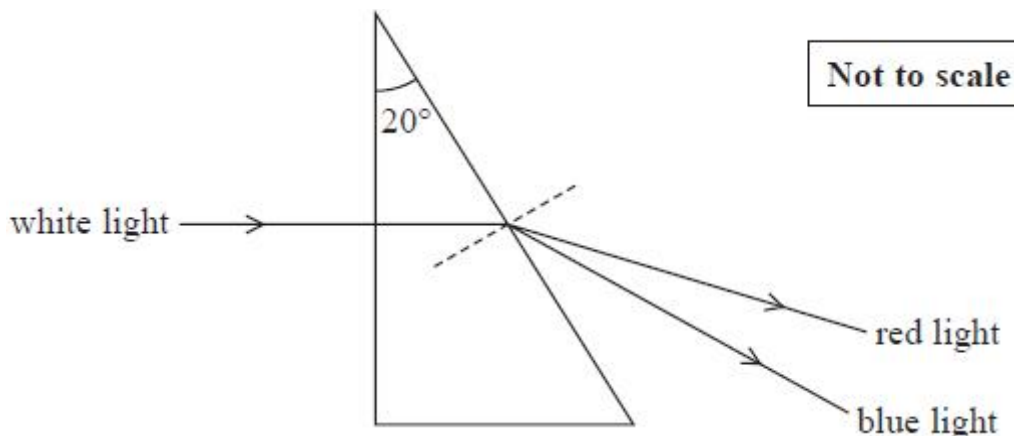
A magnifying glass consists of a converging lens and is used to magnify the details of an object.

A biologist is studying a flower using a magnifying glass. The anther of the flower has a width of 0.2 mm. The magnifying glass is placed 5.0 cm from the flower and an image of the anther is produced that is 3.5 mm wide.

The biologist notices coloured fringes around the edges of the image. This is caused by different coloured light being refracted by different angles as it passes through the lens.



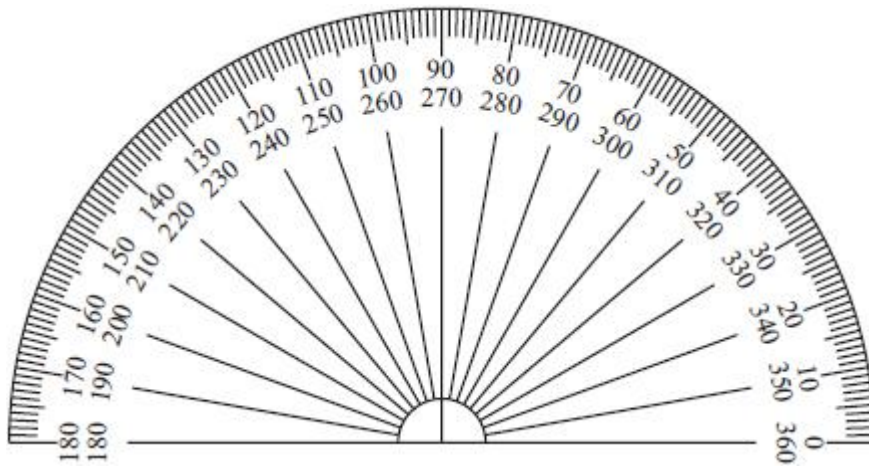
The refractive index of red and blue light as the light passes from glass into air can be investigated using a 20° glass prism.



A ray of white light is incident along the normal and passes straight into the prism.

Blue and red light rays are refracted by different angles as they leave the prism.

The angles of refraction are measured using a protractor, like the one shown.



(i) Deduce whether the measurements made using the protractor are sufficient to measure the difference in the angles of refraction between blue and red light.

refractive index of red light in glass = 1.509  
 refractive index of blue light in glass = 1.517

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(ii) The angle of incidence at the glass-air interface can be changed by altering the path of the light as it enters the prism. The angle of incidence of the red light at the glass-air interface is changed to 35°.

Deduce whether the red light will still be refracted at the glass-air boundary.

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**(Total for question = 6 marks)**

**Q2.**

A camera uses a converging lens to produce an image.

In some cameras, lenses of different focal lengths can be used. A particular camera can use a lens of focal length 50 mm or a lens of focal length 200 mm. Both lenses are made from the same material.

(i) Describe a method to determine an approximate value for the focal length of a converging lens.

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(ii) Explain why the lens with the shorter focal length is thicker at its centre.

(2)

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(iii) Both photographs show the same scene photographed from the same position.



Photograph 1



Photograph 2

One photograph was taken using the lens of focal length 50 mm and the other was taken using the lens of focal length 200 mm. Deduce which lens was used to take photograph 2.

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**(Total for question = 9 marks)**

**Q3.**

When food is cooked in a microwave oven, microwave radiation is absorbed by water molecules, increasing the internal energy of the food.

(a) The photograph shows a microwave leakage detector.

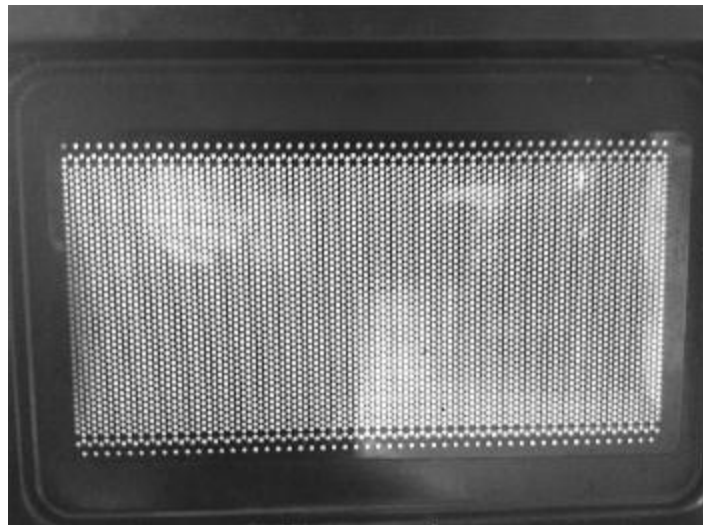


The detector is held next to the microwave oven to see if any microwave radiation is leaking to the surroundings. Suggest why microwave radiation leaking to the surroundings could be dangerous to people.

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(b) The internal walls of the microwave oven are solid metal. The photograph shows the door of a microwave oven.



The door consists of two sheets of glass with a layer of metal between. The layer of metal has many small holes in it, so that food inside the microwave oven may be seen while it is being heated without exposing the user to dangerous levels of microwave radiation. It has been suggested that, due to diffraction effects, light can pass through the holes but microwaves cannot.

(i) Explain what is meant by diffraction.

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(ii) Calculate the wavelength of the microwave radiation used in the oven.

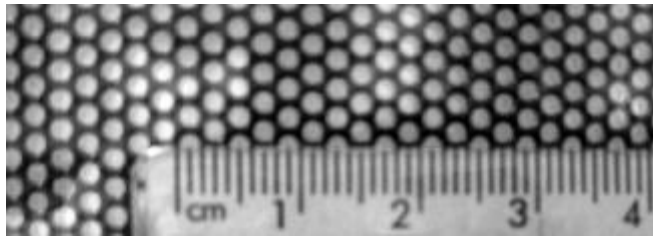
microwave frequency = 2.5 GHz.

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Wavelength = .....

(iii) The photograph shows a section of the microwave oven door. Use the photograph to determine the diameter of the holes.



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Diameter = .....

\*(iv) Discuss the suggestion that, due to diffraction effects, light can pass through the holes but microwaves cannot.

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