Worshipful Company of Spectacle Makers

Level 4 Year 1 Diploma for Optical Technicians

Unit 2: The Eye and the Principles of Optics

Duration: 1.5 hours

Candidate Number:

Date:

Answer ALL Questions

☐ Number of Supplementary Sheets used (if any), including graph paper.

For office use only

	Unit 2				Total	
Question number	1	2	3	4	Marks	%
Marks						
Moderated						

Examiner's signature	

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Examiner's use only

Question 1

Write short notes on the following: **(20 marks)**

a) Photoreceptors.

b) The cornea.

c) The Crystalline lens.

d) The retina.

e) The Ciliary muscle.

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Question 1

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Question 1

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Question 2

A prism is made from glass of **refractive index 1.56** and has an **apical angle of** 20^0. A ray of white light is incident at the first face along a normal to the surface.

Calculate the following: **(20 marks)**

a) The **angle of incidence** at the **second face**.

b) The **angle of refraction** at the **second face**.

c) The **deviation** of the ray at the **second face**.

d) Draw a simple diagram showing the path of the ray through the prism, the apical angle, the angles of incidence and refraction at the **second face** and the angle of deviation.

e) Find by calculation (or other means) an **angle of incidence** at the **first face** that would result in the refracted ray at the first face meeting the second face along a normal to its surface.

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Question 2

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Question 2

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Question 3

a) A prism made from glass of refractive index **nd = 1.53** (for yellow light) has an apical angle of **34⁰**. A ray of white light is incident along a normal to the first face of the prism. If the refractive indices of the glass for red and blue light are respectively **nC = 1.52** and **nF = 1.54**, find the angle of refraction at the second face for both the red and blue rays. **(6 marks)**

b) Calculate the angle between the red and blue refracted rays. **(3 marks)**

c) What term is used to describe this phenomena? (**3 marks)**

d) Draw a simple diagram to illustrate this effect. (**3 marks)**

e) Calculate the **Abbe** number for this glass. (**3 marks)**

f) How is the Abbe number related to the Dispersive Power of the glass? **(2 marks)**

Examiner's use only

Question 3

Question 3

Examiner's use only

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Question 4

Write short notes on the following:

a) Myopia **(5 marks)**

b) Hypermetropia **(5 marks)**

c) Astigmatism **(10 marks)**

In each case give a brief description of the condition and explain how it may be corrected using ophthalmic lenses. Use diagrams to illustrate your answers.

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Question 4

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Question 4

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Important Instructions for Candidates

Please read carefully and follow these instructions when told to do so by the Examiner/Invigilator.

1. Before you start to answer any question, take a few minutes to read through the paper.

2. Please ensure your candidate number and the date are in the boxes on the front cover of this booklet.

3. Please **DO NOT** write your name on this booklet. Candidates must remain anonymous for marking purposes.

4. Write your answers as clearly as you can, using a black/blue pen only. Do not use a pencil. If the examiner cannot read your writing or figures you may lose marks, or even receive no marks at all. ***Pencils may only be used for graphs and diagrams.***

5. You should read each question carefully, and make sure that you know what you have to do before you start to answer.

6. You must write your answers in the space provided. Additional paper may be used, if necessary, but you must show your candidate number and the question number at the top of each sheet; not your name. You must also annotate the box on the front cover of this booklet to show how many extra sheets you used.

7. Please do not write in the margins.

8. Make sure your diagrams are as clear and neat as possible; you will get marks for doing so. If you need to draw a graph, use as large a scale as practicable; this will give the most accurate answer.

9. When answering mathematical questions, write **ALL YOUR CALCULATIONS IN FULL**. Even if you get the final answer wrong, you may get credit for the parts of the calculation that are correct.

10. After you have completed each answer, re-read the question to make sure you have answered it fully.

11. Try to leave yourself enough time to check the completed paper through before handing it in.

12. Do not tear out any part of this booklet. All work must be handed in.

13. Before handing your paper in, ensure your Candidate number is entered clearly on the front of this booklet and on any extra sheets you may have used.

14. Attach any sheets to this booklet and annotate how many there are in the box on the front of this booklet.

When told to do so by the Invigilator, you may turn the paper over and begin