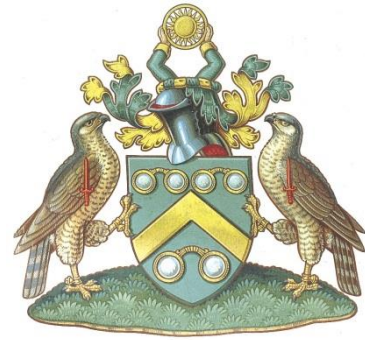


# Worshipful Company of Spectacle Makers



## Level 3 Optical Support

Unit 7: The Eye and the Principles of Optics

Summer 2018

Duration: 1.5 hours

Candidate Number:

Date:

### Answer ALL Four Questions

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

#### For office use only

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

Examiner's signature

Moderator's signature

This booklet is the property of the WCSM and **must not be removed** by the candidate from the examination room.

This page  
has been  
left blank.



<b>Q1b)</b>	Describe the relationship between refractive error and the anatomical structure of the eye in myopia <b>and</b> hyperopia.	<b>(10 marks)</b>
-------------	--	-------------------

Examiner's  
use only

Ruled area for student answer with 30 horizontal lines.

<b>Q1c)</b>	Explain <b>astigmatism</b> and how it is corrected with a spectacle lens.	<b>(5 marks)</b>
-------------	---	------------------

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**Question 2**

<b>Q2a)</b>	Explain the term <b>Chromatic Aberration</b> .	<b>(4 marks)</b>
-------------	--	------------------

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

<b>Q2b)</b>	Explain the relationship between <b>Chromatic Aberration</b> and <b>V value</b> .	<b>(2 marks)</b>
-------------	---	------------------

---

---

---

Examiner's  
use only

<b>Q2c)</b>	Calculate the <b>V value</b> for glass with the following refractive indices:  <b>i)</b> Yellow light $n_d = 1.523$ <b>ii)</b> Red light $n_c = 1.521$ <b>iii)</b> Blue light $n_F = 1.530$	<b>(6 marks)</b>
-------------	---	------------------

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

<b>Q2d)</b>	What is the relationship between the velocity ( <b>V</b> ), the frequency ( <b>f</b> ), and the wavelength ( <b><math>\lambda</math></b> ) of light?	<b>(3 marks)</b>
-------------	--	------------------

---

---

---

---

---

Examiner's  
use only

<b>Q2e)</b>	Calculate the wavelength of blue light that has a <b>velocity of <math>3 \times 10^8 \text{ms}</math></b> and a <b>frequency of <math>6.67 \times 10^{14} \text{Hz}</math></b> .	<b>(5 marks)</b>
-------------	--	------------------

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**Question 3**

<b>Q3a)</b>	State the <b>Laws of Reflection</b> .	<b>(8 marks)</b>
-------------	---------------------------------------	------------------

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

<b>Q3b)</b>	A ray of light is incident at an angle of $37^\circ$ to the normal of a plane mirror. State the <b>angle of reflection</b> .	<b>(2 marks)</b>
-------------	--	------------------

---

---

---

---

---

---

---

---

---

---

---

<b>Q3c)</b>	Calculate the <b>total deviation</b> undergone by the ray in part Q3b).	<b>(5 marks)</b>
-------------	---	------------------

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

<b>Q3d)</b>	State the properties of images formed by reflection at plane surfaces.	<b>(5 marks)</b>
-------------	--	------------------

---

---

---

---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---

---

---

**Question 4**

<b>Q4a)</b>	State the <b>Laws of Refraction</b> for light incident on a plane surface.	<b>(8 marks)</b>
-------------	--	------------------

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



<b>Q4c)</b>	If the velocity of light in a vacuum is <b><math>3 \times 10^8 \text{ m/s}</math></b> and the velocity of light in a medium is <b><math>2.25 \times 10^8 \text{ m/s}</math></b> for a wavelength of <b>589nm</b> ,  Calculate the <b>refractive index</b> of the medium for this wavelength.	<b>(4 marks)</b>
-------------	--	------------------

Examiner's  
use only

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**End of questions for this paper**

**DO NOT TURN THIS PAPER OVER UNTIL ADVISED TO DO SO BY THE INVIGILATOR**

**Important Instructions for Candidates**

Please read carefully and follow these instructions when told 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 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**