STOP WEARING GLASSES OR SEEING WITHOUT GLASSES?

This physics module is designed to be used with groups of 18 students aged 16-17.

Summary

The purpose of this series of activities is to allow pupils to join an investigative team which will study the mechanism of vision, the eye model, the different defects of vision and their corrections.

Students will work in groups to discuss, carry out several experiments, search information and pool resources.

An individual assessment will take place during the last session.

Sections include:

1. **Student Activities**
2. **Assessment**

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Objectives:

- To give students an understanding of the mechanism of vision
- To carry out experiments using the optical bench and the eye model.
- To enable students to know more about the different defects of vision and the different methods used to correct those defects so that they can make up their mind about scientific articles dealing with that topic.

Curriculum Content:

Vision, The eye model, object and image on the optical bench, convex lenses, accommodation

Prior knowledge:

Path of light in a homogeneous transparent medium, conditions required to see an object

Kind of Activity:

Communicating, working with others, critical thinking, being personally efficient, building experiments, writing a well-argued commentary.

Anticipated Time

This module is designed to be taught over five 55 minute classes.

STUDENT ACTIVITIES

SCENARIO

- VIDEO You-tube Laser Eye Surgery : the Patient Experience London Vision TV 3 min 25 sv http://www.youtube.com/watch?v=6Q_EKXN3EMg

- You, or some of your relatives or friends, are suffering from a defect of vision. Would you like to stop wearing glasses or contact lenses? Could it be possible and safe to do so?

In this series of activities you are going to join an investigative team of scientists to get enough information to answer that question.

YOUR TASKS

TASK 1 (55 min) Think about the human eye and the mechanism of vision

1. Work in groups of three people for about ten minutes. Use a rough paper and write down what you know about the eye and the mechanism of vision. List the useful key words.

2. Pooling of resources

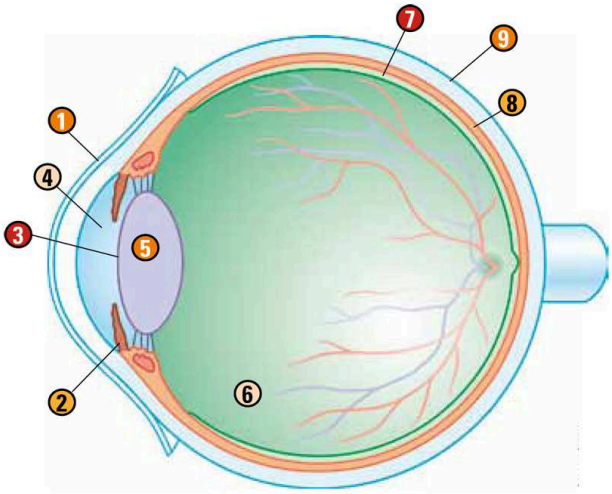
- Answer the following questions:

a) What are the conditions required to see an object?

b) What is the path of light in a homogeneous transparent medium?

c) Label the diagram below and explain the path of the light from the object to its image on the retina.

- Ciliary muscle
- Cornea
- Iris
- crystalline lens or lens
- Optic nerve
- Pupil
- Retina
- Sclera
- Vitreous humor
- Aqueous humor
- Choroid



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(extract from Prevention-santé.com)

3. Physicists use the eye model to explain the working of the human eye in the mechanism of vision.

   In your opinion, what are the constituents of the eye that take an important part in the mechanism of vision? Which devices could be used to represent them on the optical bench?

   Fill in the table below

Function	**Constituent of the eye**	**Constituent of the eye model**

4. Sketch the eye model.

TASK 2 (55 min) The eye model with an optical bench

A/ As a group you are asked to carry out an experiment describing the mechanism of vision of a distant object using the appropriate model.

Devices available: An optical bench, a set of three different convex lenses, holders for lenses, screen, a bright object (an illuminated small letter, d)

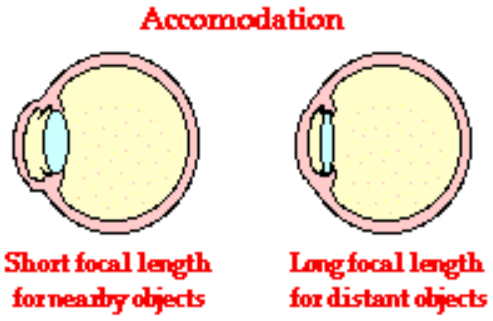
Follow the procedure below.

- Place the bright object on graduation zero on the bench.
- Position a convex lens (+ 8 δ, focal length 12.5 cm) in its holder and place it 120 cm away from the lighted object.
- Position the screen on the bench.
- Adjust the screen to get a clear image on it.
  What is the distance between the image and the lens?

1Make a sketch of that experiment. Don't forget to write the captions (see page 6)

B/ *Document* :

The distance between the retina and the cornea is fixed. The image distance is unchangeable. Subsequently, the eye must be able to alter the focal length in order to focus images of both nearby and far away objects upon the retinal surface. As the object distance changes, the focal length must be changed in order to keep the image distance constant. The ability of the eye to adjust its focal length is known as **accommodation (extract from The Physics Classroom)**



Use the previous apparatus and text to explain what happens in the human eye when observing a closer object. (The distance between the object and the lens is about 30 cm)

1Using the same scale as for the first sketch, represent your experiment. (see page 6)

1 Write a cloze test describing the accommodation.

TASK 2 part A Sketches of the experiments

Experiment 1

Experiment 2

TASK 3 (55 min) Defects of vision

- Watch the video: YouTube Laser eye surgery PRK preop.com 4 min 41 s

  http://www.youtube.com/watch?v=8BSx_CXxKW8

- What are the various defects of vision listed in the film?
- From which defect of vision was the patient suffering in the 1st film (see page1)? What did the surgeon do to cure his defect of vision?
- Myopia and hypermetropia :

  For each defect, carry out an experiment on the optical bench showing the image formed is not on the retina. Give the characteristic of the lens used and the position of the image in regard to the retina. Start your experiments describing an eye with no defects.

  Make a drawing of each experiment.

TASK 4 (55 min in class + homework) Correction of common vision defects

Myopia (short-sightedness), hyperopia or hypermetropia (long-sightedness), astigmatism, presbyopia (long-sightedness)

Find information about the different vision defects and their correction.

TASK 5 (55 min)

A/ Pooling of resources (30 min)

B/ WrittenTest (Assessment) (25 min)

Jane, who is nearly 17 years old, is suffering from myopia. She would like to get rid of her contact lenses that tend to irritate her eyes.

What would you advise her to do? Why?

TEACHER GUIDE and ASSESSMENT:

It will be formative for **TASK 1**: Every student must know what the eye model is and how it is represented in a diagram at the end of that class.

The teacher has to check that the sketches are labelled properly.

TASK 2:

- After having checked the two experiments, the corresponding sketches can be collected to give a first summative assessment. (Quality of the sketch, proper captions, correct scale, correct positions for the object and the image for both experiments)
- Cloze test: quality and clarity, appropriate choice for the key words, use of a scientific vocabulary.

TASK 3:

Formative assessment: After watching the video (three times), the students have about ten minutes to write down their answers then pooling of resources.

Summative assessment: the drawings are collected. (Quality of the drawings, titles, correct captions, correct scale, characteristic of the lens used in each case, position of the image in regard to the retina.)

TASK 4: Physics books and several web sites can be used to find information /no assessment

TASK 5:

A/ Pooling of resources

A table, as follows, can be filled in:

Defect of vision	Myopia		…
Definition or explanation			
Types of correction			
Advantages			
Disadvantages			

A volunteer student fills in the table assisted by the whole class.

- Evaluation of the contribution to the discussion based on teacher observation:
  - The student gives just one or several answers.

- His answers are quite clear and well-argued
- He gives complete sentences
- He uses a precise and proper scientific vocabulary

B/ written test : Summative assessment: well-argued commentary (advantages and drawbacks of the correction used), complete sentences, precise and proper scientific vocabulary, conclusion.