

Internal Assessment Resource

Achievement Standard Physics 91169: Demonstrate understanding of physics relevant to a selected context.

Resource reference: Physics 2.2

Resource title: DIY Adjustable Glasses

Credits: 3

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
The student: <ul style="list-style-type: none">identifies and describes the characteristics of the physics related to the given contextdescribes how and/or why the physics applies to this context.	The student: <ul style="list-style-type: none">identifies and describes in-depth the characteristics of the physics related to the given contextprovides reasons how and/or why the physics applies to this context.	The student: <ul style="list-style-type: none">comprehensively identifies and describes the characteristics of the physics related to the given contextelaborates how and/or why the physics applies to this contextjustifies why the particular physics is well-suited to this context, and/or compares alternatives.

Student instructions

Introduction

Professor Joshua Silver, a UK physicist, has a plan for bringing clear vision to a billion poor people: \$1 eyeglasses with easily adjustable, fluid-filled lenses.

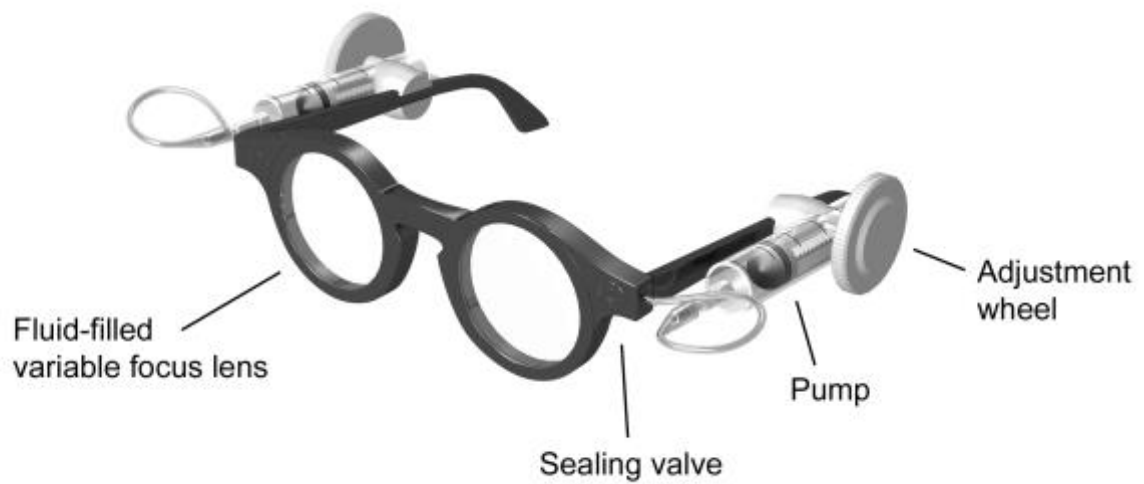
According to the World Health Organisation, "there are about one billion people who would benefit from vision correction". For many of these people, glasses are unobtainable: in parts of Africa, for example, many live on less than \$1 a day and there is only one optometrist per one million people.



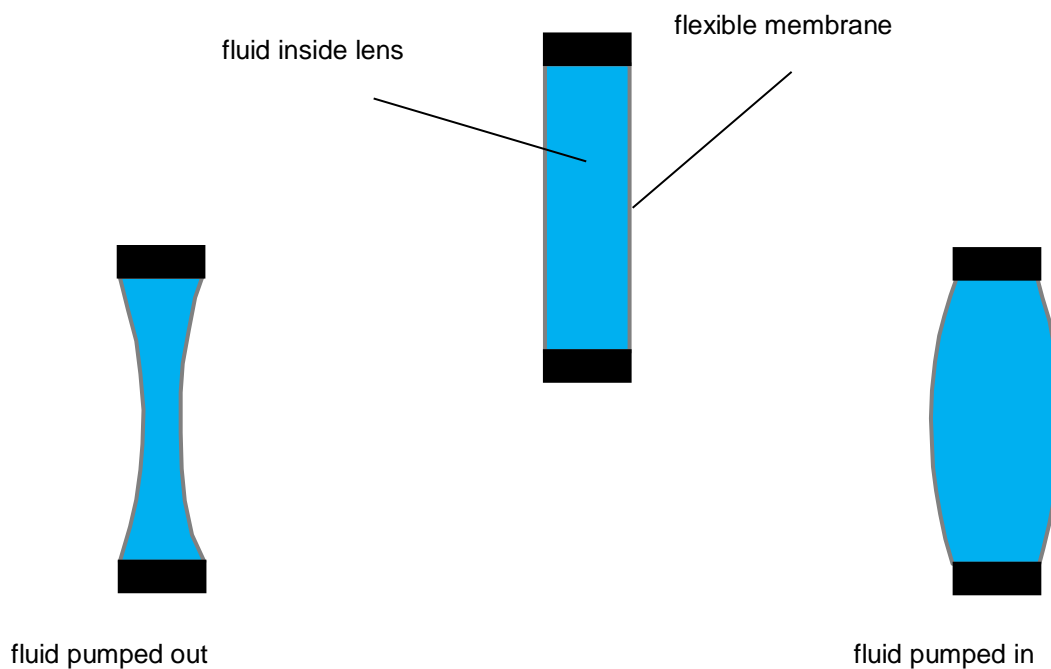
Silver invented fluid-filled lenses over 20 years ago. The fluid-filled lens is a chamber with a plastic flexible membrane on both sides. The chamber forms a clear sac that can be filled with silicone oil. The first time you put on the glasses, you use an attached syringe to

¹ Images supplied with permission by the Centre for Vision in the Developing World (<http://www.vdw.ox.ac.uk/>). Information about fluid-filled lenses abridged and amended from <http://blogs.discovermagazine.com/discoblog/2009/01/05/cheap-liquid-glasses-bring-clear-vision-to-the-poor/>.

adjust the amount of fluid in the sac. When your vision is clear, you seal the chamber, remove the syringe, and wear them just like normal glasses. Over 30,000 pairs have been distributed in 15 countries. Today, Silver continues to work on improving the technology and bring costs down.



The refractive index of silicone oil is 1.406. To adjust the lens, you turn a knob that pumps fluid into or out of the chamber.



In this assessment, you will research the physics of fluid-filled lenses and then prepare a report that explains the relevant physics principles.

This is an **individual assessment** task: you will do your own research and write your own report.

Task

Process your research information and use it as the basis for a report in which you use physics principles to **explain how adjustable fluid-filled lenses work**.

Your report should include the following key points:

- the **physics of lenses**
- how lenses are able to correct **short-sightedness, long-sightedness** and **loss of accommodation**
- why it is necessary to be able to pump the fluid in and out of the lenses
- a rationale, in terms of physics theory, for the **choices that were made in the design of materials used** in the glasses.

The report will be assessed on how well you describe the relevant physics and integrate it into the context of fluid-filled lenses. In your report, you should aim to **elaborate, justify, evaluate, compare** and **contrast**, or **analyse** the physics that underpins the context. The report will also be assessed on how well you **gather** and **reference** your information.

As a guideline, written reports should not be more than 1000 words and should include illustrations, diagrams and graphs, where appropriate (note: this page has a word count of 300 words).

The report could be modified to accommodate other formats such as:

- poster display (including supporting notes)
- video

All sources of information, images, diagrams (those not generated by the student) and data must be acknowledged and recorded in a traceable format (which means someone else could go straight to where the information came from).

Well documented evidence of how your information has been gathered will need to be shown by providing a complete formal bibliography.

For achievement at Merit or Excellence level, it will be expected you will be able to verbally answer questions relating to your report.

The report or agreed format and all research documentation will need to be handed in to your teacher by _____

Assessment Schedule AS91169 (Physics 2.2): DIY Adjustable Glasses

Part A: Research Content

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
<p>The student:</p> <ul style="list-style-type: none"> identifies and describes the characteristics of the physics related to the given context describes how and/or why the physics applies to this context. <p>For example, they provide the following information:</p> <ul style="list-style-type: none"> <i>light refracts towards the normal as light enters a denser medium</i> <i>light refracts away from the normal as light leaves a denser medium</i> <i>the shape of convex lens causes light to converge</i> <i>the shape of concave lens causes light to diverge</i> <i>how an external lens in front of the eye can correct long sight and short sight.</i> <i>how the thickness / shape of the corrective lens relates to the severity of the long / short sightedness.</i> 	<p>The student:</p> <ul style="list-style-type: none"> identifies and describes in depth the characteristics of the physics related to the given context provides reasons how and/or why the physics applies to this context. <p>For example, they provide the following information:</p> <ul style="list-style-type: none"> <i>refraction is dependent on the refractive index of the lens</i> <i>different liquids have different refractive indexes, therefore different liquids have a different effect on the power of a (same shaped) fluid filled lens</i> <i>silicone oil is more suitable than water because it has a greater refractive index and so refracts light more for the same quantity of fluid</i> <i>in fluid filled convex lenses, if more liquid is pumped into the lens, the convex lens changes shape in such a way that light converges more</i> <i>in fluid filled concave lenses, if more liquid is removed from the lens, the concave lens changes shape in such a way that light diverges more</i> <i>how increased convergence or divergence of light improves specific vision problems.</i> 	<p>The student:</p> <ul style="list-style-type: none"> comprehensively identifies and describes the characteristics of the physics related to the given context elaborates how and/or why the physics applies to this context justifies why the particular physics is well-suited to this context, and/or compares alternatives. <p>For example, they provide the following information:</p> <ul style="list-style-type: none"> <i>refraction and therefore lens power is a function of the refractive index of the lens material</i> <i>silicone oil has a greater refractive index than water, but smaller refractive index than glass or plastic – lenses made of silicone oil must be thicker than glasses made of glass or plastic and are therefore “clunky” compared to them</i> <i>a detailed explanation of how concave lenses reduce short-sightedness including details of what short-sightedness is, what a short-sightedness person would see without the aid of glasses, and how the glasses help a short-sightedness person</i> <i>a detailed explanation of how convex lenses reduce long-sightedness and loss of accommodation including details of what long-sightedness/loss of accommodation is, what a long-sightedness/loss of accommodation person would see without the aid of glasses, and how the glasses help a long-sightedness/loss of accommodation person.</i>