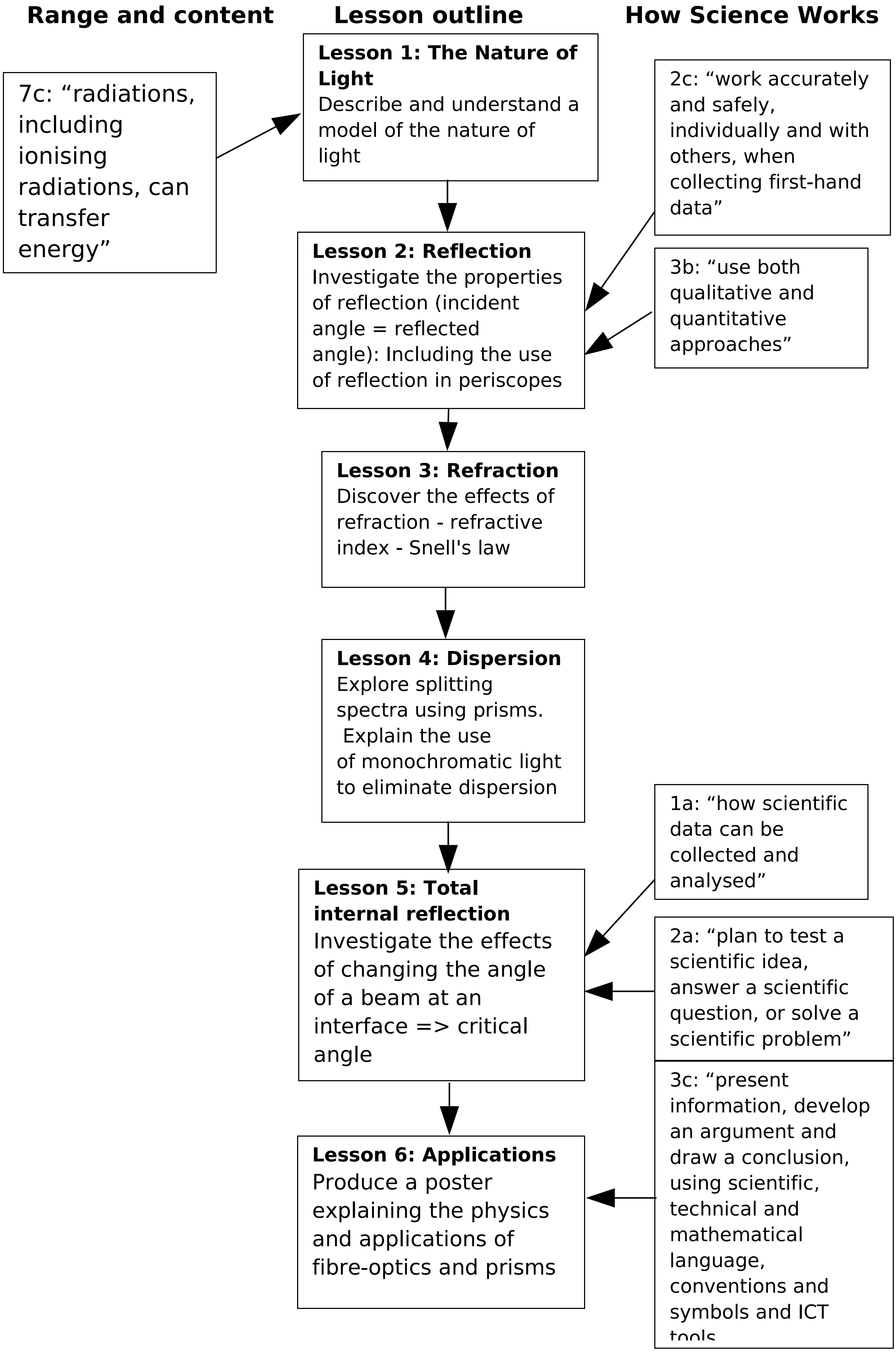
A topic plan for a KS4 series of lessons on optics

Including reflection, refraction and T.I.R.

By
Victor Hui
Mark Perryman
Kristina Hakansson


Range and content
Lesson outline
How Science Works
7c: “radiations, including ionising radiations, can transfer energy”
Lesson 1: The Nature of Light
Describe and understand a model of the nature of light
2c: “work accurately and safely, individually and with others, when collecting first-hand data”
Lesson 2: Reflection
Investigate the properties of reflection (incident angle = reflected angle): Including the use of reflection in periscopes
3b: “use both qualitative and quantitative approaches”
Lesson 3: Refraction
Discover the effects of refraction - refractive index - Snell's law
Lesson 4: Dispersion
Explore splitting spectra using prisms. Explain the use of monochromatic light to eliminate dispersion
1a: “how scientific data can be collected and analysed”
Lesson 5: Total internal reflection
Investigate the effects of changing the angle of a beam at an interface => critical angle
2a: “plan to test a scientific idea, answer a scientific question, or solve a scientific problem”
Lesson 6: Applications
Produce a poster explaining the physics and applications of fibre-optics and prisms
3c: “present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools

PGCE Secondary Science

Lesson title	Lesson 1: The nature of light

NC / syllabus ref	Science KS4, 7c "radiations, including ionising radiations, can transfer energy"

Learning Objectives **'We are learning to…'**
1. Describe light as a wave which transfers energy from one place to another
2. Understand the meaning of the words opaque, translucent and transparent
3. Explain how we see coloured objects
4. State that light travels in a straight line

Possible assessment strategies (tick)	
Rich questioning ✓	Self/peer assessment ✓
Rich activity	Negotiated targets
Observation ✓	
Feedback	

Resources Required
Prism Raybox A4 paper Barrier, e.g. a book Mini-whiteboards Pens Wipes

Science Lesson Outline

Time	**Pupil activity** Describe the activity, including the groupings. This may be in note form but should be in sufficient detail to enable a competent practitioner to teach	**Teaching and learning** Include teaching and learning styles/scripted differentiated questions/opportunities for assessing the learning during the activity, during mini plenaries etc	**Resources needed**
5 min	To start this new topic, ask open questions about light.	Assessment of what pupils already know about light. What is light? What do you know about light? What is colour?	
5 mins	Explain that light is a transfer of energy using electromagnetic waves. Demonstrate what happens when you shine light through a prism.		Prism Raybox
10 mins	Talk about how shadows are created; show some examples on the wall using a bright light bulb. Ask the students how we can make the shadows sharper or more blurred (they probably know this from experience). Ask students to explain why.		
5 mins	Introduce the words opaque, translucent and transparent.		
10 mins	In groups of 3-4, get students to write as many examples of opaque, translucent and transparent materials/objects as possible. After 5 minutes, ask each group to read out their answers.		
5 min	Show a diagram of how a raybox works. Explain that the light emitted from a light bulb travels in all directions so if we put it in a		

	box with a slit we only get the parts of the beam that travel in that direction. This is how a ray is created.		
10 min	Demonstrate the use of a raybox on a sheet of paper. Can see that light travels in a straight line. Put an opaque barrier in the way → light ray stops.		Raybox A4 paper Barrier, e.g. a book
10 min	"Who wants to be a millionaire" quiz on light. Use mini-whiteboards for answers. The letter that most students choose is the answer selected.		Mini-whiteboards Pens Wipes

PGCE Secondary Science

Lesson title	Lesson 2: Reflection

NC / syllabus ref	Science KS4: How Science works 2c "work accurately and safely, individually and with others, when collecting first-hand data" 3b "use both qualitative and quantitative approaches"

Learning Objectives **'We are learning to…'**
1. Know how light is reflected
2. Understand how we use reflection in everyday life

Possible assessment strategies (tick)	
Rich questioning ✓	Self/peer assessment
Rich activity	Negotiated targets
Observation ✓	
Feedback	

Resources Required
Rayboxes (10) Mirrors (20) Sheets of A4 paper Blutack to stick mirrors to paper and paper to desk Rulers Protractors Periscope worksheet

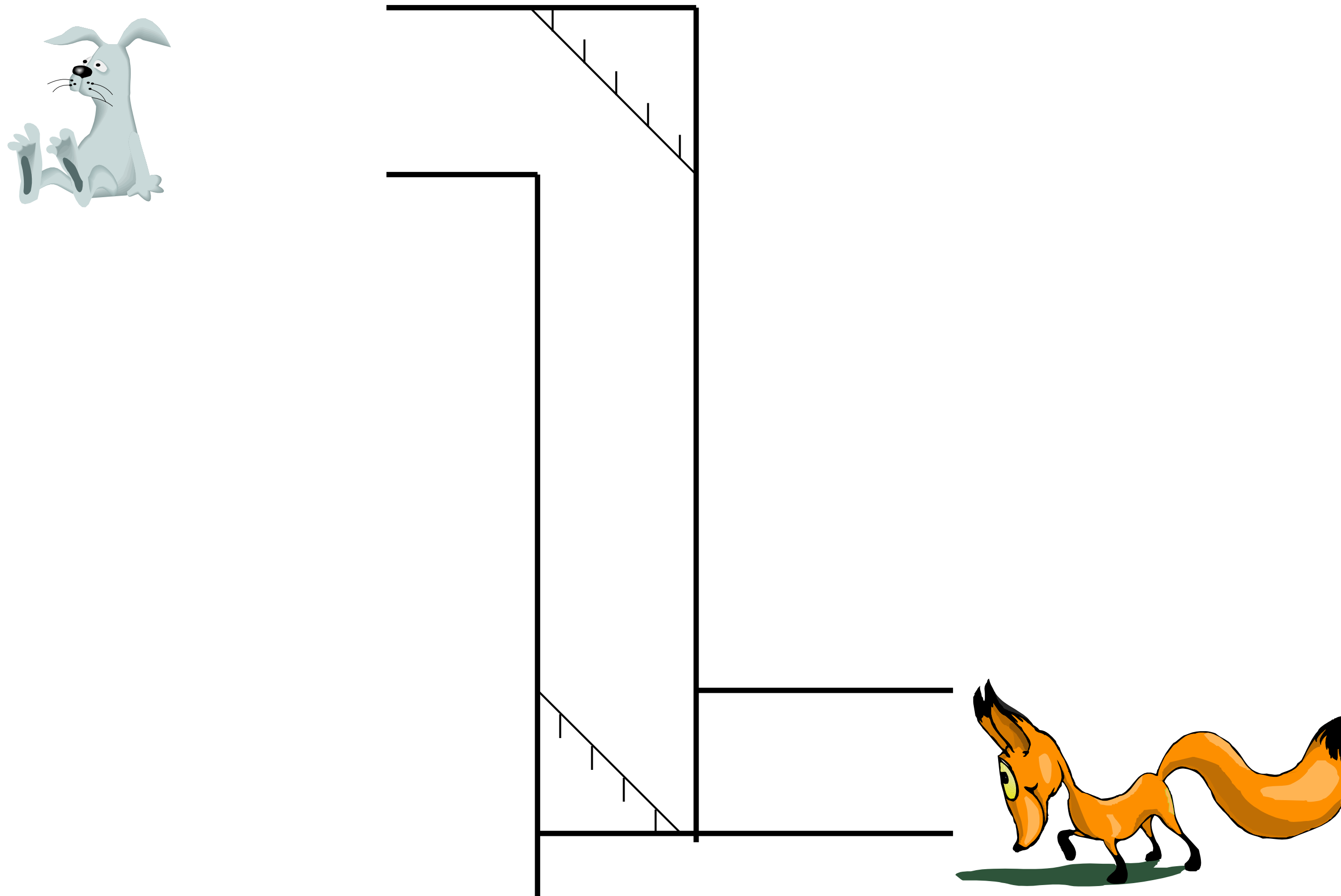
Science Lesson Outline

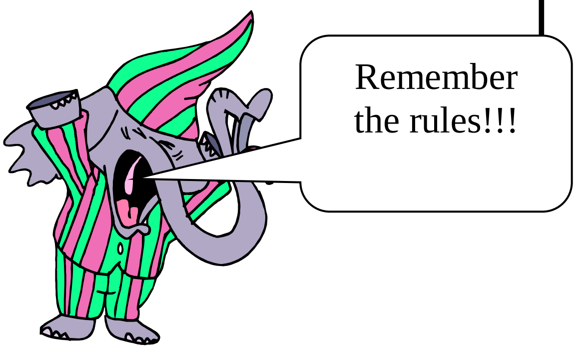
Time	**Pupil activity** Describe the activity, including the groupings. This may be in note form but should be in sufficient detail to enable a competent practitioner to teach	**Teaching and learning** Include teaching and learning styles/scripted differentiated questions/opportunities for assessing the learning during the activity, during mini plenaries etc	**Resources needed**
10 min	Introduce reflection. Ask students if they can think of any uses of reflection in real life. (mirrors, periscopes etc) Talk about how police cars and ambulances have backwards writing on them.		
10 min	Using a raybox and a mirror standing on a sheet of paper and working in groups of 3, students shine a ray of light onto the mirror and trace (using a ruler) the incident and reflected rays, as well as the plane of the mirror on the paper.	Practical work. Light ray tracing	Rayboxes Mirrors Sheets of A4 paper Blutack Rulers
5 min	Draw a line to show the normal to the mirror plane (using a protractor). Measure the angles between the normal and the two rays drawn on the paper.	Making accurate drawings, using a protractor.	Protractors
10 min	Give each group another mirror and ask them to align them to get a (horizontal) periscope.		
5 min	Students to put equipment back on shelves.		
10 min	Give each student a copy of the periscope worksheet and ask them to draw the light ray from the rabbit to the fox.		Periscope worksheet
10 min	What have we learnt today? Get students to work out what the learning objectives were and ask them to show thumbs up if they feel confident that they have achieved each learning objective.		

(Source: http://www.tes.co.uk/teaching-resource/Periscopes-3008299/)

Periscopes

Complete the diagram to show how the fox can see the rabbit.





1. Light travels in straight lines
2. Use a ruler and pencil
3. Reflect from the surface of the mirror
4. Angle of reflection = angle of incidence
5. Arrows
6. The ray must start at the object and enter the eye

(Source: http://www.tes.co.uk/teaching-resource/Periscopes-3008299/)

PGCE Secondary Science

Trainee	Victor Hui
School	SCT4

Lesson title and context (prior learning)	Snell's law: the law of refraction (The law of reflection)

Date	3rd of 6 lessons	**Period/Time**	
Class Size	30	**Year/Class**	9
Topic	Propagation of light	**Room**	

Ability	Mixed	**NC / syllabus ref**	

Learning Objectives **'We are learning to…'**	**Learning Outcomes** **'What I am looking for….'** **(Match to learning objectives)**
1. Know that light travels slower in dense media than in air.	1. That explains the apparent depth of a swimming pool when observed from above.
2. Know that the term refraction describes the phenomena of light that deviates from its direction of propagation when entering another medium.	2. Be able make the distinction between the phenomena of reflection and reflection.

3. Know that refraction Snell's law: where is the refractive index of the material	3. To know that Snell's law can be verified experimentally.

Possible assessment strategies (tick)	
Rich questioning √	Self/peer assessment √
Rich activity √	Negotiated targets
Observation √	
Feedback √	

Differentiation (activities and/or teaching style)		
SUPPORT LEARNERS	**CHALLENGE LEARNERS**	
To perform two experiments of refraction: light incident into perplex and glass blocks.	To understand mathematical meaning of the sine function.	

Resources Required	**Use of IT**
• Light boxes • Perplex blocks • Glass blocks • Protractors • Rulers. • Calculators.	

Risk Assessment – action points to be incorporated into the lesson activities (tick to ensure completion)		
Risk	**Precaution / Action**	

The light boxes could get very hot	Verbal precaution

Deployment of support staff e.g. teaching assistant; technician etc.		
Staff	**Task**	
Technician	Allocation of equipments	

Homework Task	**Deadline**
Finish the write up of the experiment.	Bring the work to the next lesson.

Science Lesson Outline

Time /min	Pupil activity Describe the activity, including the groupings. This may be in note form but should be in sufficient detail to enable a competent practitioner to teach	Teaching and learning Include teaching and learning styles/scripted differentiated questions/opportunities for assessing the learning during the activity, during mini plenaries etc	Resources needed
00:00 - 00:05	Observe illustrations and photographs that depict the phenomena of refraction and determine which normally occur and never occur.	**Starter:** • I will show 10 illustrations and photographs, write down which pictures depicts a commonly occurred phenomenon. • ***Q: Where would you have seen the phenomenon.*** • ***Q: Why do some illustrations show a kink of a straight object if half of which is embed in another medium?***	10 illustrations and photographs show a straw in a glass of water, picture underneath a block of glass, fish tanks, etc.

00: 05- 00:15	• Work in pairs • discuss with each other a way to complete a ray tracing diagram on a work sheet that would explain the apparent depth of a swimming pool.	• (Assessment) walked around the classroom to join in the discussions. • Pay attention to good explanations and misconceptions. • Select representative explanation and misconception and ask the pupil originators to explain their reasoning to the whole class. • ***Q: Imagine walking from one patch of land into another one but keeping the same pace (number of steps per allocated time).*** • ***Q: How to adjust the steps of the walk such that the walking path is deviated from its course the way the ray-tracing diagram shown?*** • ***Q: In order to explain the apparent depth, we conclude that light enter water must deviate from its direction of propagation.***	Display the apparent depth illustration but leave out the ray-tracing part of it for the pupils to complete.
00:15 - 00:25	• Response to questions. • Use the ray-tracing diagram worksheet to find out the speed of light in the water of the swimming pool. • Write Snell's law down in notebooks.	• ***Q: Use ray-tracing diagram, surely there is way to find out the speed of light in the water of the swimming pool. How? (waiting time a minute or two)*** • Formally introduce Snell's law: display Snell's law and definitions over the projector. • Brief explanation of the sine function and demonstrate the operation using a calculator.	
00:25 - 00:55	**Practical:** • Work in pairs. • Trace the ray of incidence and refraction of light through a block of perplex or glass and verify Snell's law. • Take the reading of the angles and plot the graph.	• Quick demonstrate the experiment. • ***Q: What are the dependent, independent and controlled parameters of the experiment.*** • (Assessment) walk around the classroom and assess the progress of the experiments and the result calculation. • Make sure the pupils are aware that the refractive index is different for different materials.	• Light boxes. • Perplex and glass blocks. • Protractors. • Rulers. • Graph paper. • Calculators.

00:55 - 00:60	**Practical:** • Watch my demonstration. • Work in groups of 6 (formed from 3 working pairs) • Replicate my demonstration.	**Plenary:** • Move over to one group. • Demonstrate using the corner sections of perplex or glass blocks to change the direction of light propagation. • ***The ability to change the direction of propagation found many practical applications. Lenses in different shape can converge and diverge the beams of the light.*** • Use three blocks to converge and diverge three beams of light.	

PGCE Secondary Science

Trainee	Victor Hui
School	SCT4

Lesson title and context (prior learning)	Internal reflection. (Snell's law: the law of refraction)

Date	4^{th} of 6 lessons	**Period/Time**	
Class Size	30	**Year/Class**	9
Topic	Propagation of light	**Room**	

Ability	Mixed	**NC / syllabus ref**	

Learning Objectives **'We are learning to…'**	**Learning Outcomes** **'What I am looking for….'** **(Match to learning objectives)**
1. Know that the path of a ray is reversible.	1. The phenomenon can be demonstrated using a prism.
2. Know that there exists a critical incident angle beyond which a beam of light incident from a dense medium to a less dense medium will not emerge but totally and internally reflected.	2. That the image of reflection can be seen on the interface of the water and air from inside the water.

3. Know that the critical angle for total internal reflection can be derived from Snell's law	3. Be able to use the formula to calculate the critical angles for totally internal reflection for different materials.

Possible assessment strategies (tick)	
Rich questioning√	Self/peer assessment √
Rich activity√	Negotiated targets
Observation √	
Feedback √	

Differentiation (activities and/or teaching style)		
SUPPORT LEARNERS	**CHALLENGE LEARNERS**	
To perform two experiments of refraction: light incident into perplex and glass blocks.	To understand mathematical meaning of the sine function.	

Resources Required	Use of IT
• Light boxes • glass blocks. • Semi circular perplex and glass prisms. • Protractors • Rulers. • Calculators.	

Risk Assessment – action points to be incorporated into the lesson activities (tick to ensure completion)		

Risk	Precaution / Action
The light boxes could get very hot	Verbal precaution

Deployment of support staff e.g. teaching assistant; technician etc.		
Staff	**Task**	
Technician	Allocation of equipments	

Homework Task	Deadline

Science Lesson Outline

Time /min	**Pupil activity** Describe the activity, including the groupings. This may be in note form but should be in sufficient detail to enable a competent practitioner to teach	**Teaching and learning** Include teaching and learning styles/scripted differentiated questions/opportunities for assessing the learning during the activity, during mini plenaries etc	**Resources needed**
00:00 - 00:05	Peer-assess the written work of the experiment done in the last sentence.	Explain the assessment criteria	

00: 05- 00:15	• Class discussion. • Write down the explanations of the observations.	**Starter: examining the observations of the experiments did in the last lesson (law of refraction).** • ***Q: Is there any refraction if the ray is incident normally into the block?*** • Yes, but the angle of refraction is zero. • ***Q: What do you notice to the beam of light incident and emerged from the block?*** • Demonstrate using a pupil's report that the rays are parallel. Rotate the ray-tracing diagram half a circle, the ray diagram is indistinguishable. Conclude that the path of the light beam is reversible. • ***Q: What do you notice about the graphs you plotted for last lesson's experiments?*** • ***Q: What happens when the angle of incident becomes 90^o?*** • ***Q: Since the path of the light ray is reversible, imagine what happens to a beam of light incident from inside the glass block?*** • It implies a beam of light if incident at certain critical from the inside of the glass block, it cannot come out. • ***Q: How can we send a beam of light into a glass block such that it will incident into the air at the other side of block will be greater than the critical angle.*** • Sending a ray into a semi-circular prism. The beam will always be normally incident, therefore the angle of refraction is zero.	
00:15 - 00:20	Writing down the definition and method into the notebooks.	Formally introduce the definition and method of calculation of the critical angle for total internal reflection.	Display the definition and method.

00:20 - 00:50	**Practical:** • Work in pairs. • Trace the ray of incidence and refraction of light through a perplex or glass semi-circular prisms. • Take the reading of the angles and plot the graph. • Verify Snell's law. • Estimate the critical angle for total internal reflection using the graph. • Compare the refractive index with the one obtained in the last lesson. • Compare the estimate with the calculation using Snell's law. • Pupils will have time to write up the experiment report.	• Quick demonstrate the experiment. • ***Q: What are the dependent, independent and controlled parameters of the experiment.*** • (Assessment) walk around the classroom and assess the progress of the experiments and the result calculation.	• Light boxes. • Perplex and glass semi-circular prisms. • Protractors. • Rulers. • Graph paper. • Calculators.
00:50 - 00:60	**Practical:** • Watch my demonstration. • Work in groups of 6 (formed from 3 working pairs) • Replicate my demonstration.	**Plenary:** • Demonstrate that the semi-circular glass prism can be used as reflector. • ***Q: What are differences and similarities of prism reflectors and mirror?*** • Energy loss in prism reflectors can be lower than metal coated glass mirror. A prism reflector is made from one material only.	

Lesson Plan

Topic

Optics – Refraction – Critical Angle and Total Internal Reflection
5th Lesson of 6. In this lesson we extend our investigation into critical angles

National Curriculum References

How science works
1.1a - how scientific data can be collected and analysed
1.2a - plan to test a scientific idea, answer a scientific question, or solve a scientific problem

Pupil Learning Targets

Understand how critical angles and total internal reflection appear.
Notice that internal reflection effects build up gradually

Resources:

Equipment required per experiment:

- 1 semicircular prism
- 1 laser/beam box
- 1 protractor
- Graph paper

Risk Assessment

Ensure pupils are aware not to shine lights towards anyone’s eyes.
Pupils must take care not to risk dropping or damaging the prisms.

Homework

Research real-life uses of fibre optics and prisms for poster session during following lesson

Lesson Outline

Time	Pupil activity	Teaching and learning	Resources needed
10 min	WHOLE CLASS Recap previous refraction lessons. Pupils suggest potential variables in a refraction experiment. Assuming that varying the angle is suggested, discuss the apparatus, controls, etc that will be required to investigate this. - Measure effect from air to glass or vice-versa? - Reason for using semicircular prism.	Lead whole class discussion. [ASSESSMENT]	none
10 min	GROUPS OF 4 Set up apparatus.	Demonstrate set-up of apparatus, including procedure for recording data.	+ Prism + Light source + Protractor
20 min	GROUPS OF 4 Beginning at an angle of incidence of 90º, take readings at 10º intervals until an angle of 10º. Record data.	Supervise practical, ensure all pupils are participating, and that there are no systematic errors in any of the experiments. [ASSESSMENT]	Table for recording results
10 min	GROUPS OF 4 Plot graph, analyse results	Ensure that pupils have finished recording results. Pupils should notice that past the critical angle, no more refraction takes place.	Graph paper
10 min	WHOLE CLASS Summarise findings, introduce next lesson (real life applications of optics)		none

Lesson Plan

Topic

Optics – Refraction – Applications of Total Internal Reflection

In the final lesson of the series, pupils produce a poster to summarise the content of the previous lessons and form a solid basis for an understanding of the applications of optics

National Curriculum References

How science works:

1.3c - present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools.

1.4a - about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks

Pupil Learning Targets

Produce a poster explaining the physics and applications of fibre-optics and prisms
Understand the importance of total internal reflection to modern technologies.

Resources

- A0 paper (1 sheet per 4 pupils)
- Articles detailing uses of fibre-optics in medicine and telecomunications; and uses of prisms in high-end telescopes and periscopes. [included as Appendix]

Access to computers for research and printing

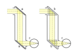
Lesson Outline

Time	Pupil activity	Teaching and learning	Reso urces needed
10 min	WHOLE CLASS Recap previous lessons Explain task: “You must produce a poster that explains how total internal reflection works, and how it is used in modern technologies. You may assume an audience of year 10 pupils.”	Clear up remaining misconceptions from previous lesson.	
40 min	GROUPS OF 4 Use available resources (from previous lesson’s learning, homework, articles provided to the class, internet research) to produce a poster. It must describe the Physics principles and discoveries from previous lessons, in addition to an overview of the applications.	Teacher circulates around groups, ensuring that they are on task. As the lesson progresses, the teacher will be able to assess the pupils’ participation and understanding.	A0 Paper
10 min	WHOLE CLASS Topic plenary. Each group is asked in turn to name one thing they have learnt during the previous 6 lessons. Continue until everything has been covered, or lesson ends.	Opportunity for final learning combined with summative assessment. Pupils summarising what they have learnt in their own words is a useful internalisation strategy.	

Periscope

From Wikipedia, the free encyclopedia

A **periscope** is an instrument for observation from a concealed position. In its simplest form it consists of a tube with mirrors at each end set parallel to each other at a 45-degree angle. This form of periscope, with the addition of two simple lenses, served for observation purposes in the trenches during World War I. Military personnel also use periscopes in some gun turrets and in armored vehicles.



Principle of the periscope. The periscope on the left uses mirrors at location "a" whereas the right uses prisms at "b". The observer is "c".

More complex periscopes, using prisms instead of mirrors, and providing magnification, operate on submarines. The overall design of the classical submarine periscope is very simple: two telescopes pointed into each other. If the two telescopes have different individual magnification, the difference between them causes an overall magnification or reduction.

Contents

Early examples

Johann Gutenberg, better known for his contribution to printing technology, marketed a kind of periscope in the 1430s to enable pilgrims to see over the heads of the crowd at the vigintennial religious festival at Aachen. Johannes Hevelius described an early periscope with lenses in 1647 in his work *Selenographia, sive Lunae descriptio* [Selenography, or an account of the Moon]. Hevelius saw military applications for his invention. Simon Lake used periscopes in his submarines in 1902. Sir Howard Grubb perfected the device in World War I.[1] Morgan Robertson (1861–1915) claimed[*citation needed*] to have tried to patent the periscope: he described a submarine using a periscope in his fictional works.

Australian Light Horse troops using a periscope rifle, Gallipoli 1915. Photograph by Ernest

Periscopes, in some cases fixed to rifles, served in World War I to enable soldiers to see over of the tops of trenches, thus avoiding exposure to enemy fire (especially from snipers).[2]

Brooks.

Tanks use periscopes extensively: they enable drivers or tank commanders to inspect their situation without leaving the safety of the tank. An important development, the Gundlach rotary periscope, incorporated a rotating top; this allowed a tank commander to obtain a 360-degree field of view without moving his seat. This design, patented by Rudolf Gundlach in 1936, was first used in the Polish 7-TP light tank (produced from 1935 to 1939). As a part of Polish-British pre-World War II military cooperation, the patent was sold to Vickers-Armstrong for use in British tanks, including the *Crusader*, *Churchill*, *Valentine*, and *Cromwell*. The technology was also transferred to the American Army for use in its tanks, including the *Sherman*. The USSR later copied the design and used it extensively in its tanks (including the T-34 and T-70); Germany also made and used copies.[3]

Periscopes proved useful in trench warfare, as seen in the illustrations, representative of action at Gallipoli in 1915.

Naval use

Periscopes allow a submarine, when submerged at a shallow depth, to search visually for nearby targets and threats on the surface of the water and in the air. When not in use, a submarine's periscope retracts into the hull. A submarine commander in tactical conditions must exercise discretion when using his periscope, since it creates a visible wake and may also become detectable by radar, giving away the sub's position.


Officer at periscope in control room of a U.S. Navy submarine in World War II

The Frenchman Marie Davey built a simple, fixed naval periscope using mirrors in 1854. Thomas H. Doughty of the US Navy later invented a prismatic version for use in the American Civil War of 1861-1865.

The invention of the collapsible periscope for use in submarine warfare is usually credited to Simon Lake in 1902. Lake called his device the *omniscope* or *skalomniscope*. There is also a report[*citation needed*] that an Italian, Triulzi, demonstrated such a device in 1901, calling it a *cleptoscope*.

In another early example of naval use of periscopes, Captain Arthur Krebs adapted two on the experimental French submarine *Gymnote* in 1888 and 1889. Perhaps the earliest example came in 1888 from the Spanish inventor Isaac Peral on his submarine *Peral* - developed in 1886 but launched on September 8, 1888. Peral's fixed, non-retractable periscope used a combination of prisms to rely the image to the submariner, but his submarine pioneered the ability to fire live torpedoes while submerged. Peral also developed a primitive gyroscope for his submarine navigation.[4]

As of 2009 modern submarine periscopes incorporate lenses for magnification and function as telescopes. They typically employ prisms and total internal reflection instead of mirrors, because prisms, which do not require coatings on the reflecting surface, are much more rugged than mirrors. They may have additional optical capabilities such as range-finding and targeting. The mechanical systems of submarine periscopes typically use hydraulics and need to be quite sturdy to withstand the drag through water. The periscope chassis may also support a radio or radar antenna.

Submarines traditionally had two periscopes; a navigation or observation periscope and a targeting, or commander's, periscope. Early navies originally mounted these periscopes in the conning tower, one forward of the other in the narrow hulls of diesel-electric submarines. In the much wider hulls of recent US Navy submarines, the two operate side-by-side. The observation scope, used to scan the sea surface and sky, typically had a wide field of view and no magnification or low-power magnification. The targeting or "attack" periscope, by comparison, had a narrower field of view and higher magnification. In World War II and earlier submarines it was the only means of gathering target data to accurately fire a torpedo, since sonar was not yet sufficiently advanced for this purpose (ranging with sonar required emission of an electronic "ping" that gave away the location of the submarine) and most torpedoes were unguided.

A torpedoed Japanese destroyer, photographed through the periscope of U.S.S. *Wahoo* or of U.S.S. *Nautilus*, June 1942

21st century submarines do not necessarily have periscopes. The United States Navy's *Virginia*-class submarines and the Royal Navy's Astute Class submarines instead use photonics masts, pioneered by the Royal Navy's HMS *Trenchant*, which lift an electronic imaging sensor-set above the water. Signals from the sensor-set travel electronically to workstations in the submarine's control center. While the cables carrying the signal must penetrate the submarine's hull, they use a much smaller and more easily sealed—and therefore less expensive and safer—hull opening than those required by periscopes. Eliminating the telescoping tube running through the conning tower also allows greater freedom in designing the pressure hull and in placing internal equipment.

See also

- Vickers Tank Periscope MK.IV
- Relay lens

References

1. ^ [1] (http://inventors.about.com/library/inventors/blperiscope.htm)
2. ^ *First World War* - Willmott, H.P.; Dorling Kindersley, 2003, Page 1337
3. ^ Not Only Enigma... Major Rudolf Gundlach (1892-1957) and His Invention), Warsaw-London, 1999
4. ^ http://pedrocurto.com/1.html

External links

- *The Fleet Type Submarine Online: Submarine Periscope Manual* (http://www.maritime.org/fleetsub/pscope/index.htm) United States Navy **Navpers 16165**, June 1946
- *Simulation of a Periscope* (http://www.phy.ntnu.edu.tw/ntnujava/index.php?topic=1348.0) at NTNUJAVA Virtual Physics Laboratory (http://www.phy.ntnu.edu.tw/ntnujava/index.php)

Categories: Optical devices | Submarines | British inventions

Why Fibre Optic Broadband Is Better

Updated 13th January 2011 0 Share

The

future's looking bright and many are enjoying internet access at the speed of light. Read our informative fibre optic broadband guide to find out why you should too.

There are several types of broadband out there, with most people getting online using their landline telephone connection.

Fibre optic cable broadband is the future, so it's time to do away with the telephone wires which have served us so well over the years in favour of a much faster, modern alternative.

In the UK, Virgin Media is the largest fibre optic internet service provider, although BT is catching up with its own fibre optic network being gradually rolled out to replace the older network.

Fibre optic broadband is better than its main rivals for a number of key reasons, the most important of which is speed!

How does fibre optic broadband work?

Fibre optic broadband reaches homes and businesses via an extensive network of underground cables rather than the overhead wires that provide older dial-up and broadband internet connections.

Because the cabling is laid underground is that there is no chance of damage being caused by wind, rain, sleet, stray tree branches or any other factors that can affect telephone wires and leave you without an internet connection for hours or days. You can always rely on a fibre optic broadband connection to provide you with unbroken internet access.

How fast is fibre optic broadband?

Fibre optic broadband is the best choice for anyone who wants the fastest possible internet connection. Current download speeds available from fibre optic providers can reach up to 50Mbps and in the future this will be ramped up to 200Mbps or more as the technology continues to improve.

Rather than electrical signals sent via copper wire, a technology which dates back to the invention of the telephone, fibre optic networks send digital information via glass fibre cables. Much faster and far more reliable!

Fibre optic broadband is also more consistent than alternatives and no matter where you are on the network you'll be able to get online at close to the advertised speed.

Postcode checker
Compare the latest cable packages, deals & offers in your area

Postcode

Check

Providers
We work with the UK's leading providers. Select a provider to find out more.

See all providers

Cable | Virgin Broadband | Virgin TV | Broadband, TV & Phone | Sky TV | Sky HD | BT Broadband

This is because the fibre optic signal doesn't become weaker over distances. In other words, whether you live next door to your local telephone exchange or miles away, you'll probably get the internet at close to the speeds your fibre optic provider advertises, not at a fraction of the speed, which is a real problem for people relying on telephone line-based broadband.

How much does fibre optic broadband cost?

Many people will be more concerned with the monthly cost of their broadband connection, rather than the speed and consistency that it offers. The good news is that fibre optic broadband is competitively priced and will usually cost the same as or even less than an equivalent connection from a traditional provider.

In most cases this will make the choice easier, because you'll be able to compare two connections on their own merits rather than just on how much you are going to save by choosing one provider over another. It'll also be easier for people who value performance above all else to get the kind of broadband connection that they've always dreamed of. High speed broadband is no longer a high cost service.

Is faster broadband always better?

Talking about fibre optic broadband in relation to its speed and connection consistency is all well and good if you know what they can be used for, but you may be in the dark as to why any of these features are actually better and worth having. Getting access to a high speed broadband connection opens up all that the internet has to offer.

Entertainment and information of all kinds are available online, from high definition movies to online gaming, social networking to voice calls over your internet connection. If you have a sluggish service provider then you'll only be able to enjoy a fraction of this next generation of content, but with fibre optic broadband there should be far fewer restrictions.

It also means that you could save hours of your life that you might spend waiting for a website to refresh or a file to download on a broadband connection that doesn't use fibre optic technology.

Who can get fibre optic broadband?

At the moment there are two major UK firms offering fibre optic broadband. Virgin Media has the most fibre optic broadband customers because it has the biggest network, covering over half of all UK households.

BT is the second main provider. However, at the moment it has fibre optic services available in a fairly small number of locations around the country but it's investing over a billion pounds in making sure that many more people can get its fibre optic broadband in the future.

For the moment the people who happen to live in the largest towns and cities will be getting fibre optic broadband first, because it only makes sense to install the networks if there is enough demand and the providers can make a profit.

People who live in rural areas are not very high on the list of areas that will get fibre optic broadband, because it will be expensive to run cables all the way into the countryside and then only have a small number of additional people connected.

Having said that, there are actually some initiatives around the UK that are attempting to get fibre optic broadband to isolated communities and there has already been some success.

If you can get a fibre optic broadband connection in your area now, it's a good to sign up. Fibre optic broadband is going to become the standard in the coming years. If you can access it now, you'll start enjoying the internet at a speed you'd never have thought possible.

Compare The Latest Fibre Optic Broadband Deals And Offers

How Do Fiber Optics Work?

By April Sanders, eHow Contributor

Light and Glass

Fiber optics is the name for the process by which data is transferred via light pulses, which are sent through thin strands of glass or plastic. These strands of glass or plastic, also called optical cables, are as thin as a human hair, which means a lot of them can be bound together. It also means they can be damaged very easily.

Bending Light

Light waves do not "bend" by themselves; they cannot go around a corner without reflecting off of a mirror or other reflective surface. Fiber optics bend lights by "bouncing" the pulses of light all along their inner walls. This is called total internal reflection. These light pulses, full of data, can travel (http://www.ehow.com/travel/) quickly over great distances.

Transmitters and Receivers

A transmitter at one end of the fiber optic system sends the data by converting electronic signals into light pulses, which are beamed into the fibers. A receiver at the other end receives and decodes the pulses, transforming them into electrical signals, which are then sent on to televisions, computers (http://www.ehow.com/computers/) and other electronic devices. Sometimes, a regenerator is needed to boost the power of the light signal over very long distances.

Resources

- The physics behind fiber optic technology