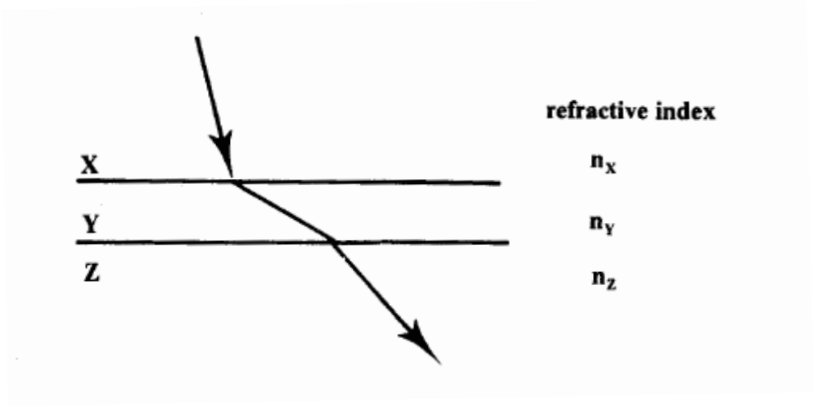
Multiple choice questions



A narrow beam of light passes through materials, X, Y and Z,

Example 1 1982 Question 34, 1 mark

Which of the following statements about the refractive indices is correct?

A. $n_Z > n_Y > n_X$

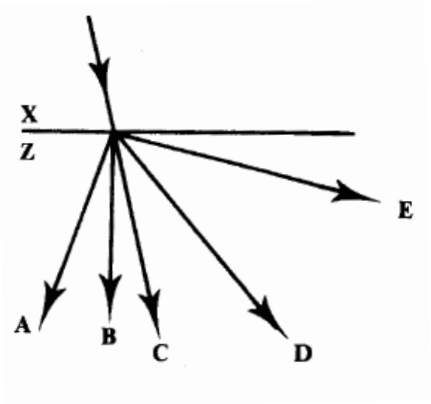
B. $n_Y > n_X$ and $n_Y > n_Z$

C. $n_X > n_Z > n_Y$

D. $n_Z > n_X > n_Y$

Example 2 1982 Question 35, 1 mark

Material Y is now removed. Which path (A, B, C, D or E) would be followed by the beam?



Example 3 QLD 2012 Question 9, 1 mark

If the speed of light in a diamond is 124000 km/s, what is its index of refraction?

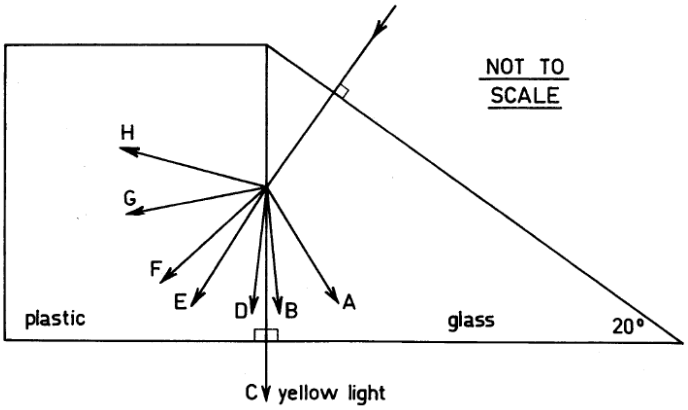
A. 4.13×10^{-4}

B. 0.413

C. 2.42

D. 2419

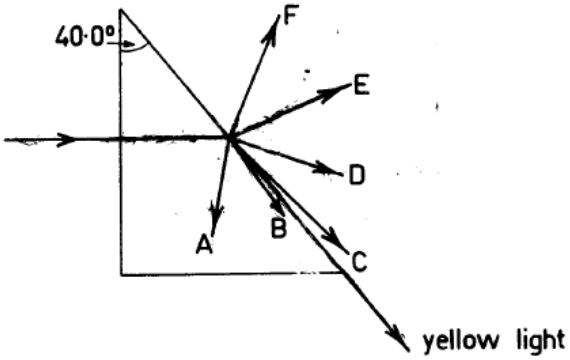
A narrow beam of yellow light is incident normally on one face of a triangular glass prism which is joined to a rectangular block of plastic. After passing through the glass the yellow light is refracted parallel to the interface between the glass and the plastic. The refractive index of glass is 1.50 for yellow light.



Example 4 1973 Question 47, 1 mark

The plastic block is now replaced with one made of quartz, refractive index 1.54 for yellow light.
Which of the arrows **A to H** now represents the path of the refracted light?

A narrow beam of white light is incident normally on one face of a triangular glass prism of angle 40^0. At the opposite face the yellow component of the light is refracted along the surface of the prism. The refractive index for blue light is slightly greater than the refractive index for yellow light.

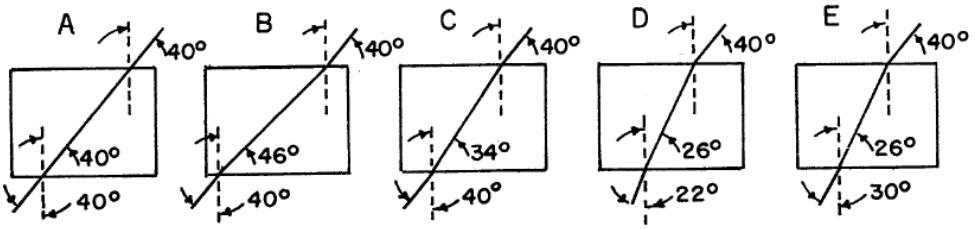


Example 5 1971 Question 62, 1 mark

Which of the paths **A - F** best represents that travelled by blue light?

A block of clear glass, with opposite faces parallel, is placed successively in various transparent, colourless liquids referred to as liquid 1, liquid 2 and liquid 3. The table below gives the refractive indices of the media involved

Air	1.0
Liquid 1	1.3
Liquid 2	1.5
Liquid 3	1.7
Glass	1.5



For each of the situations described in questions 48 to 50, select the diagram which best, represents the path of the ray of light passing through the glass.

Example 6 1970 Question 48, 1 mark

The block of glass is entirely submerged in liquid 1.

Example 7 1970 Question 49, 1 mark

The block of glass is entirely submerged in liquid 2.

Example 8 1970 Question 50, 1 mark

The block of glass is placed in liquid 3 in such a way that only its lower half is submerged.

Example 9 QLD 2013 Question 9, 1 mark

The wavelength of green light in a vacuum is approximately 510 nm. If the wavelength of green light in a medium is 450 nm, its velocity in that medium is closest to

A. 1.13×10^8 m s^{-1}.

B. 2.26×10^8 m s^{-1}.

C. 2.65×10^8 m s^{-1}.

D. 3.77×10^8 m s^{-1}.

A beam of light passes from vacuum into glass of refractive index *n.* The frequency of the light in vacuum is *v*

Example 10 1967 Question 59, 1 mark

Which of the following is the correct expression for the frequency of the light in the glass?

A. *v*

B. n*v*

C. $\frac{v}{n}$

D. $\frac{n}{v}$.

Example 11 1967 Question 60, 1 mark

If the speed of light in the vacuum is *c,* which of the following is the correct expression for the speed of light in the glass?

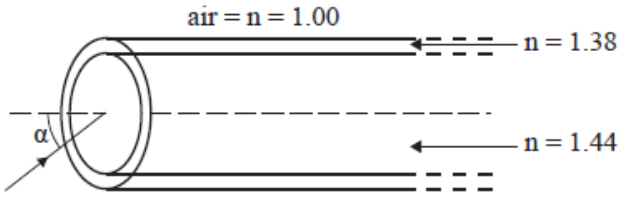
A. $\frac{c}{n}$

B. *nc*

C. *c*

D. $\frac{n}{c}$.

The figure below shows a step-index fibre-optic waveguide.
The outer cladding has a refractive index of 1.38, and the inner core has a refractive index of 1.44.



Example 12 2010 Question 5, 2 marks

Which of the following best gives the value of the critical angle for total internal reflection between the core and cladding?

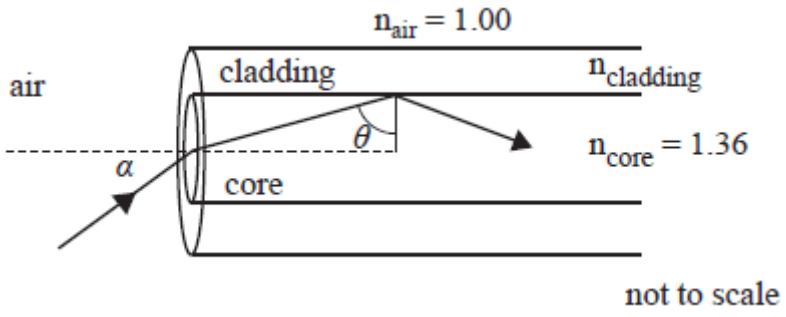
A. 17°

B. 44°

C. 46°

D. 73°

The figure shows a step-index fibre-optic waveguide, with a ray of light entering it.



Example 13 2009 Question 7, 2 marks

The critical angle for total internal reflection at the interface between the cladding and the core of the waveguide is found to be 80°.
Which one of the following is the best estimate of the refractive index, $n_{cladding}$, of the cladding material?

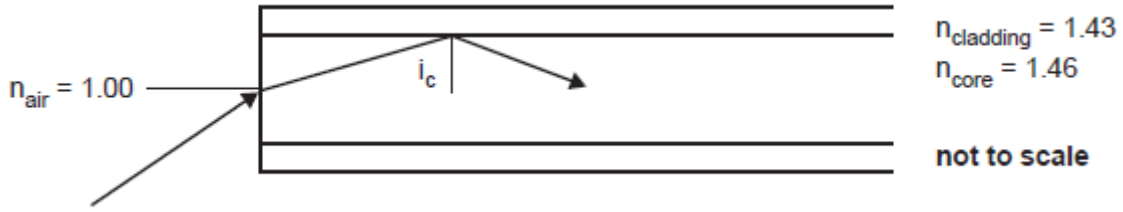
A. 1.32

B. 1.34

C. 1.36

D. 1.38

The figure below shows a ray of light entering from air (n_{air} = 1.00) into a step index fibre which has n_{core} = 1.46 and $n_{cladding}$ = 1.43. The ray is incident on the core-cladding interface at the critical angle for total internal reflection, i_c. (n = refractive index)



Example 14 2007 Question 5, 2 marks

The best estimate of i_c is

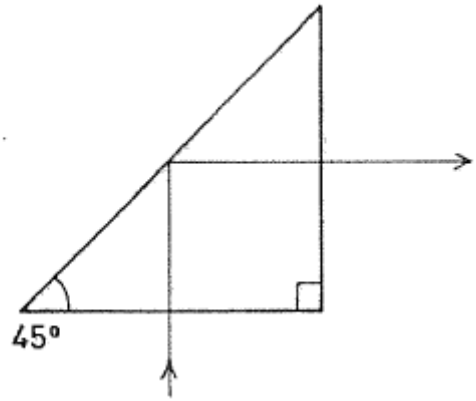
A. 12°

B. 43°

C. 47°

D. 78°

A right angled isosceles made out of a transparent plastic material is to be used in an optical instrument to replace a mirror to deviate all of the incident light through 90°.



Example 15 1967 Question 55, 1 mark

What is the minimum value of the refractive index of plastic suitable for this purpose?

A. 0·71.

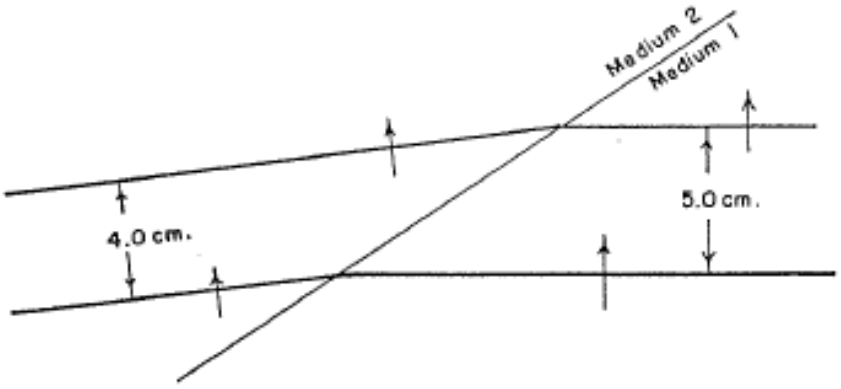
B. 1·00.

C. slightly greater than 1.00.

D. 1·41.

E. 1·50.

The figure shows successive wave-fronts of a wave crossing the boundary between two media.



Example 16 1974 Question 51, 1 mark

For the same pair of media, is total internal reflection possible for some angles of incidence?

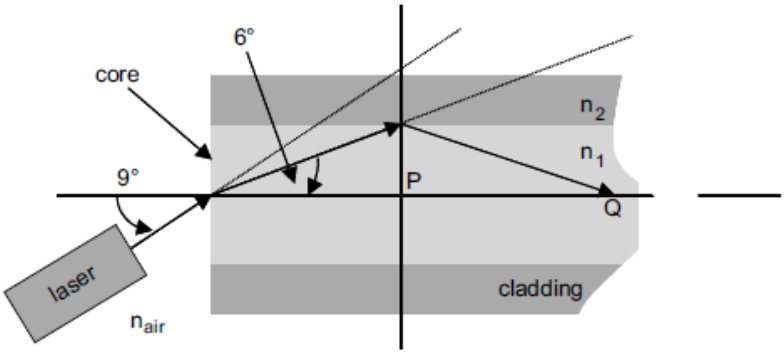
A. Yes, only for waves travelling from Medium 1 towards Medium 2.

B. Yes, only for waves travelling from Medium 2 towards Medium 1.

C. Yes, for waves travelling in either direction.

D. No, total internal reflection is not possible.

A beam of red laser light of wavelength 632 nm is incident on a fibre optic cable of refractive index n_1 as shown. The light enters the cable and proceeds as shown to the point P where it meets the cladding of refractive index n_2, reflects and proceeds to point Q. (Note that the diagram is not to scale.)



Example 17 2004 Pilot Sample Question 5, 2 marks

Which **one** of the following statements (**A – D**) best describes the relative refractive indices of the material involved?

A. $n_{air} > n_1 > n_2$

B. $n_{air} < n_1 < n_2$

C. $n_{air} > n_1 < n_2$

D. $n_{air} < n_1 > n_2$

Example 18 2004 Pilot Sample Question 7, 2 marks

The red laser is now **replaced** with a green laser of wavelength 510 nm. Which of the following statements best describes the path of the green laser beam as it enters the fibre optic cable?

A. The beam does not enter the cable as it totally internally reflects.

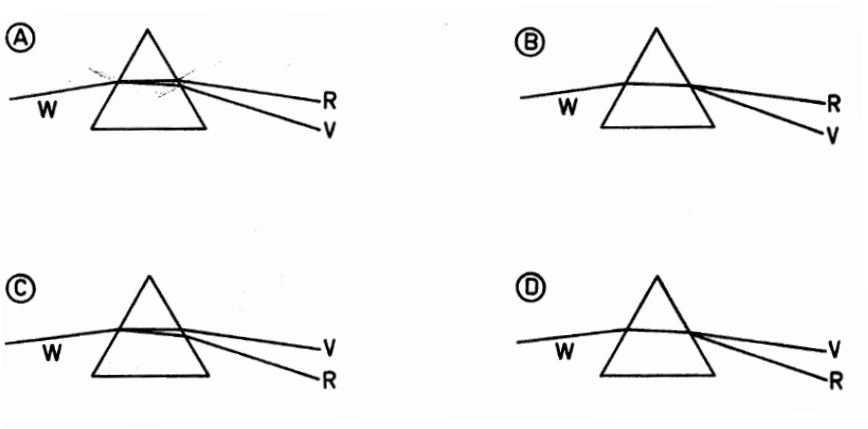
B. The beam enters the cable and meets the cladding at point P.

C. The beam enters the cable and meets the cladding to the left of point P.

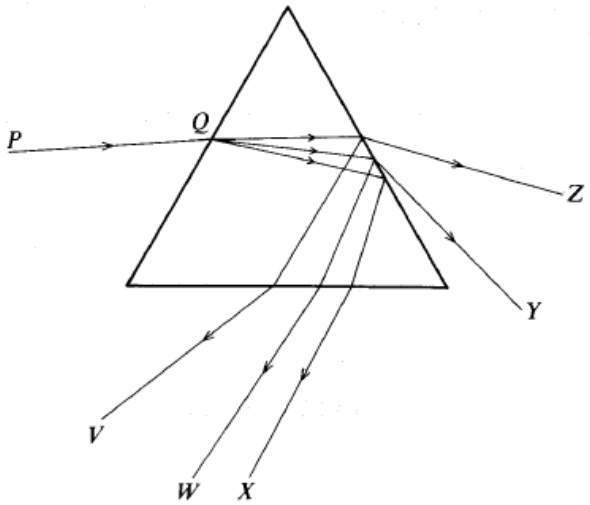
D. The beam enters the cable and meets the cladding to the right of point P.

Example 19 1976 Question 53, 1 mark

A narrow beam of white light (W) is incident upon a prism. Which diagram best shows the subsequent path of red light (R) and violet light (V)



A mixed beam of red and blue light is incident to a glass prism along the path PQ as shown below.



The paths of the emerging beam of red light are marked as W and Y on the diagram.

Example 20 1985 Question 35, 1 mark

Which of the choices (**A - E**) could represent the path of the blue light emerging from the prism?

A. X

B. W

C. V and Z

D. W and Y

E. V

Example 21 QLD 2011 Question 14, 1 mark

A laser light source produces blue light of wavelength 450 nm. The energy of a single photon of this laser would be

A. 7.0×10^{-16} J

B. 4.4×10^{-17} J

C. 4.4×10^{-19} J

D. 3.0×10^{-40} J

Example 22 NSW 2001 Question 6, 1 mark

The signal from a microwave transmitter can be thought of as a beam of photons.
The photons from a particular transmitter have a wavelength of 3.5×10^{-2} m.
What is the approximate energy of each photon?

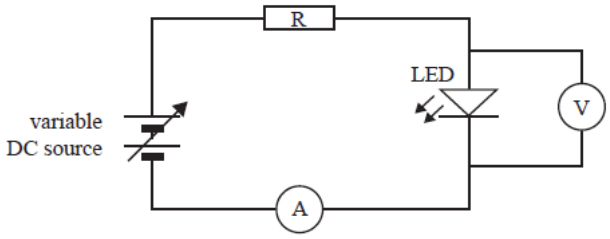
A. 7.73×10^{-44} J

B. 5.68×10^{-24} J

C. 2.32×10^{-35} J

D. 1.89×10^{-32} J

A variable DC power supply is used to investigate the operation of an LED of band gap energy 2.30 eV. The voltage of the power supply is increased slowly. At a potential of 2.30 V across it, the LED emits light. A current of 4.0 mA is now flowing through the LED.



Example 23 2009 Question 5, 2 marks

Assuming an ideal diode, which one of the following best gives the wavelength of light emitted by the LED?

A. 284 nm

B. 540 nm

C. 865 nm

D. 8.65×10^{-17} nm

Example 24 2009 Question 6, 2 marks

The power supply voltage is now increased.
Which one of the following statements is true?

A. The wavelength of the light emitted decreases and the current increases.

B. The wavelength of the light emitted and the current both stay the same.

C. The wavelength of the light emitted stays the same and the current increases.

D. The wavelength of the light emitted increases and the current increases.

Example 25 NSW 2005 Question 14, 1 mark

An FM radio station transmits at a frequency of 102.8 MHz.
What is the energy, in joules, of each photon emitted by the transmitter?

A. 6.446×10^{-42}

B. 6.812×10^{-26}

C. 2.918

D. 3.084×10^{16}

Example 26 NSW 2016 Question 11, 1 mark

What is the wavelength, in metres, of a photon with an energy of 3.5 eV?

A. 1.2×10^{-6}

B. 3.5×10^{-7}

C. 1.18×10^{-15}

D. 5.67×10^{-26}

Example 27 2010 Question 1, 2 marks

Which one of the following contains only sources that produce predominantly incoherent light?

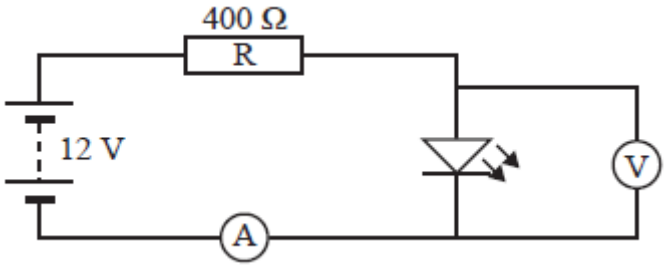
A. incandescent globe, fluorescent tube, laser

B. laser, fluorescent tube, sun

C. sun, candle, incandescent globe

D. sun, candle, laser

A student sets up the following circuit to test this LED, as shown below.
The (ideal) battery has a voltage of 12 V and the resistor has a resistance of 400 Ω.



The red LED is replaced by a blue LED, using the same circuit.

Example 28 2010 Question 4, 2 marks

Which of the following statements best describes the effect on the circuit?

A. The blue LED emits light, and the current through it is greater than the current through the red LED.

B. The blue LED emits light, and the current through it is the same as the current through the red LED.

C. The blue LED emits light, and the current through it is less than the current through the red LED.

D. The blue LED does not emit light, and the current through it is less than the current through the red LED.

Example 29 2009 Question 2, 2 marks

Which one of the following statements best describes the production of light in an incandescent light bulb?

A. stimulated emission of photons by electrons in the electric current

B. transition of excited valence electrons back to lower energy states

C. acceleration of electrons in random thermal collisions

D. emission of electromagnetic radiation (light) by electrons accelerated by the applied voltage

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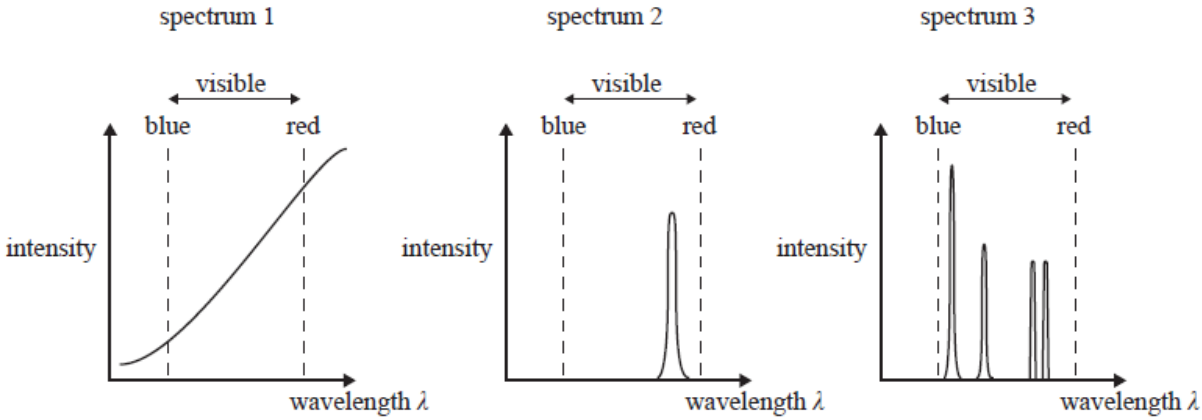
The spectra of light from three different light sources are shown in Figure 1. The dashed lines indicate the range of visible wavelengths.



Five possible light sources are listed below.

- mercury vapour lamp
- red laser
- 100 W incandescent globe
- LED (light-emitting diode)
- sunlight

Example 30 2009 Question 1, 2 marks

Which one of the options (**A – D**) below correctly identifies the light source for each spectrum?

	spectrum 1	**spectrum 2**	**spectrum 3**
A.	mercury vapour lamp	red laser	sunlight
B.	100 W incandescent globe	mercury vapour lamp	LED
C.	100 W incandescent globe	LED	mercury vapour lamp
D.	sunlight	red laser	LED

Example 31 2009 Question 3, 2 marks

Which one of the following statements best describes the production of light in an LED (light-emitting diode)?

A. movement of electrons from the conduction band to the valence band

B. movement of electrons from the valence band to the conduction band

C. movement of electrons from the valence band to lower energy bands

D. movement of ground state electrons to higher energy bands

Example 32 2009 Question 4, 2 marks

Which one of the following is the best statement about laser light compared to light from an LED?

A. Light from a laser is of higher frequency (energy) than light from an LED.

B. Lasers can switch on and off rapidly, but LEDs cannot.

C. Laser light is incoherent, but light from an LED is coherent.

D. Laser light has a narrower spread of frequencies than light from an LED.

The band gap of a LED is 1.80 eV.

Example 33 2008 Question 2, 2 marks

Which one of the following best gives the wavelength of light emitted by this LED?

A. 110 nm

B. 690 nm

C. 6.90×10^{-7} nm

D. 1.10×10^{-16} nm

Example 34 2008 Question 3, 2 marks

Comparing light from a laser and from a LED, which one of the following statements is true?

A. Light from a LED is coherent but light from a laser is incoherent.

B. Light from both a LED and a laser is coherent.

C. Light from a laser has a narrow range of wavelengths (more monochromatic) than light from a LED.

D. Light from a LED is pulsed but light from a laser is continuous.

Example 35 2008 Question 4, 2 marks

Which one of the following statements best describes stimulated emission in a laser?

A. Atoms are raised to a metastable state.

B. A population inversion is created.

C. Photons interact with atoms in a metastable state causing them to release their energy as photons.

D. Photons interact with the atoms in a metastable state to cause emission of electrons.

An LED emits light of wavelength 5.8×10^{-7} m.

Example 36 2006 Question 2, 2 marks

Which one of the following (**A - D** below) is the best estimate of the band gap of the semi-conductor material in this LED?

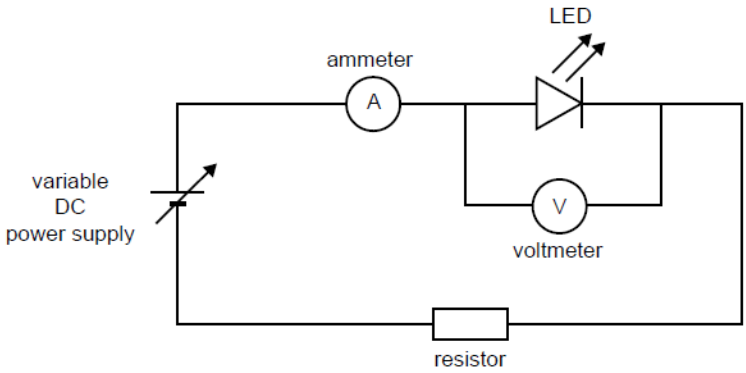
A. 2.14 eV

B. 21.4 eV

C. 214 eV

D. 2.14 keV

Chris is testing LEDs (Light Emitting Diodes). She has a LED which emits blue light (blue LED) and another which emits red light (red LED). Blue light has a higher frequency than red light.
She uses the circuit shown below.



With the blue LED in the circuit the supply voltage is gradually increased. The LED does not emit light until the voltage reading on the voltmeter is 2.64 V. At this time there is a current of 5.00 mA read on the ammeter, A.

Example 37 2007 Question 4, 2 marks

The blue LED is now replaced with the red LED. The supply voltage is left unchanged. Which one of the following sets of observations **(A - D)** will now describe the situation?

	Red LED	**Voltage across LED**	**Current through A**
A	Light emitted	Less than 2.64 V	Greater than 5.00 mA
B	Light emitted	Greater than 2.64 V	Less than 5.00 mA
C	No light emitted	Less than 2.64 V	Greater than 5.00 mA
D	No light emitted	Greater than 2.64 V	Less than 5.00 mA

Example 38 2006 Question 3, 2 marks

Which one of the following (**A - D** below) indicates the correct sequence of LED colours in **decreasing** value of band gap?

A. blue, green, red

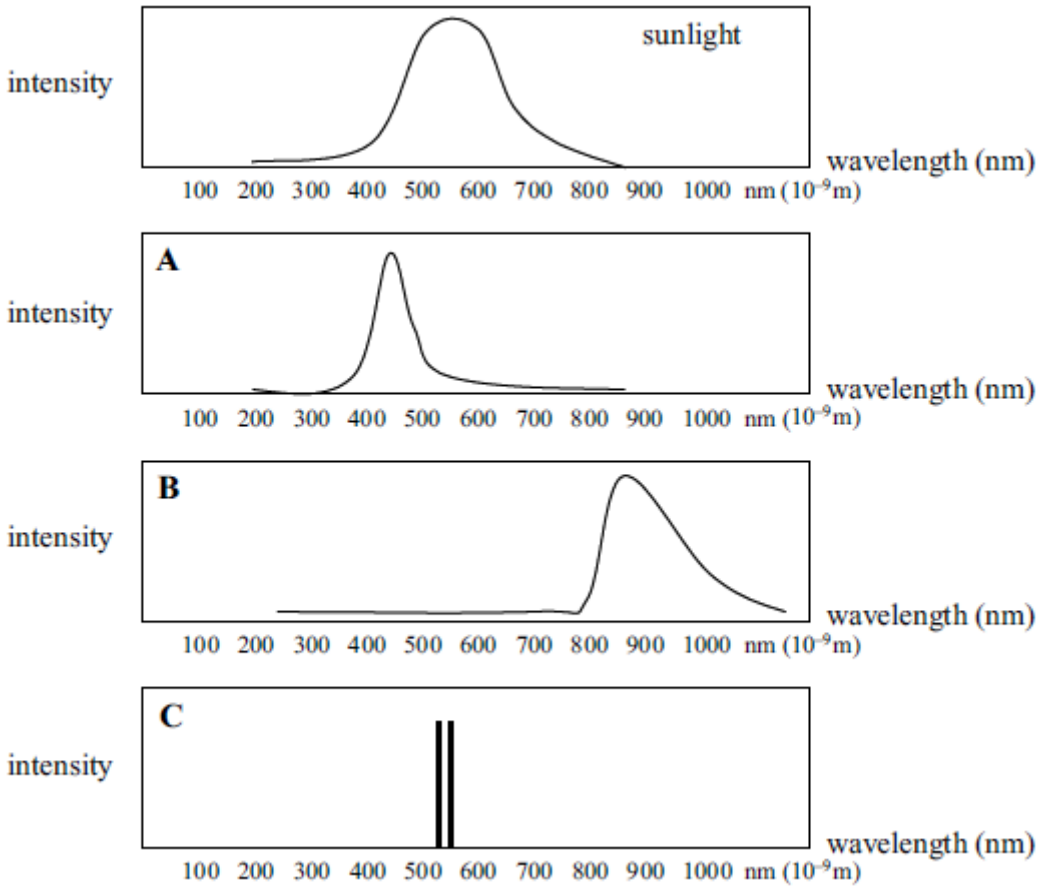
B. red, blue, green

C. green, red, blue

D. blue, red, green

Example 39 2004 Pilot Sample Question 2, 3 marks

The spectrum for sunlight is shown below. Use this as a reference to identify which of the spectra (**A – C**) best matches the following sources of light.



Electric stove element	
Blue theatre light	
Sodium vapour lamp (yellow)	

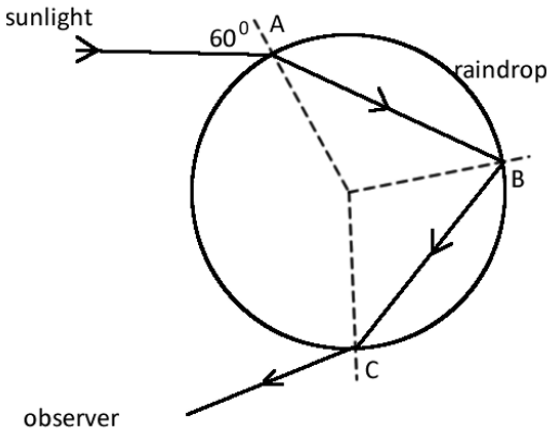
Extended answer questions

The diagram shows a model of electromagnetic waves.

Example 40 2019 NSW Question 25, 4 marks

Relate this model to predictions made by Maxwell.

A rainbow is formed when light, usually from the Sun, enters water droplets and both refracts and reflects to leave the droplet on a path to a person's eye.
Consider a single droplet with white light incident on it as in the diagram below.



For RED light, n = 1.331. Suppose the angle of incidence is 60°.

Example 41 2019 TAS Question 15a, 2 marks

Calculate the angle of refraction at A of the red light into the droplet.

At the point of the reflection at B:

Example 42 2019 TAS Question 15b i, 2 marks

Calculate the critical angle of reflection.

Example 43 2019 TAS Question 15b ii, 2 marks

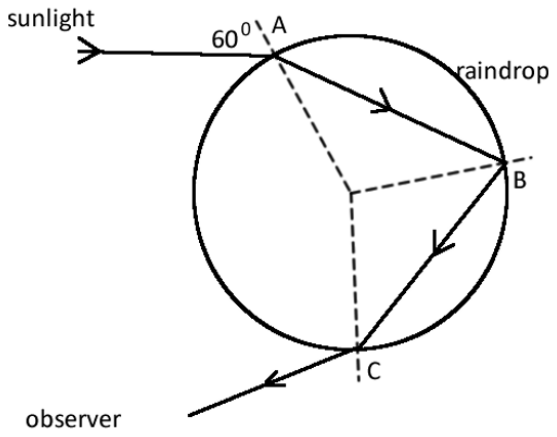
Is the incident red light fully internally reflected? Justify.

Example 44 2019 TAS Question 15c, 1 mark

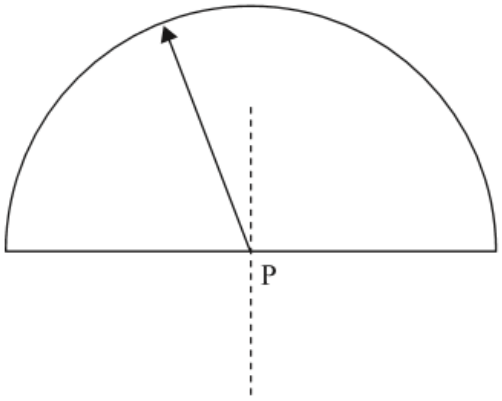
At point C, where the light leaves the droplet, what will be the angle relative to the normal?

Example 45 2019 TAS Question 15d, 2 marks

Blue light has a refractive index of 1.345 in water. On the diagram below sketch the path of the blue light from A through the raindrop and into the air.



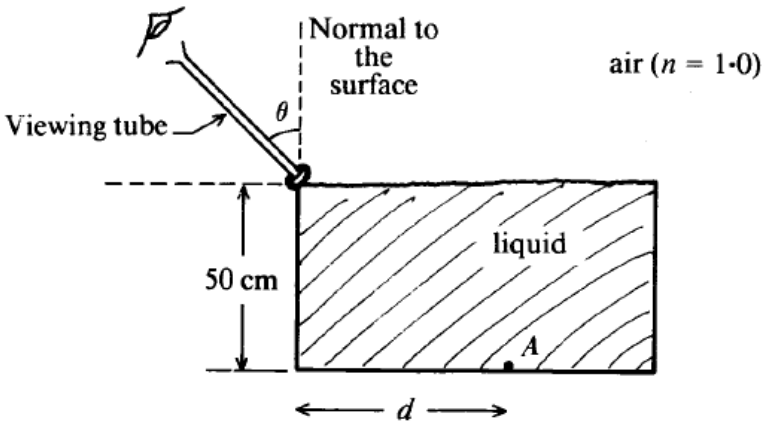
The diagram below shows a ray of light travelling through a semicircle block of glass. The glass has a higher optical density than air. The dotted line is at right angles to the base and goes through point P, the centre of the radius of curvature.



Example 46 2018 QLD Question 2, 2 marks

Sketch a plausible path for the ray before it enters the block and after it leaves.

In order to measure the refractive index of a liquid, a student completely fills a 50 cm deep tank liquid, as shown below. She places a marker, A, on the floor of the tank at various distances, d, from the wall, and uses a hollow metal tube which is pivoted at the edge of the tank to observe the marker.
She notes that when the marker is more than 50 cm from the wall, it is not possible to see it, regardless of the angle, θ, at which she views through the pipe. However at distances, d, less than 50 cm it is possible to see the marker.



Example 47 1985 Question 36, 1 mark

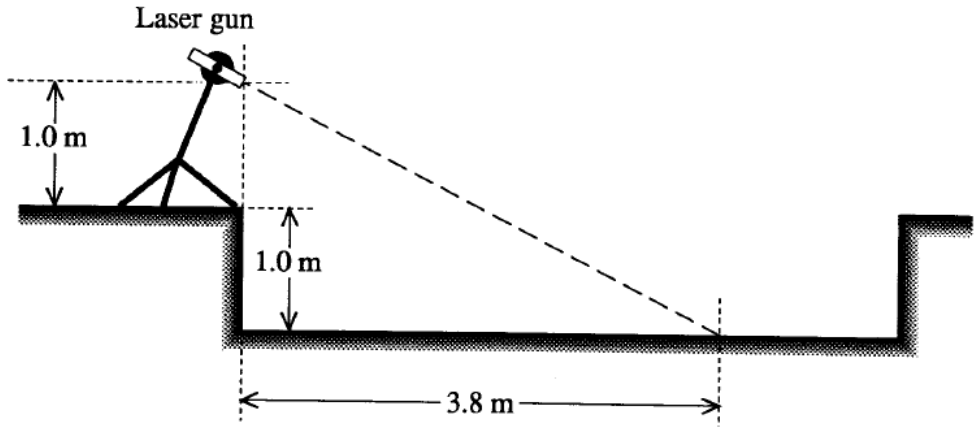
What is the refractive index of the liquid?

The tank is now emptied and completely refilled with water with a refractive index of 1.3. The marker, A, is fixed to the floor of the tank at a distance of 50 cm from the wall.

Example 48 1985 Question 37, 1 mark

Calculate the angle, θ, of the viewing tube in order to see the marker A.

The figure below shows a swimming pool which can hold water to a depth of 1.0 m. Initially the pool is empty, and Teresa sets up a laser on a stand at a height of 1.0 m at the edge of the pool so that it shines a beam of red light towards the bottom of the pool. She observes that the beam hits the bottom of the pool 3.8 m from the edge of the pool as shown.



The pool is now filled with water which has a refractive index of 1.3, to a depth of 1.0 m, and the position where the beam hits the bottom of the pool changes.

Example 49 1991 Question 30, 2 marks

How far from the edge of the pool does the beam now hit the bottom of the pool?

Example 50 1991 Question 31, 2 marks

Which statement below (**A - D**), concerning the properties of the light, and the colour of the spot on the bottom of the pool as observed by Teresa, is correct?

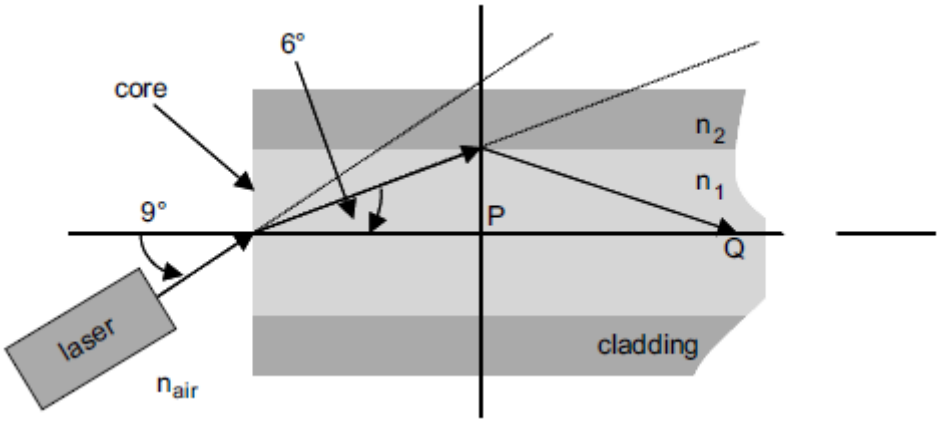
A. Because the light travels more slowly in water than in air its wavelength is longer, and the spot will appear a deeper red colour.

B. Because the light travels more slowly in water than in air its wavelength is shorter and the spot will appear a more orange colour.

C. Although the light travels more slowly in water than in air, its wavelength is unchanged, and the colour unaltered.

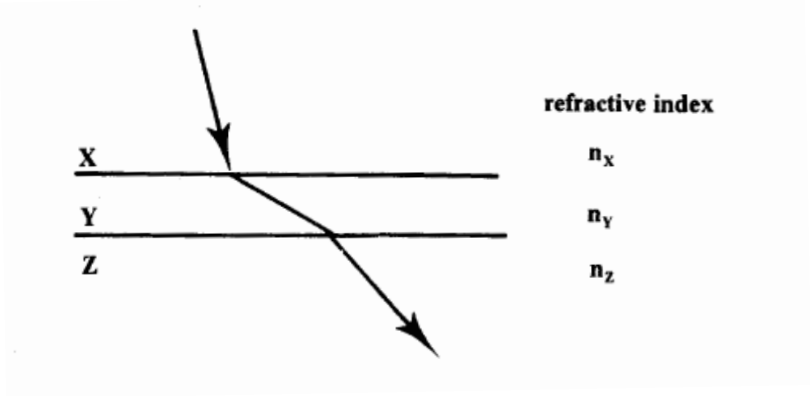
D. The light travels more slowly in water than in air, and its wavelength is shorter, but the colour of the spot is unaltered.

A beam of red laser light of wavelength 632 nm is incident on a fibre optic cable of refractive index n_1 as shown. The light enters the cable and proceeds as shown to the point P where it meets the cladding of refractive index n_2, reflects and proceeds to point Q. (Note that the diagram is not to scale.)



Example 51 2004 Pilot Sample Question 6, 2 marks

Calculate the refractive index of the core.

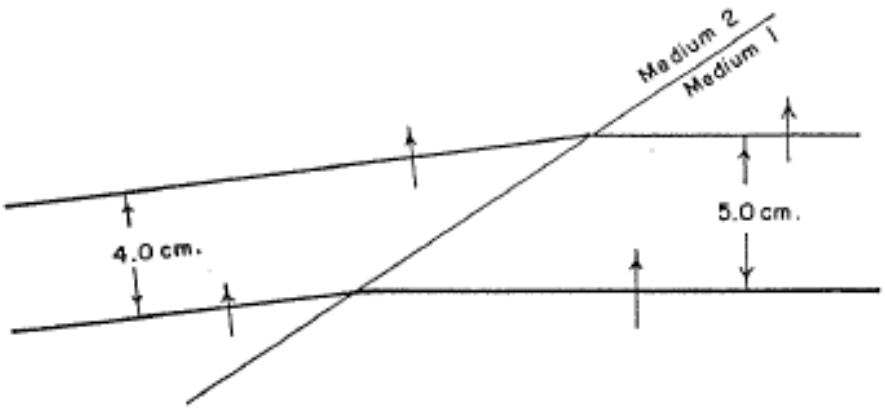


A narrow beam of light passes through materials, X, Y and Z,

Example 52 1982 Question 36, 1 mark

If the velocity of light in material X (refractive index n_X) is *v*, write an expression for the velocity of the same light in material Z (refractive index n_Z).

The figure shows successive wave-fronts of a wave crossing the boundary between two media.



Example 53 1974 Question 48, 1 mark

What is the refractive index for waves travelling from medium I to medium 2?

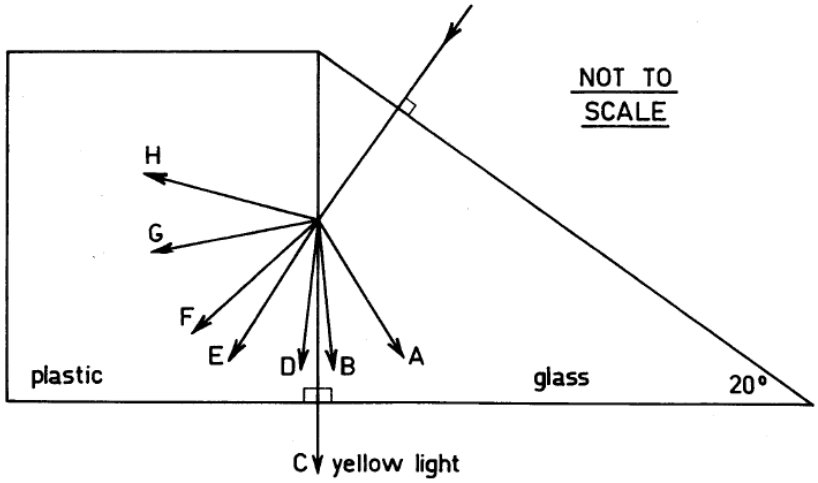
Example 54 1974 Question 49, 1 mark

What is the value of the ratio $\frac{\text{frequency of waves in medium 1}}{\text{frequency of waves in medium 2}}$?

Example 55 1974 Question 50, 1 mark

What is the value of the ratio $\frac{\text{speed of waves in medium 1}}{\text{speed of waves in medium 2}}$?

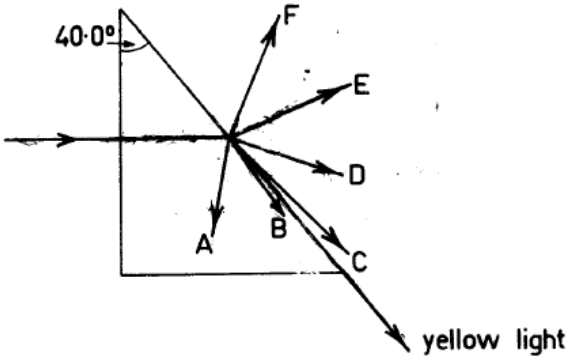
A narrow beam of yellow light is incident normally on one face of a triangular glass prism which is joined to a rectangular block of plastic. After passing through the glass the yellow light is refracted parallel to the interface between the glass and the plastic. The refractive index of glass is 1.50 for yellow light.



Example 56 1973 Question 46, 1 mark

Calculate the refractive index of the plastic for yellow light.

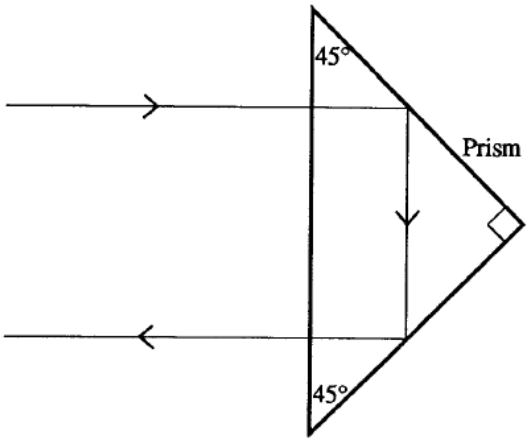
A narrow beam of white light is incident normally on one face of a triangular glass prism of angle 40^0. At the opposite face the yellow component of the light is refracted along the surface of the prism. The refractive index for blue light is slightly greater than the refractive index for yellow light.



Example 57 1971 Question 63, 1 mark

Find the refractive index of the glass for yellow light?

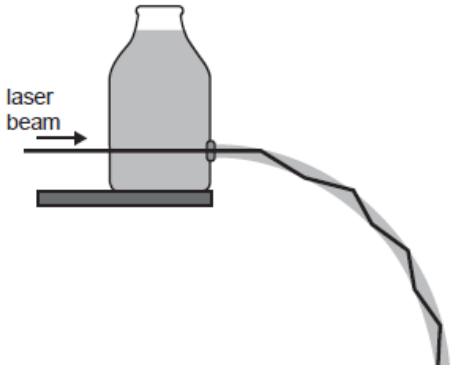
A comer reflector is made with a right-angled prism as shown in the figure below.



Example 58 1991 Question 32, 2 marks

What is the minimum refractive index of the prism for this comer reflector to work in air?

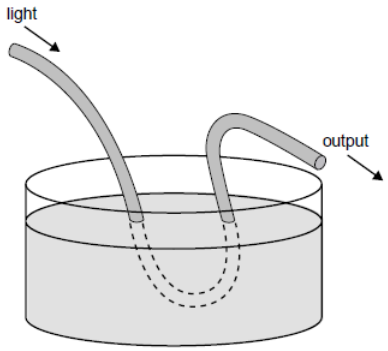
A bottle filled with water has a small hole drilled in one side. When the cork is removed from the hole, water will begin to stream out. A beam of laser light is directed into the bottle from the opposite side of the hole, through the water. The laser light exits the jug through the hole but remains contained in the water.



Example 59 2006 Question 11, 2 marks

Explain why the laser beam remains contained within the stream of water.

Students are performing an experiment to investigate the transmission of light in a long plastic cable, 3 mm in diameter. Initially, the cable transmitted about 30% of the input light to the output. When the cable was partially immersed in a fluid as shown below, the output changed dramatically. Note that the refractive index of the fluid is greater than that of the plastic.



Example 60 2004 Pilot Question 5a, 1 mark

Does the output **increase** or **decrease** when the plastic is immersed into the fluid?

Example 61 2004 Pilot Question 5b, 2 marks

Explain the reasoning behind your answer.

Take the velocity of light to be 3.00×10^{8} m s^{-1} and Planck's constant to be 6.63×10^{-34}J s.
A teacher, performing a demonstration of the photoelectric effect, used two different sources of radiation. One emitted red light and the other emitted ultraviolet radiation.
The power of the two sources was the same and each source emitted radiation of a single wavelength. The wavelength of the red light was 600 nm (1 nm = 10^{-9} m). The wavelength of radiation from the ultraviolet source was 200 nm.

Example 62 1994 Question 1, 1 mark

What is the value of the ratio $\frac{\text{number of photons of red light emitted per second}}{\text{number of photons of ultraviolet radiation emitted per second}}$?

Example 63 1994 Question 2, 1 mark

Calculate the energy of each photon emitted by the ultraviolet radiation source.

A helium-neon laser has a power output of 1.0 mW and produces monochromatic red light of wavelength 640 nm.

Example 64 1998 Question 4, 2 marks

Calculate the energy of a single photon of red light emitted from the laser. ($h = 6.63 \times 10^{-34}$ J s)
($c = 3.0 \times 10^{8}$ m s^{-1})

Example 65 1998 Question 5, 2 marks

Calculate the number of photons per second emitted by the laser.

Example 66 1999 Question 2, 2 marks

Calculate the energy, in eV, of a single photon of light of wavelength 254 nm.
($h = 4.14 \times 10^{-15}$ eV s, $c = 3.0 \times 10^{8}$ m s^{-1})

Example 67 2000 Question 3, 3 marks

What is the energy of a photon of 450 nm light? Give your answer in electron volt.
($h = 4.14 \times 10^{-15}$ eV s, $c = 3.0 \times 10^{8}$ m s^{-1})

Example 68 2002 Question 1, 3 marks

Calculate the wavelength of 70 keV X-rays.
($h = 4.14 \times 10^{-15}$ eV s, $c = 3.0 \times 10^{8}$ m s^{-1})

Example 69 2007 Question 7, 2 marks

X-rays of wavelength 0.120 nm travel along a synchrotron beam line onto a sample of crystalline material. What is the energy, in keV, of these X-rays?

Caesium metal is illuminated by green light with a wavelength of 550 nm.

Example 70 2004 Question 1, 2 marks

Calculate the energy of a photon of green light.

($h = 4.14 \times 10^{-15}$ eV s, $c = 3.00 \times 10^{8}$ m s^{-1})

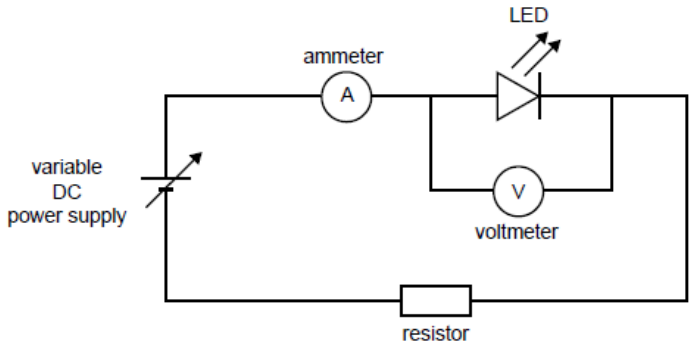
Example 71 2005 Question 1, 3 marks

In the sentences below, options are given within the brackets. Only **one** of the options will be correct. Circle the best option.

A laser produces **[*coherent / multi-modal / wide spectrum*]** light. The input power to the laser produces **[*coherence / a population inversion / ionisation*]** in the electron energies of the gas atoms. The atoms are stimulated to release their energy by interacting with **[*electrons of the same / photons of the same / photons of higher*]** energy.

Use the following information to answer Questions 2 - 4.

Chris is testing LEDs (Light Emitting Diodes).
She has a LED which emits blue light (blue LED) and another which emits red light (red LED).
Blue light has a higher frequency than red light. She uses the circuit shown below.



With the blue LED in the circuit the supply voltage is gradually increased. The LED does not emit light until the voltage reading on the voltmeter is 2.64 V. At this time there is a current of 5.00 mA read on the ammeter, A.

Example 72 2007 Question 2, 2 marks

Explain why the blue LED needs 2.64 V to emit light.

Example 73 2007 Question 3, 3 marks

Assuming an ideal diode, calculate the wavelength of the blue light emitted by the blue LED.

The light produced by a red LED and a red HeNe laser is being compared.

Example 74 2006 Question 4, 2 marks

Identify **three** features of the red HeNe laser light that are superior to the light produced by the red LED.

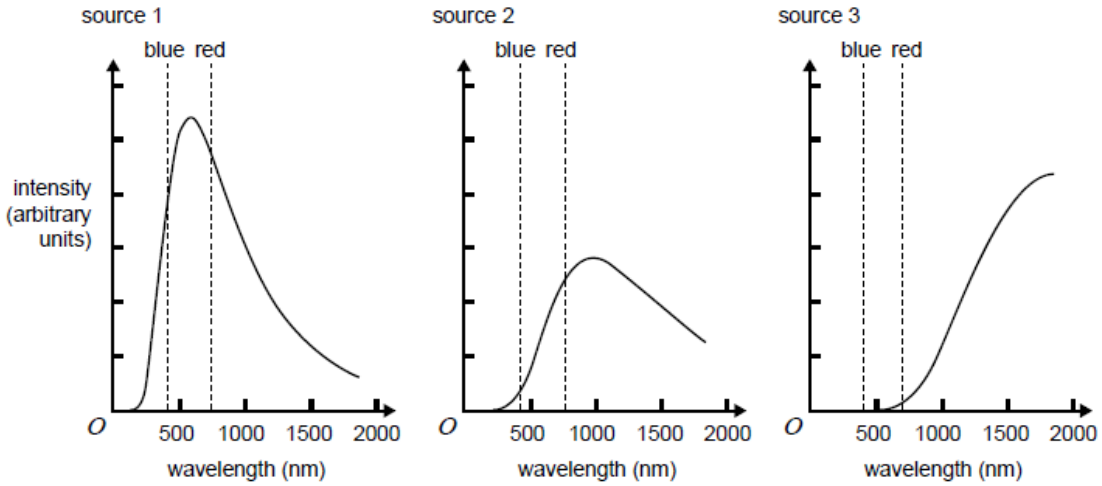
Example 75 2005 Question 3, 2 marks

Explain how light is produced in a LED (Light Emitting Diode). Your explanation should include reference to the band gap.

Example 76 2005 Question 4, 2 marks

The band gap in a LED is 2.1 eV. Calculate the average wavelength of light emitted by this LED.

Visible light is typically in the range 400 – 700 nm. Shown below are the individual wavelength properties of three different light sources. The dashed-vertical lines indicate the range of visible wavelengths.



Example 77 2004 Pilot Question 1, 3 marks

Identify each source of light from the six options below, and write your choice clearly in the boxes.

- candle
- 100 W incandescent globe
- laser
- LED (Light Emitting Diode)
- mercury vapour lamp
- sunlight

source 1

source 2

source 3

Example 78 2004 Pilot Sample Question 1, 3 marks

One way of producing an intense narrow beam of red light is to use a Helium-Neon (HeNe) laser. Alternatively, an incandescent lamp coupled with a **red** filter and a series of lenses arranged to focus the beam can also produce an intense beam of light. Compare the characteristics of the red light in these two cases by describing how the light is produced. Use **each** of the following keywords in your answer.
i. Wavelength **ii.** Coherence **iii.** Phase

Bonus Questions (Beyond the course)

Example 79 2018 QLD Question 6, 2 + 4 = 6 marks

A light ray strikes a homogeneous rectangular block of glass of thickness w at an angle i as indicated in the diagram below. The glass block is surrounded by air. The ray emerges at point B at an angle i'.
NA and NB represent the normal lines at the points of entry and exit of the block.

i. Provide a mathematical justification that shows the incident and the emerging rays are parallel.

ii. ii. Given that the refractive index of air (n_1) is 1.0, the refractive index of glass (n_2) is 1.55,
w = 3.0 cm, i' = 32°, calculate the length of the line OB.