Lesson 18: P6.18 - Colour

Connection

1. What is the speed of all EM waves?
2. What part of the atmosphere are radio waves refracted off?
3. If a radio wave has a wavelength of 100m, what is its frequency?

Activation

LI: describe what happens when light of different wavelengths lands on an object.

1. https://www.youtube.com/watch?v=5U1vOWjC4uA
2. Make a note of the title and the LI
3. Read pages 226-227
4. Define “Transparent”, “Translucent”, “Opaque” and “Filter” using the glossary
5. Draw and label figure 6.54 and 6.55

Demonstration

Attempt questions 1-7.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the P6 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: P6.18 - Colour

Connection

1
Approximately
300,000,000m/s

2.
Ionosphere

3
$v=f\lambda$

$f=v/\lambda=300,000,000/100$
$=3,000,000Hz$

Demonstration

1 No colours are reflected by a black object.
2 All the colours apart from yellow.
3 The colour of an object is the colour of light that it reflects.
4 All of the colours apart from blue.
5a red
5b black
5c black
5d black
6a black
6b green
6c black
6d green
7 A grey colour is the same as white only darker. Therefore, a grey object will partially absorb all the colours and partially reflect all of them.

Lesson 19: P6.19 - Lenses

Connection

1. What is white light made of?
2. Explain how an red car appears to be red
3. What colour would the red car appear through a blue filter?

Activation

LI: draw ray diagrams to show the formation of images by lenses.

1. https://www.youtube.com/watch?v=xpcX3B4xE7Q
2. Make a note of the title and the LI
3. Read pages 228-229
4. Define “Convex” and “Concave” using the glossary
5. Draw and label figure 6.56 and 6.57

Demonstration

Attempt questions 1-6.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the P6 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: P6.19 - Lenses

Connection

1
White light is made up of all the different colours together

2.
A red car appears red because it is absorbing all the other colours but reflecting red light

3
A red car would appear black through a blue filter

Demonstration

1a It is the place where rays that are parallel to the axis meet once they have passed through the lens.
1b Yes, for example parallel rays that enter the lens at an angle to the principal axis will be focused onto another point.
2 The principal axis.
3 To reduce the focal length you would have to bend the rays more so they were focused closer to it. Therefore, the lens needs to have a fatter shape.
4 The light bends towards to the normal when it enters the lens and away from the normal after it leaves the lens. Due to the shape of the surface of the lens – this means that the light diverges.
5 If you draw rays from a point on an object near a lens, the rays that can enter the lens will spread apart from each other (diverge) quite steeply. Moving the object further away, the rays that can enter the lens will still be diverging but not as steeply –so they are more parallel to each other. The further away you move the object, the more parallel the rays get.
6 You can consider the centre of a thin lens to be the same shape as the middle of a rectangular block. This displaces the ray sideways but it still continues in the same direction (see section 6.6). If the lens is thin then the displacement is very small and so it looks like the ray does not refract at all.

Lesson 20: P6.20 - Images and magnification

Connection

1. Draw the symbols for convex and a concave lenses
2. What is the principle focus?
3. Explain why a magnifying glass can start a fire

Activation

LI: draw ray diagrams to show the formation of real and virtual images by lenses.

1. https://www.youtube.com/watch?v=EwBK_cXUTZI
2. Make a note of the title and the LI
3. Read pages 230-231
4. Define “Real image”, “Virtual image” and “Magnification” using the glossary
5. Draw and label figure 6.61
6. Draw and label figure 6.63 and 6.64
7. Copy the equation for magnification

Demonstration

Attempt questions 1-7.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the P6 DIP file

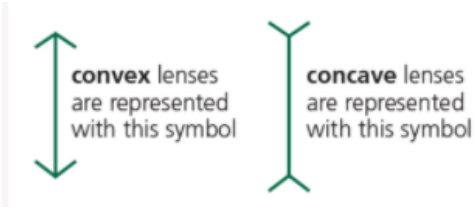
Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: P6.20 - Images and magnification

Connection

1

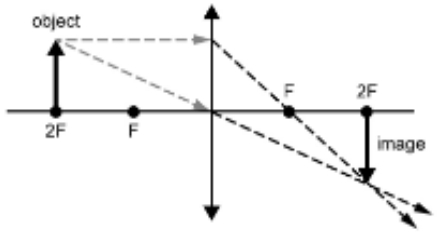


2.
The principle focus is where the light leaving a convex lens converge to a point

3
When sunlight passes through a magnifying glass, the light converges at the principle focus and all the light energy focused in one spot can cause a fire.

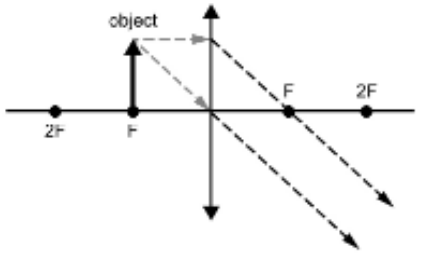
Demonstration

1



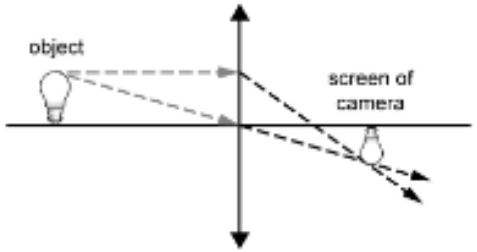
The image is inverted, it is real and it is the same size as the object.

2



The image can't be formed because the rays entering the eye are parallel to each other. (It is also correct to say the image is virtual, an infinite size, the right way up and an infinite distance away)

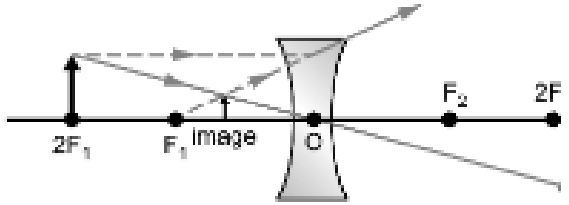
3



Answers: P6.20 - Images and magnification Continued

Demonstration

4



The image is upright, virtual and smaller than the object.
5 1.2 cm = 12 mm. Magnification = 12 / 1.6 = 7.5
6 1.76 m = 176 cm. Magnification = 1.9 / 176 = 0.011 (to 2 significant figures)
7 A ray diagram drawn to scale will produce an image that is 2cm high and is 6cm to the right of the lens. Therefore, the magnification = 2 cm / 1 cm = 2.

Lesson 21: P6.21 - Emission and absorption of infrared radiation

Connection

1. What is the equation for magnification in an equation triangle

2. If the image is 5cm tall, and the real object is 2.5cm tall, what is the magnification?

Activation

LI: realise that all bodies emit and absorb infrared radiation.

1. https://www.youtube.com/watch?v=je-qc7sxYzU
2. Make a note of the title and the LI
3. Read pages 232-233
4. Define “Black body” using the glossary
5. Stick in the handout showing how intensity of radiation changes with temperature.
6. Write a conclusion for the graph based off of “A perfect black body”

Demonstration

Attempt questions 1-6.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

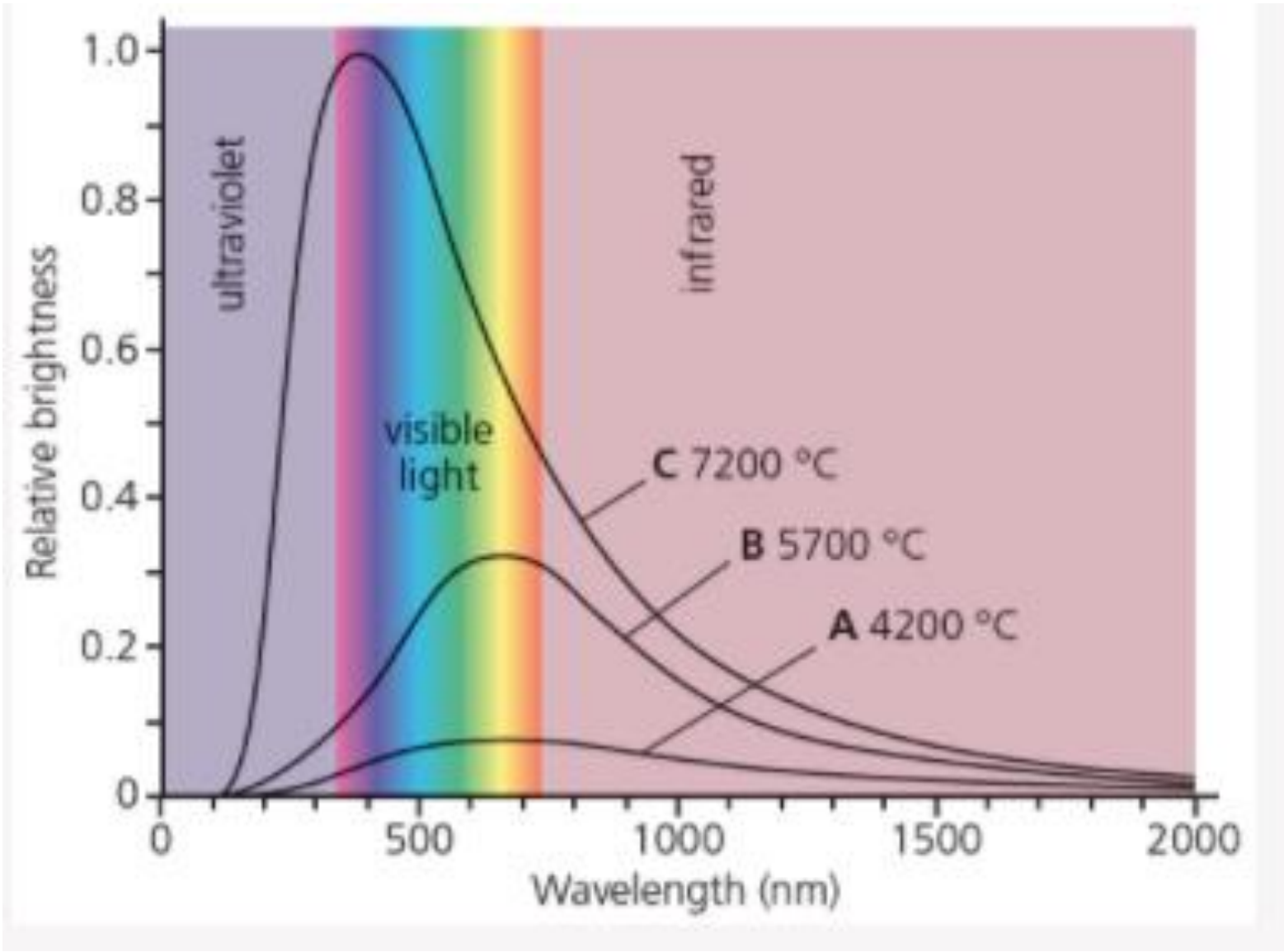
Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the P6 DIP file

Extension

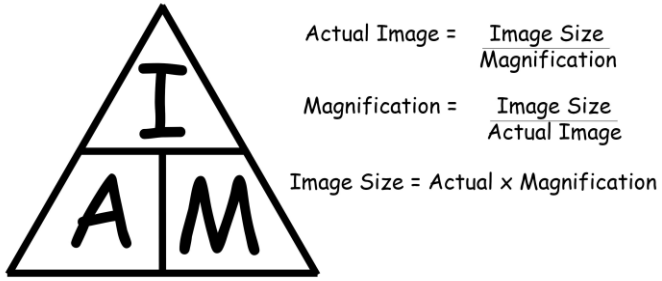
Make a note of one thing you think you understand well and one thing that you would like to ask your teacher


1.0
0.8
0.6
0.4
0.2
0
Relative brightness
ultraviolet
visible light
infrared
C 7200 °C
B 5700 °C
A 4200 °C
0
500
1000
1500
2000
Wavelength (nm)

Answers: P6.21 - Emission and absorption of infrared radiation

Connection

1



$$\text{Actual Image} = \frac{\text{Image Size}}{\text{Magnification}}$$

$$\text{Magnification} = \frac{\text{Image Size}}{\text{Actual Image}}$$

$$\text{Image Size} = \text{Actual} \times \text{Magnification}$$

2.

M=I/A=5/2.5=2

Demonstration

1 The surface of the drink. It is the hottest part of the picture.
2 They also have a temperature (above absolute zero).
3 The shiny white side.
4 Shiny copper pipes are poor absorbers of infrared radiation. Painting them black makes them absorb the infrared more effectively so the water is heated more quickly.
5 It would be glowing white hot at a higher intensity than when it was at 7200 0C. It would also be producing electromagnetic radiation of a much shorter wavelength but this would be invisible to the eyes.
6 The white object would be the same colour as the black object in question 5 only much dimmer because it wouldn't be as effective at emitting radiation.

Lesson 22: P6.22 - Temperature of the Earth

Connection

1. At 4200°C what colour is an object glowing?
2. What happens to the intensity of all wavelengths of radiation as the temperature increases?
3. What happens if you wear black in the middle of summer?

Activation

LI: describe how the atmosphere absorbs radiation in a way that varies with wavelength.

1. https://www.youtube.com/watch?v=U2CPwWgY_G4
2. Make a note of the title and the LI
3. Read pages 234-235
4. Describe what thermal equilibrium is
5. Draw and label figure 6.68
6. Describe two ways the temperature of the earth can be changed

Demonstration

Attempt questions 1-8.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the P6 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: P6.22 - Temperature of the Earth

Connection

1
The object would be glowing red

2.
The intensity of all wavelengths increases as the temperature increases.

3.If a person wears black in summer, you will feel hotter as black is a good absorber of infrared radiation

Demonstration

1 The temperature is increasing.
2 White objects are poor absorbers and emitters of radiation. Therefore, the white objects warm up or cool down more slowly than black objects do.
3 It is at a temperature above absolute zero.
4 The mean temperature of the Earth is reached when the amount of infrared radiation it absorbs balances the infrared radiation it emits. Therefore, the mean temperature of the Earth depends on the activity of the Sun and the state of the atmosphere.

Answers: P6.22 - Temperature of the Earth continued

Demonstration

5a absorption: how reflective the Earth is –e.g. icy surfaces don't absorb infrared radiation very effectively reflection: again, icy surfaces reflect infrared radiation more than other surfaces; cloud cover also reflects infrared radiation from the Sun and also from the ground emission: this depends on the temperature of the Earth and the nature of the gases in the atmosphere which might absorb the radiation on its way back into space.

5b absorption: Humans add gases into the atmosphere which absorb the infrared radiation reflection: Humans change the surface of the Earth (by building things)emission: emission is changed due to human activities which affect absorption and reflection

6 Human activities have led to gases being put into the atmosphere which absorb the infrared radiation emitted from the surface of the Earth and prevent them from reaching space.

7 This could decrease the temperature of the Earth because the particles prevent the infrared radiation of the Sun from reaching the surface of the Earth. (This is a larger effect than the greenhouse effect that they might produce.)

8 The temperature of the Earth depends on many factors such as the output of the Sun, the varying weather patterns, oceanic currents etc. Even if there is a correlation between carbon dioxide levels going up and temperature going up, this does not necessarily mean that one of them causes the other. Also the temperatures change all the time over every part of the world and it is difficult to measure the average temperature change to a high degree of accuracy. So the increase in temperature could be a random short term effect.

P6 - Revision

Connection

Q1. What do objects that are hotter than their environments do?

Q2. How does radiation affect the temperature of the Earth?

Q3. How is the greenhouse effect changing the Earth temperature?

Activation

LI: Create a topic summary sheet

1. Fold an A3 sheet so it is divided into 8 sections
2. Look back over you lesson and group them into 8 main headings
3. Summarise the key points into each section, use keywords and diagrams and symbols rather than sentences

Demonstration

Test yourself by working with the person sitting next to you by talking though each box on your summary sheet and seeing how many key facts you can remember

Consolidation

Look though the relevant past paper questions for this topic - From the P6 DIP file – see if you can complete any additional questions

Extension

Make a list of anything that you would like to ask your teacher to go over again

Answers: P6 Revision

Connection

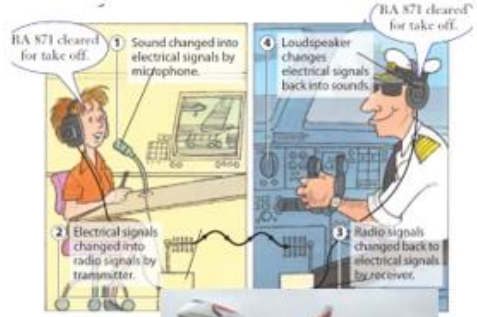
1 Emit radiation at a greater rate than they absorb it.

2 The temperature f the Earth depends on the rate of absorption of radiation from the Sun and the emission of radiation and the rate of reflection back out into space.

3 The green house gas layer reflects radiation that has been reflected from Earth back towards Earth causing the Earths temperature to increase.

DART P6 RADIO WAVES

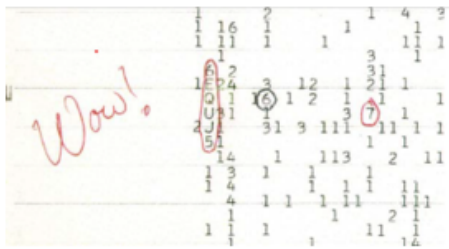
The longest wavelengths in the electromagnetic spectrum are radio waves. Any electromagnetic wave with a longer wavelength than 50 cm is a radio wave.
The main use for radio waves is communication. Sounds can be sent by radio waves and the receiver converts the radio waves back into sounds by radio waves.
Radio messages from the control tower help planes to land.



Radio is now so widely used that our planet is constantly awash with radio waves. When radio waves hit living cells, they mostly pass through them. This means that nothing happens, so we think it is a safe technology to use.
However, high-energy radio waves can be absorbed by tissues, which causes them to heat up.

This may cause damage such as cataracts in the eyes.
For example, being very close to a **radar** antenna can be dangerous, so workers are not allowed near them when they are switched on. A walkie-talkie has such a low power that it is completely safe.
Radio waves are **absorbed** by thicker or denser objects like thick walls. Metals can absorb or **reflect** them.
For a receiver to pick up radio signals, the aerial must be made of metal so it absorbs the waves. When it does so, the radio waves produce an alternating current in the aerial. The frequency of this current is the same as the radio wave itself. This electric signal can be changed into the sound that comes from a loudspeaker.
The electric current in the metal may also make it warmer.

Radio waves are made naturally by some stars. Astronomers study these using banks of big dish receivers which can pick up these radio waves. To pick up very large wavelengths we can link together the results from several radio dishes which can be many kilometres apart.
The largest single-dish radio receiver in the world is at Arecibo in Puerto Rico.
One of its uses is to look for radio messages from space that may have been sent by aliens. This forms part of the Search for Extra-Terrestrial Intelligence (SETI) project. So far, no alien messages have been received; although one unusual one from 1977 remains unexplained.



References:

Longman AQA Science; Nigel et al; 2009

https://www.sciencefocus.com/future-technology/how-does-a-tv-aerial-work/

QUESTIONS

1a. Name the longest part of the EM spectrum and state its minimum wavelength.

1b. State some uses of radio waves.

1c. Describe how the radio waves might help the pilot land the plane safely.

2a. Describe some properties of radio waves

2b Describe some uses of radio waves

2c. Compare the use of a walkie-talkie to a radar antenna in terms of energy and safety.

3a. Explain why most radio waves can pass safely through humans without causing any harm.

3b. Explain how aerials work and why they can be dangerous.

3c. Use the information contained in the text to prepare a leaflet explaining how radio waves are being used by SETI to search for extra-terrestrial life.

P6 – DART ANSWERS – Waves

1a. Radio waves with a minimum wavelength of 50 cm.

1b. Communications, TV aerials, radars, walkie talkies

1c. Sounds can be sent by radio waves between the pilot and air traffic control and the receiver converts the radio waves back into sounds by radio waves.

2a. Radio waves are longer wavelength waves with lower energy and frequencies.

2b. Radio waves are used by air traffic controllers to guide planes down safely bu converting signals between radio and sound wavelengths. They are also used in aerials. Metal aerials absorb and reflect radio waves better than other materials. Once absorbed the radio signal gets converted into an alternating current with the same frequency which can then be changed to a sound signal from a loudspeaker.

2c. Walkie talkies use lower energy and longer wavelength radio signals compared to the higher energy radio waves used in radars and aerials. These higher energy waves can damage body tissue and organs as they pass through us whereas the walkie talkie radio waves can pass through us safely without causing any issues.

3a. Radio waves are longer length waves on the EM spectrum. Most of the radio waves are low energy and low frequency such as those used on walkie talkies which can pass through the body without causing damage to internal tissue and organs.

3b. Metal is very good at absorbing and reflecting radio waves. The absorbed radio signal gets converted into an alternating current with the same frequency which can then be changed to a sound signal from a loudspeaker. Aerial radio signals are at the higher end of the spectrum and can cause damage to human body tissue and organs as they pass through.

3c. Students should create a leaflet using information from the whole text in particular the last paragraph to describe how radio waves are used in space research.

Attainment Band :	P6 Waves (AQA) Knowledge and Understanding
Yellow Plus/ Yellow	Rearrange and apply the wave equation. Explain the difference between transverse and longitudinal waves. Explain how to measure the speed of ripples on a water surface, and relate this to more general wave behaviour. Describe evidence that, for e.g. ripples on a water surface, it is the wave and not the water itself that travels. Describe how different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength. Use wavefront diagrams to explain refraction in terms of a change in wave velocity. Describe how radio waves are produced. Evaluate the risks and consequences of exposure to radiation. Explain why each type of electromagnetic wave is suitable for the application.
Blue	Use the wave equation $v = f \lambda$ to calculate wave speed. Give examples of longitudinal and transverse waves. Describe how to measure the speed of sound waves in air. Give examples of energy transfer by waves (including electromagnetic waves). Describe examples of reflection, transmission and absorption of waves (including electromagnetic waves) at material interfaces. Construct ray diagrams to illustrate refraction at a boundary. Compare the groupings of the electromagnetic spectrum in terms of wavelength and frequency. Explain the risks associated with the use of ionising and ultraviolet radiation. Describe examples of energy transfer by electromagnetic waves.
Green	Describe the amplitude, wavelength, frequency and period of a wave. Realise that waves can be transverse or longitudinal. Describe how sound waves travel through air or solids. Understand that waves transfer energy or information. Understand that waves can be absorbed, transmitted or reflected at a surface. Explain what happens to a ray that is refracted. Name the main groupings of the electromagnetic spectrum. Describe the hazardous effects of gamma rays, X-rays and ultraviolet radiation. Give examples of the uses of the main groupings of the electromagnetic spectrum.
White	Some elements of the above have been achieved