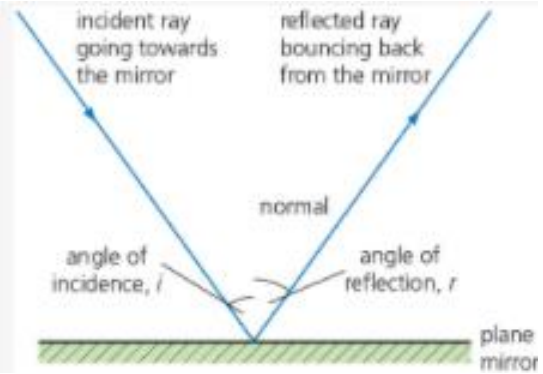
Answers: P6.8 - Sound waves

Connection

1 Specular reflection is when all the light is reflected off in the same direction, where as diffuse reflection is when light is reflected in all directions

2.



Demonstration

1a No
1b Yes
2 f = v / λ so if the wavelength increases, the frequency decreases (the speed stays the same). This means that the sound will be lower in pitch.
3 16 cm
4 The air particles vibrate to the left and right about a fixed position as the longitudinal wave passes through them.
5 The vibrating air particles in the ear canal transfer energy to the energy store of the ear drum. This makes the ear drum vibrate. In turn, the ear drum makes the ossicles vibrate which make the fluid in the inner ear vibrate. The inner ear transfers energy from the energy store of the fluid in the inner ear into electrical impulses in the nerves.
6 This would make the coil vibrate with a large amplitude and a high frequency.

Lesson 9: P6.9 - Exploring ultrasound

Connection

1. Sound waves are **longitudinal/transverse**
2. What is the range of human hearing?
3. Why is the speed of sound different in different mediums?

Activation

LI: describe how ultrasound is used in medicine and in industry

1. https://www.youtube.com/watch?v=8ixr2NQF9Dg
2. Make a note of the title and the LI
3. Read pages 208-209
4. Define “Ultrasound” using the glossary
5. List four ways that ultrasound is used in industry and medicine
6. Copy down the sentence from the “REMEMBER!” bubble

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

Demonstration

Attempt questions 1-10.
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

Answers: P6.9 - Exploring ultrasound

Connection

1 Sound waves are longitudinal

2. 20Hz – 20,000Hz

3. The speed of sound is different in different mediums because the mediums are of different densities

Demonstration

1 It has a frequency that is too high for humans to hear.
2 Sound has a longer wavelength than ultrasound and this means that it can't be focused into a narrow beam. This would blur the image.
3 X-rays are particularly dangerous to bodies that are growing rapidly (such as a developing baby or a young child). So using ultrasound is much safer.
4 e.g. checking the health of unborn babies; checking that materials used in aircraft don't have any cracks in them.
5 An ultrasound image can detect cracks in pipes so this will determine whether there is a leak.
6 If the speed changes by a large amount then most of the ultrasound is reflected. This might be a problem because if most of the ultrasound is reflected then the ultrasound that can pass to deeper structures in the body becomes very weak and these structures might not be able to be imaged.
7 To prevent too much reflection so most of the ultrasound passes into the body.

Answers: P6.9 - Exploring ultrasound Continued

Demonstration

8 A short pulse of ultrasound waves is transmitted into the body. When the pulse hits a boundary (e.g. between one tissue and another tissue) some of it reflects back and some of it continues onwards. By measuring the reflected pulses, a computer can form an image of the structures inside the body.

9 The second pulse has travelled further than the first pulse. The extra distance it goes is twice the size of the head (because it passes through the head and reflects back again).Let the size of the head = d Distance = speed × time2d= 1500 × 140 × 10-6= 0.21 m So d= 0.21 / 2 = 0.105 m or 10.5 cm

10 Lungs are full of air. Ultrasound travels at a very different speed in air than in body tissue so most of the ultrasound would reflect back from the lungs. Therefore, any pulses passing to the other side of the lungs would be far too weak to be used to form an image

Lesson 10: P6.10 - Seismic waves

Connection

1. What is the name of reflected sound waves?
2. Name two uses of ultrasound
3. What is the function of ultrasound gel?

Activation

LI: explain how the properties of seismic waves allow us to investigate the inside of the Earth.

1. https://www.youtube.com/watch?v=h4jvZ_zHKYY
2. Make a note of the title and the LI
3. Read pages 210-211
4. What is the name of the equipment that is used to detect seismic waves
5. Draw and label figure 6.31
6. Copy down the definitions of P-waves and S-waves
7. Draw and label figure 6.33

Demonstration

Attempt questions 1-5.
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

Extension

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

Consolidation

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

Answers: P6.10 - Seismic waves

Connection

1 An echo

2 to measure the thickness of objects , to check that an unborn baby is developing properly

3 Without gel, nearly all the ultrasound would be reflected at the skin and a good image of the internal structure would not be obtained.

Demonstration

1 Gravity
2 The base of the seismometer needs to move around with the rock while the weight remains still.
3a Longitudinal
3b Transverse
4 A P wave travels faster than an S wave.
5 The density of the Earth gets larger the further in you go towards to core and so the speed of the waves increases. As this is a gradual change of density then the speed also gradually changes. The waves gradually refract and so they curve rather than change direction suddenly.

Lesson 11: P6.11 - The electromagnetic spectrum

Connection

1. Name the two types of seismic waves

2. Which seismic wave is transverse and which is longitudinal?

3. Which type of seismic wave may travel through the core of the earth?

Activation

LI: describe the main groupings and wavelength ranges of the electromagnetic spectrum

1. https://www.youtube.com/watch?v=bjOGNVH3D4Y
2. Make a note of the title and the LI
3. Read pages 212-213
4. State the speed of all EM waves in a vacuum
5. Draw and label figure 6.34
6. Give uses for gamma rays, x-rays, UV, visible, infrared, microwaves, radio waves.

Consolidation

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

Demonstration

Attempt questions 1-9.
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

Extension

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

Answers: P6.11 - The electromagnetic spectrum

Connection

1 P- waves, S-waves

2 P-waves are longitudinal
S-waves are transverse

3 S-waves cannot pass through the core of the earth and leaves a shadow sone on the other side of the earth

Demonstration

1 A transverse wave vibrates at right angles to the direction that it travels and a longitudinal wave vibrates along the same direction that it travels.
2 They don't need a material to carry them; they can travel in a vacuum.
3 They are all transverse waves and they all travel at the same speed in a vacuum.
4 Gamma rays
5 f = v / λ = 3.0 × 108 / 3.5 × 10-7 = 8.6 × 1014 Hz
6 f = v / λ = 3.0 × 108 / 0.2 = 1 500 000 000 Hz = 1.5 × 109 Hz
7 Ultraviolet waves have a higher frequency than radio waves. Therefore, they can transfer more energy. This increases their ability to do harm.
8 The food in the oven warms up, which means that the waves have transferred energy from the oven to the food.
9 The waves spread out so the energy that they carry becomes diluted. This means that the signal becomes weaker the further away you are from a phone mast.

Lesson 12: P6.12 - Reflection, refraction and wavefronts

Connection

1. Name the seven types of EM waves
2. Which type of EM wave has the highest energy?
3. Describe the trend that relates frequency and wavelength in terms of EM waves

Activation

LI: use wavefront diagrams to explain refraction in terms of the difference in velocity of the waves in different substances

1. https://www.youtube.com/watch?v=XvV6KWVEsek
2. Make a note of the title and the LI
3. Read pages 214-215
4. Define “Wavefront” using the glossary
5. Draw and label figure 6.37
6. Copy the text from the “KEY INFROMATION” box

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: P6.12 - Reflection, refraction and wavefronts

Connection

1 gamma rays, x-rays, UV, visible, infrared, microwaves, radio waves.

2 gamma rays

3 As the frequency of the EM wave increases the wavelength decreases. This is because the speed of all EM waves is a constant.

Demonstration

1 Aluminium foil is shiny so it is a good reflector of infrared radiation. Therefore, the heat is reflected back into the room rather than absorbed by the walls. This reduces heat transferring through the walls and so reduces the heating bills.

2 e .g. a thermos flask, white buildings in hot countries

3 $\lambda = v / f = 3.0 \times 108 / 10 \times 106 = 30$ m

4 $f = v / \lambda = 3.0 \times 108 / 100 = 3.0 \times 106$ Hz $= 3.0$ MHz

5 Under the right conditions, radio waves can reflect off the atmosphere. This enables them to reach places that are out of line of sight due to the curvature of the Earth.

6a The wavefronts get closer together and they change direction

6b They travel faster in deeper water. The diagram shows that they slow down when they enter shallow water because they become closer together (like cars do in a traffic jam).

Lesson 13: P6.13 - Gamma rays and X-rays

Connection

1. Name the three behaviours of electromagnetic waves

2. Why would putting aluminium foil behind radiators be a benefit?

3. Draw a wavefront of refraction

Activation

LI: List the properties of gamma rays and X-rays

1. https://www.youtube.com/watch?v=dBFGjdgbpno
2. Make a note of the title and the LI
3. Read pages 216-217
4. Describe the two ways that gamma rays are used in medicine:
   - As a tracer
   - To kill cancer cells
5. Describe how x-rays are used to image bones
6. List two similarities and two differences between x-rays and gamma rays

Consolidation

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

Demonstration

Attempt questions 1-9.
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

Extension

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

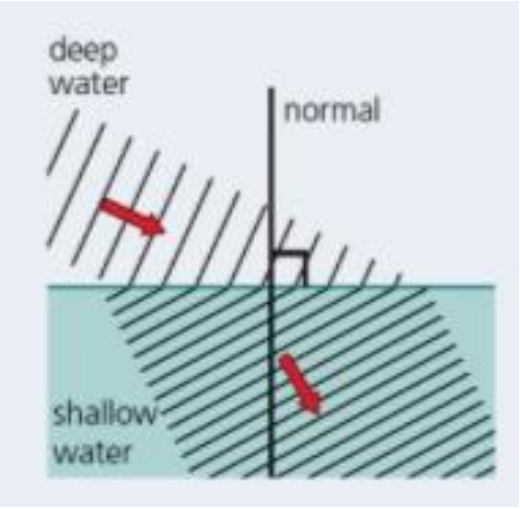
Answers: P6.13 - Gamma rays and X-rays

Connection

1 reflection, transmission, absorption

2 aluminium foil reflects infrared light back into the building keeping the building warmer.

3



Demonstration

1 It is long enough to be useful but not too long so that the patient is exposed where there are no more benefits.
2 They should be gamma emitters; they should not be dangerously toxic.
3 Usually radiotherapy needs X-rays which transfer a higher energy than the X-rays used for imaging. This means that X-rays used for radiotherapy will tend to have shorter wavelengths.
4 Gamma rays can pass straight through bone and tissue so there wouldn't be enough contrast in the image to enable any diagnosis to take place
5 Similarities: they are both electromagnetic wave. Differences: Gamma rays tend to have a higher frequency than X-rays (although there is some overlap); gamma rays come from the nucleus of an atom whereas X-rays are produced by the electrons.
6 Gamma rays come from a radioisotope which doesn't need electricity to work. X-rays are produced by accelerating electrons so they collide with a target with high energy. You need an electricity supply in order to accelerate the electrons.
7 They are dangerous and can give you radiation sickness / cancer.
8 The X-ray image is different if there is a fault in a weld so an expert can detect the fault.
9 The chest X-ray has a very small dose compared to what an average person would receive anyway so this procedure is relatively safe and the benefits for most people would easily outweigh the risks. The CT scan has a much bigger dose but this is still below what an average person would receive from natural sources. So if you only have one CT in a year then it is relatively safe although the doctors need to decide whether the risk is worth it and CT scan will help them to make the patient better.

Lesson 14: P6.14 - Ultraviolet and infrared radiation

Connection

1. Name one use of gamma rays
2. Name one use of x-rays
3. Name one similarity and one difference between x-rays and gamma rays

Activation

LI: describe the properties of ultraviolet and infrared radiation

1. https://www.youtube.com/watch?v=V9K6gjR07Po
2. Make a note of the title and the LI
3. Read pages 218-219
4. Name two uses of UV radiation
5. Name two uses of infrared radiation
6. Describe the hazards of UV radiation and describe how sunscreen works.

Consolidation

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

Demonstration

Attempt questions 1-10.
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

Extension

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

Answers: P6.14 - Ultraviolet and infrared radiation

Connection

1 Gamma rays can be used as medical tracers or be used to kill cancer cells

2 X-rays can be used to image a persons bones

3 both x-rays and gamma rays are electromagnetic waves and move at a constant speed

Gamma rays have a higher frequency and energy that x-rays

Demonstration

1 e.g. security marking; tanning; producing vitamin D
2 You can use an invisible ink that glows when ultraviolet light is shone on it.
3 So they can check the bank notes to see if they are genuine.
4 Ultraviolet lights often do have a purple colour but this is due to the visible light they produce in addition to the ultraviolet. This is a safety measure to show the user that they are switched on. Ultraviolet light is invisible to our eyes so it has no colour.
5 Small doses help your body to make vitamin D. Large doses can cause sunburn or skin cancer.
6 Snow reflects ultraviolet light so skiers will be exposed to more ultraviolet than people on the beach if the sunlight is the same in both situations.
7 Infrared radiation can't pass through the chicken. You need to wait for the inside of the chicken to be heated by other processes.
8 Conduction.
9 e.g. they can detect the presence of a warm body and set the alarm off; they can be used with a beam of infrared and set the alarm off if the beam is blocked by something going past.
10 Infrared radiation reflects off surfaces, so the remote can point towards a surface and the infrared beam can reflect off this towards the TV

Lesson 15: P6.15 - Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface

Connection

1. Put these in order from longest wavelength to shortest wavelength
    1. Gamma rays
    2. Infrared
    3. Microwaves
    4. Radio
    5. X-rays
    6. Visible
    7. UV
2. Name one use for UV radiation and Infrared radiation

Activation

LI: apply ideas from an investigation to a range of practical contexts.

1. https://www.youtube.com/watch?v=LFwio38EK9s
2. Make a note of the title and the LI
3. Read pages 220-221
4. Experiment 1 –
    - Draw and label figure 6.46
5. Experiment 2 –
    - Draw and label figure 6.47

Demonstration

Attempt questions 1-11.
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: P6.15 - Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface

Connection

1
Radio
Microwave
Infrared
Visible
UV
X-rays
Gamma rays

2. UV – tanning, fluorescent lighting

Infrared – communication, cooking

Demonstration

1 The experiment shows how quickly a surface can absorb infrared radiation.
2 The stopper connected to the blackened metal plate should drop first. This is because black surfaces absorb infrared more effectively than shiny surfaces.
3 The thickness of the plates should be the same, the mass of the stoppers and the amount of wax used to stick them should be the same, the heater needs to give the same heat transfer in both directions and the plates need to be placed the same distance either side of the heater.
4 This ensures that the temperature of each surface is the same.
5 To make it a fair test and ensure that the effect of the area on the infrared radiation is kept the same.
6 The infrared detector needs to be placed the same distance from each of the sides of the container.
7 The blackened bulb will absorb the infrared effectively and so the thermometer can measure the amount of infrared being produced.
8 The infrared sensor.
9a A firefighter's suit needs to be white or shiny.
9b Solar panels needs to be matt black.
10a It needs to be shiny (so that it doesn't emit much infrared radiation).
10b They need to be matt black (so they emit lots of infrared radiation).
11Although they are emitting different intensities of infrared light, the sides of the cube are all at the same temperature. This is because of conduction of heat through the walls from the water. Therefore, the thermometer would give the same reading on all of the sides

Lesson 16: P6.16 - Microwaves

Connection

1. What coloured surface is the best absorber of infrared light

2. What coloured surface is the best reflector of infrared light

3. Name three ways infrared radiation is used

Activation

LI: describe how microwaves are used for cooking food and in radar.

1. https://www.youtube.com/watch?v=wCrtk-pyP0I
2. Make a note of the title and the LI
3. Read pages 222-223
4. Draw and label figure 6.48
5. Describe how microwaves are used to cook food
6. Describe how microwaves are used in radar

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: P6.16 - Microwaves

Connection

1
Black

2.
Shiny silver

3
Cooking
Heating
Infrared cameras

Demonstration

1 Mobile phones / Satellite communication / cooking
2 This is quite a long wavelength in the microwave region. Therefore, these microwaves have low energy and are likely to be used for communication.
3 Microwaves only cook water or fat molecules and they penetrate about 1cm beneath the surface of the food. Conventional ovens use infrared to cook food. Infrared red only reaches the outer surface of the food but it does cook all materials. Both processes rely on conduction for the remainder of the food to cook.
4 It is quicker because the microwaves penetrate into the food. Food is cooked more evenly because the microwaves heat up the food from the inside rather than just at the surface.
5 Usually bread is cooked using infrared. This makes the outside of the toast crispy and the inside moist. Making toast in a microwave oven would have the opposite effect. The inside would be baked hard (or burnt) and the outside will still be soft bread.
6 Distance microwave travels = speed × time = 3.0 × 108× 64 × 10-6= 19 200 m. The microwave travels to the target and back so the target is 19 200 / 2 = 9 600 m away.
7 The signal gets weaker the further it goes so the equipment won’t be sensitive enough. Also there are more reflections from other objects which confuse the signal, the further away the targe

Lesson 17: P6.17 - Radio and microwave communications

Connection

1. What are the range of wavelengths for microwaves?
2. Describe how microwaves are used to heat food?
3. Why are microwaves non-ionising radiation?

Activation

LI: describe how radio waves are used for television and radio communications.

1. https://www.youtube.com/watch?v=Ldnh0XlMVc0
2. Make a note of the title and the LI
3. Read pages 224-225
4. Draw and label figure 6.50
5. Describe how microwaves are used in communications
6. Draw and label figure 6.51
7. Describe how radio waves are transmitted via the ionosphere

Consolidation

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

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

Extension

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

Answers: P6.17 - Radio and microwave communications

Connection

1
1cm – 30cm

2.
Microwaves cause water and fat molecules to vibrate and transfer energy to them

3
Microwaves are non-ionising because they do not have enough energy to rip electrons off of atoms

Demonstration

1 Radio waves travel very fast (the speed of light) which means that communication can be very fast. Radio waves can travel large distances and they can pass through most walls.
2 $f = v / \lambda = 3.0 \times 108 / 100 = 3.0 \times 106$ Hz = 3.0 MHz.
3 A radio receiver has a wire or a coil. Radio waves induce oscillations in the wire or coil which results in a changing current. This current is the radio signal that the receiver picks up and can be turned into sound.
4 These radios use the energy transmitted by the radio waves for their power.
5 Microwaves don't pass through the walls of houses very effectively.
6 Buildings absorb microwave signals so you need lots of aerials for the signals to make sure that users can pick up a signal wherever they are.
7 They refract in the ionosphere and return to Earth.
8 Waves with this frequency don't return to Earth but are transmitted into space.