PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 5: LIGHT AND THE ELECTROMAGNETIC SPECTRUM (PACK 1)

SCORE	PERCENTAGE
/91	%

STEMUP

These questions belong to Pearson Edexcel, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by Pearson Edexcel. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with Pearson Edexcel and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. Pearson Edexcel has not endorsed, approved or been involved in the production of it. Pearson Edexcel and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

Pearson Edexcel publishes its past papers, mark schemes and examiner reports. Always check the current specification at qualifications.pearson.com before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

A student investigates what happens when light travels from air to glass.

Figure 2 shows some of the apparatus used in the investigation.

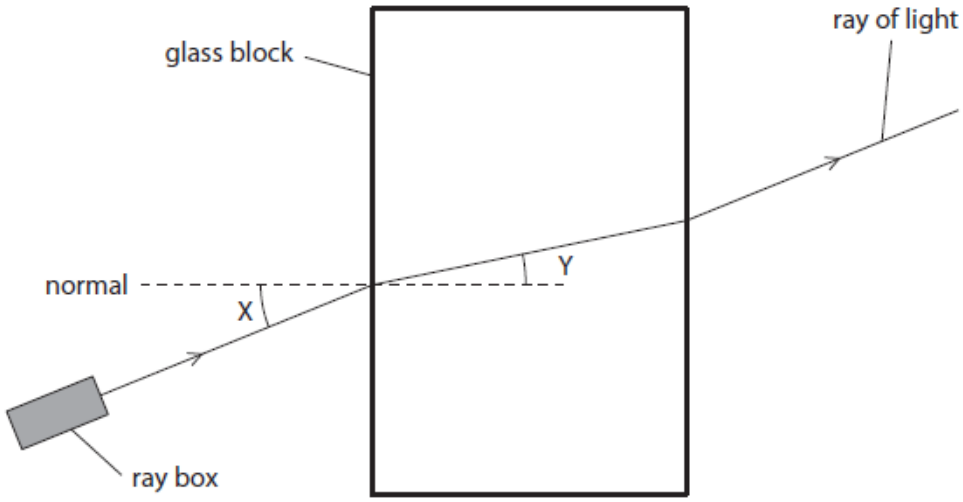


Figure 2

(i) In Figure 2, angle Y is the angle of

(1)

☒ **A** deflection

☒ **B** incidence

☒ **C** reflection

☒ **D** refraction

(ii) Figure 3 is a graph of the student's results.

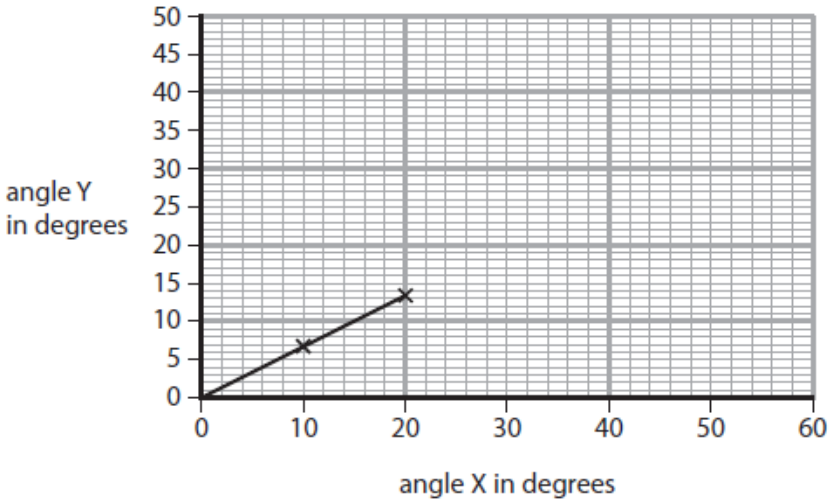


Figure 3

Use the graph to calculate a value for

$$\frac{\text{angle Y}}{\text{angle X}}$$

(2)

$$\frac{\text{angle Y}}{\text{angle X}} = \text{.....}$$

(iii) The student concludes that angle Y is directly proportional to angle X.

Explain what the student must do to test this conclusion in more detail.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q2.

Shot-put is an Olympic event.
The shot is a heavy ball.
An athlete throws the shot as far as possible.

A sports scientist analyses an athlete's throw to help improve performance.

In one throw, the shot continues to rise by another 1.3 m after it leaves the athlete's hand.
The mass of the shot is 7.26 kg.

Calculate the amount of gravitational potential energy gained by the shot.

(2)

gravitational potential energy gained = ... J

(Total for question = 2 marks)

Q3.

Radio waves from Jupiter take 40 minutes to reach Earth.

Light waves from the Sun take 8 minutes to reach Earth.

Calculate how many times further it is from Earth to Jupiter than from Earth to the Sun.

State the property of electromagnetic radiation that is used in your answer.

(2)

..... times

property .....

.....

(Total for question = 2 marks)

Q4.

Figure 13 shows two ice skaters during a performance.



Figure 13

(i) The two ice skaters are travelling together in a straight line at 3.50 m/s.

Their total momentum is 371 kgm/s.

The man has a mass of 64.5 kg.

Calculate the mass of the woman.

(4)

mass = ... kg

(ii) Calculate the kinetic energy of the man.

(2)

kinetic energy = ... J

(Total for question = 6 marks)

Q5.

(i) The aircraft lands with a velocity of 71 m/s.

The mass of the aircraft is 3.6 × 105 kg.

Calculate the kinetic energy of the aircraft as it lands.

(2)

kinetic energy of aircraft = ... J

(ii) When the aircraft has come to a stop, all the kinetic energy has been transferred to the surroundings.

Give **one** way that the energy has been transferred to the surroundings.

(1)

.....

.....

(Total for question = 3 marks)

Q6.

In a science fiction story, lightning is used as an energy source for accelerating a car.

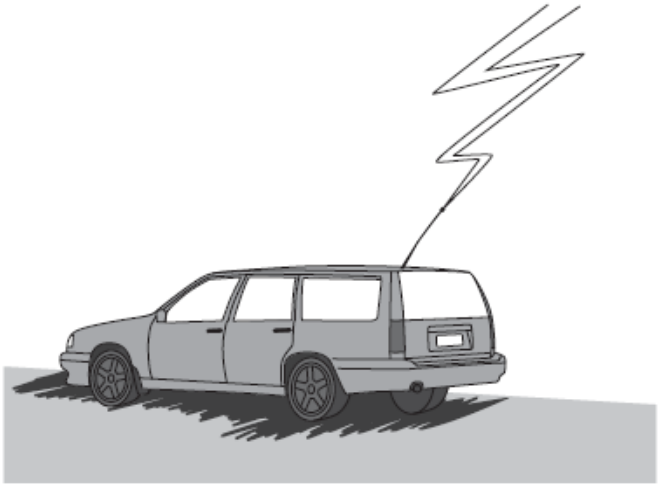


Figure 6

In the story, the car has a kinetic energy of 960 kJ at a speed of 40 m/s.

(i) Calculate the mass of the car.

(4)

mass = ... kg

(ii) Only 5% of the energy of the lightning bolt is transferred to the kinetic energy of the car.

Calculate the total energy of the lightning bolt in MJ.

(2)

energy = ... MJ

(Total for question = 6 marks)

Q7.

A kettle is used to heat water.

Figure 11 shows a graph of temperature against time for the water in the kettle.

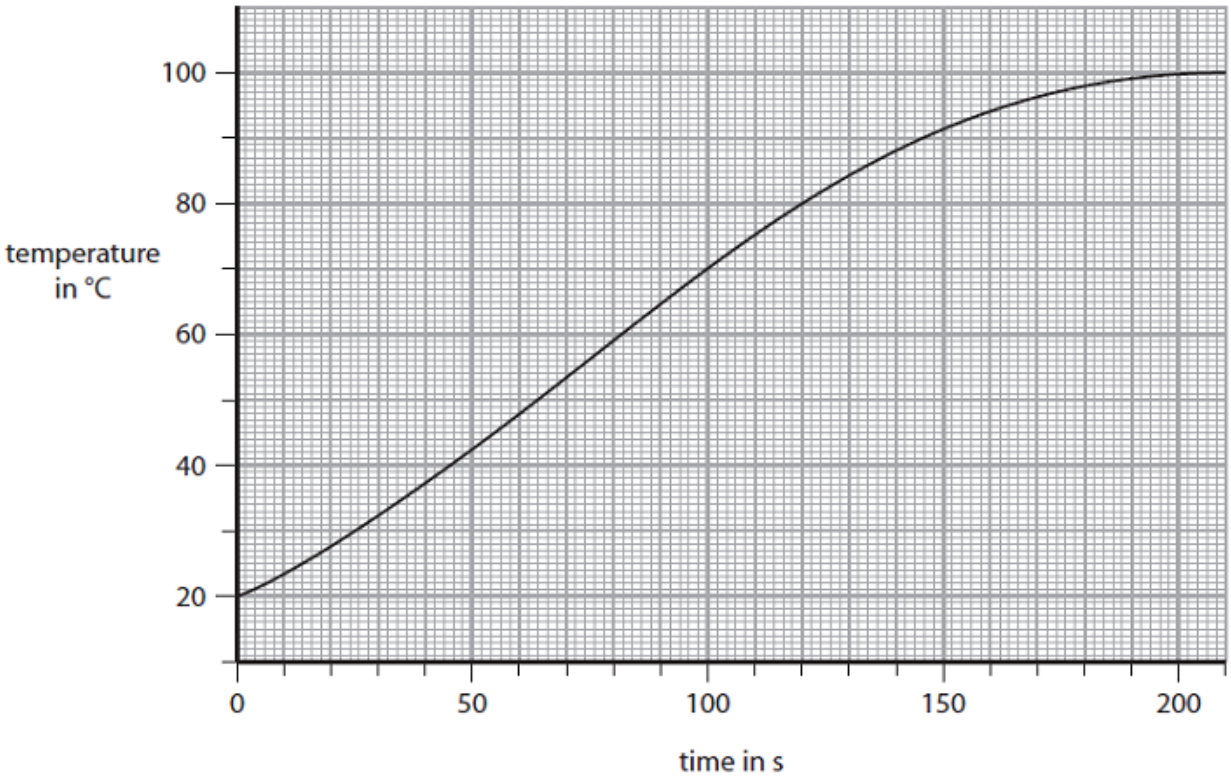


Figure 11

Calculate the rate of increase in temperature at a time of 150 s, by drawing a tangent to the curve in Figure 11 at a time of 150 s.

(3)

..... °C / s

(Total for question = 3 marks)

Q8.

A kettle is used to heat water.

The kettle has an efficiency of 91% in supplying energy to the water.
The thermal energy of the water increases by 3.3×10^5 J in 200 s.

Calculate the total amount of energy supplied to the kettle in the 200 s.

Use the equation

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$$

(2)

total amount of energy supplied = ... J

(Total for question = 2 marks)

Q9.

This question is about waves in the electromagnetic (e.m.) spectrum.

(i) A microwave oven uses waves of frequency 2.45 GHz.

Calculate the wavelength of the microwaves.

The velocity of light is 3.00×10^8 m/s.

(3)

wavelength = ... m

(ii) The microwave oven is 55% efficient and transfers 42 000 J of energy to some food when it is heated.

Calculate the total amount of energy that must be supplied to the oven.

(3)

energy supplied to oven = ... J

(Total for question = 6 marks)

Q10.

Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Which statement describes conservation of energy in a closed system?

(1)

☒ **A** when there are energy transfers, the total energy reduces

☒ **B** when there are energy transfers, the total energy does not change

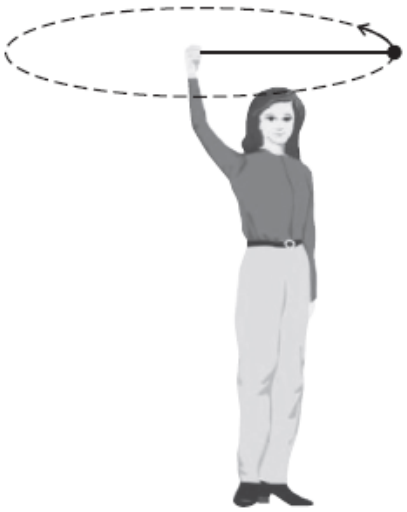
☒ **C** when there are no energy transfers, the total energy reduces

☒ **D** when there are no energy transfers, the total energy increases

(Total for question = 1 mark)

Q11.

(a) The diagram shows a girl swinging a rubber ball in a horizontal circle above her head.



(i) In which direction does the resultant force act on the ball?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** away from the centre of the circle

☒ **B** in the direction of the arrow on the diagram

☒ **C** in the opposite direction to the arrow on the diagram

☒ **D** towards the centre of the circle

(ii) State the name of the resultant force acting on the ball.

(1)

.....

(iii) Suggest what would happen to the ball as the girl gets tired.

(2)

.....

.....

.....

.....

(iv) The girl lets go of the string and the ball hits a wall.

The collision is not elastic.

Explain what happens to both momentum and kinetic energy when the ball hits the wall.

(2)

.....

.....

.....

.....

*(b) Describe a cyclotron and how charged particles move inside it.

You may draw a labelled diagram to help with your answer.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question = 12 marks)

Q12.

Radio waves and gamma radiation are at opposite ends of the electromagnetic spectrum.

Compare how these two electromagnetic radiations are produced.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q13.

* Nuclear fission and nuclear fusion are two non-renewable sources of energy.

Compare nuclear fission and nuclear fusion as possible sources of energy for generating electricity using a nuclear reactor.

Your comparison should refer to

- the differences between nuclear fission and nuclear fusion
- the relative advantages and difficulties involved in using these sources.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q14.

* X-rays and radio waves are part of the electromagnetic spectrum and have different uses.

These radiations are produced in different ways.

X-rays are emitted when electrons within an atom go through energy changes.

Radiowaves are produced by electrons in circuits.

Compare X-rays with radio waves.

Your answer should refer to

- the uses of both types of radiation
- the different ways that electrons are involved in producing X-rays and radio waves.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q15.

A student lifts a toy car from a bench and places the toy car at the top of a slope as shown in Figure 2.

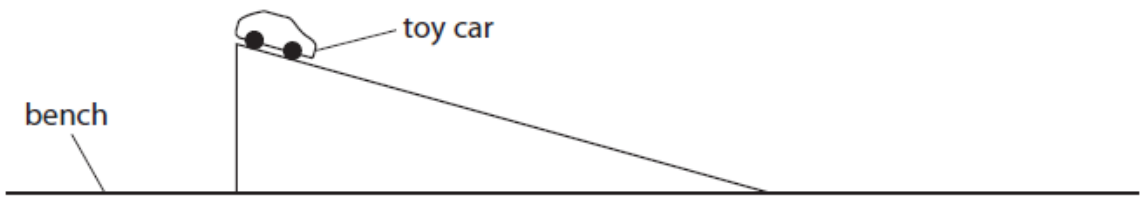


Figure 2

Describe an energy transfer that occurs when the student lifts the toy car from the bench and places the toy car at the top of the slope.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q16.

Ultraviolet waves cover a range of frequencies.

Scientists divide this range into three types, UVA, UVB and UVC.

The table in Figure 11 shows the frequency range for each type.

type	frequency range in Hz
UVA	7.5×10^{14} to 9.4×10^{14}
UVB	9.4×10^{14} to 10×10^{14}
UVC	10×10^{14} to 30×10^{14}

Figure 11

Figure 12 is a diagram about the effect that the Earth's atmosphere has on three types of ultraviolet radiation.

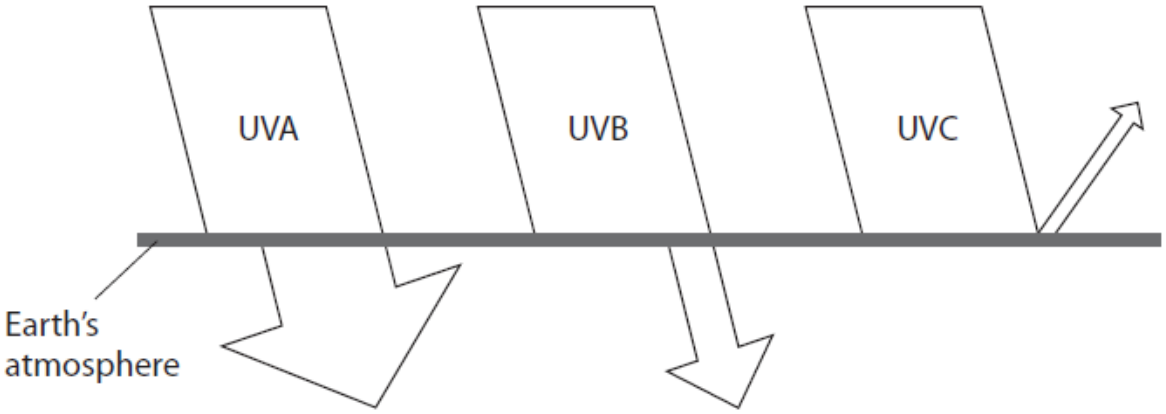


Figure 12

Describe how the effects change with **wavelength**, using information from Figure 11 and Figure 12.

The width of the arrows drawn indicates the amount of radiation that is involved.

Calculations are **not** required.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q17.

To investigate refraction in a rectangular glass block a student uses the apparatus shown in Figure 3.

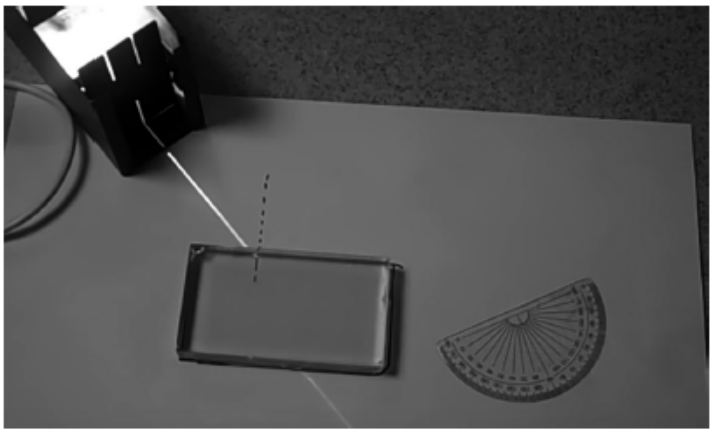


Figure 3

Describe how the student should measure the angle of refraction.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q18.

Expanded polystyrene, used to insulate buildings, has different densities.

Figure 4 shows how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

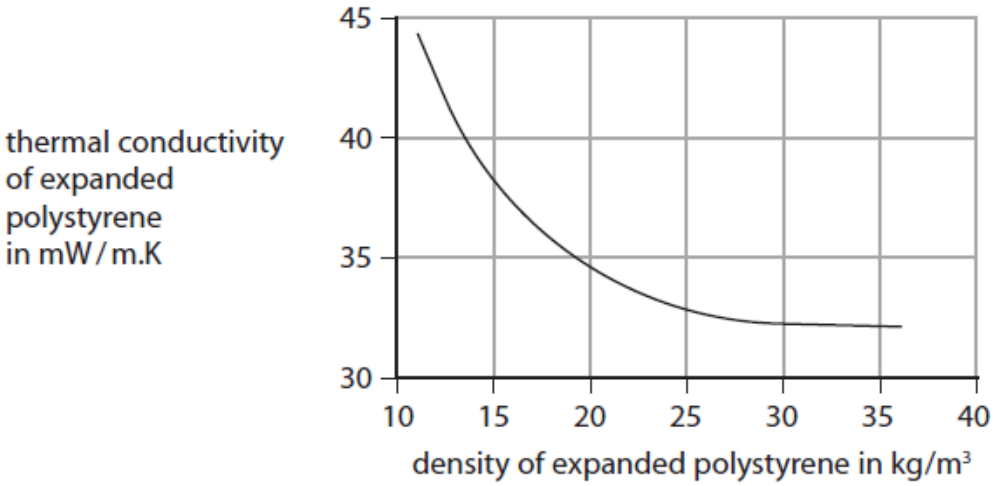


Figure 4

Using the graph in Figure 4, describe how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q19.

A student uses the apparatus in Figure 3 to find out which of two materials, sand or sawdust, is the better insulator.



Figure 3

The student also has a kettle to boil water, a thermometer and a stop clock.

(i) Draw a labelled diagram to show how the student should set up the equipment to investigate which material is the better insulator.

(3)

(ii) Give **three** factors that the student must control in this investigation.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(Total for question = 6 marks)

Q20.

(a) Here are some forms of energy:

chemical	elastic potential	electrical
heat (thermal)	kinetic	light
nuclear	sound	

(i) Use words from the box to complete the table.
Each word may be used once, more than once, or not at all.

The first one has been done for you.

(3)

device	energy transferred from...	energy is mostly transferred into...
electric motor	electrical	kinetic
bow and arrow	elastic potential	
electric kettle	electrical	
microphone		electrical

(ii) In the electric motor only some of the electrical energy is transferred into kinetic energy.

State what happens to the remaining electrical energy.

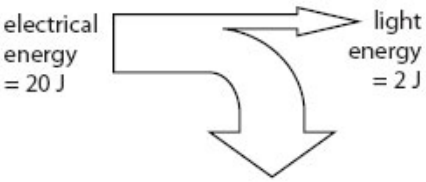
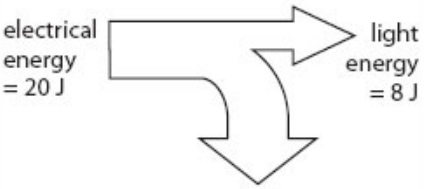
(1)

.....

(b) Many appliances are sold with an energy efficiency rating.

A-rated appliances are the most energy efficient.

Here is some information about two types of electric lamp.

	halogen lamp	compact fluorescent lamp (CFL)
energy efficiency rating	B	A
energy transfer diagrams (not drawn to scale)	energy transfer in one second 	energy transfer in one second 

(i) Calculate how much energy is wasted in one second by the compact fluorescent lamp (CFL).

(1)

energy wasted = ...J

(ii) Use the energy transfer diagrams to explain why the CFL lamp has a better efficiency rating than the halogen lamp.

(2)

.....

.....

.....

.....

(c) The photograph shows an electric heater used to warm garages.



When the heater is switched on, it quickly warms up and then stays at a constant temperature.

Explain why the heater stays at a constant temperature.

(2)

.....

.....

.....

.....

(Total for Question is 9 marks)

Q21.

The International Space Station (ISS) has several solar panels called wings.



(a) The wings convert energy from the Sun into a form useful in the ISS.

(1)

☒ **A** transverse and electromagnetic

☒ **B** electromagnetic but not transverse

☒ **C** transverse but not electromagnetic

☒ **D** neither transverse nor electromagnetic

(b) In one second, the useful energy available from one wing is 34.3 kJ.
The energy incident on the wing from the Sun is five times this amount.

What is the percentage efficiency of the wing?

(3)

efficiency = ... %

(c) A wing is in direct sunlight.
The ISS is not receiving energy from the wing.
The temperature of the wing remains constant.

Explain why the temperature of the wing remains constant in these conditions.

(2)

.....

.....

.....

.....

Q22.

(a) A wind generator is used as the source of energy for a remote farmhouse.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

If the farmhouse is about 7 m high, the height of the axle of the generator is

(1)

☒ **A** 20 m

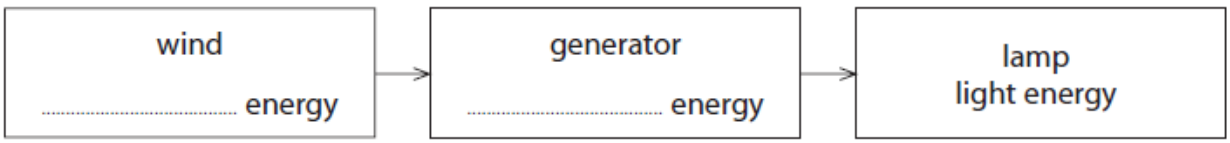
☒ **B** 50 m

☒ **C** 100 m

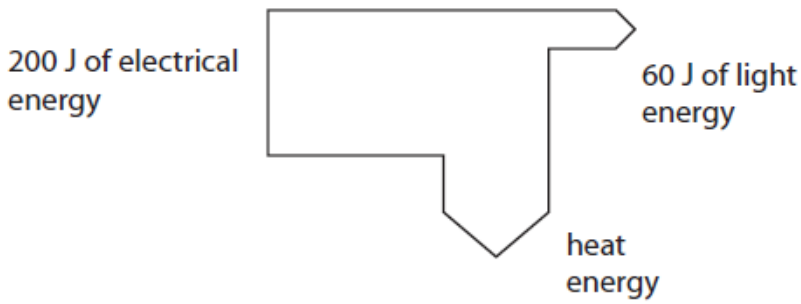
☒ **D** 150 m

(ii) Complete the flow chart to show the energy transfers that take place from the wind to light a lamp.

(2)



(b) A student produced a diagram to show energy changes in a lamp.



(i) Calculate the amount of heat energy produced by the lamp.

(1)

heat energy =.....J

(ii) Calculate the efficiency of the lamp.

(2)

efficiency =.....

(iii) When the lamp is first switched on, it heats up.
It then reaches a constant temperature.

Explain why the temperature of the lamp remains constant.

(2)

.....

.....

.....

.....

(c) A wind power system costs £6000 to install.
It saves £250 each year.

Calculate the payback time.

(2)

payback time =.....

(Total for Question = 10 marks)

Q23.

A student is investigating the refraction of light.

Figure 4 shows part of the apparatus and the angles to be measured.

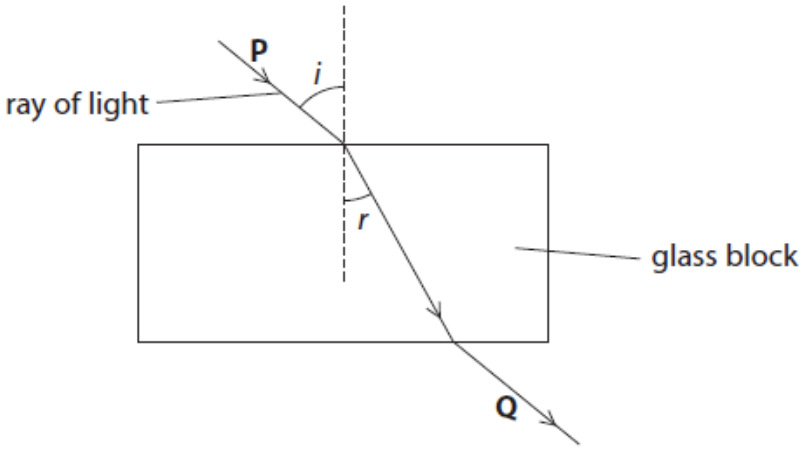


Figure 4

The student measures angle *r* for several different values of angle *i*.

Figure 5 shows the student's results.

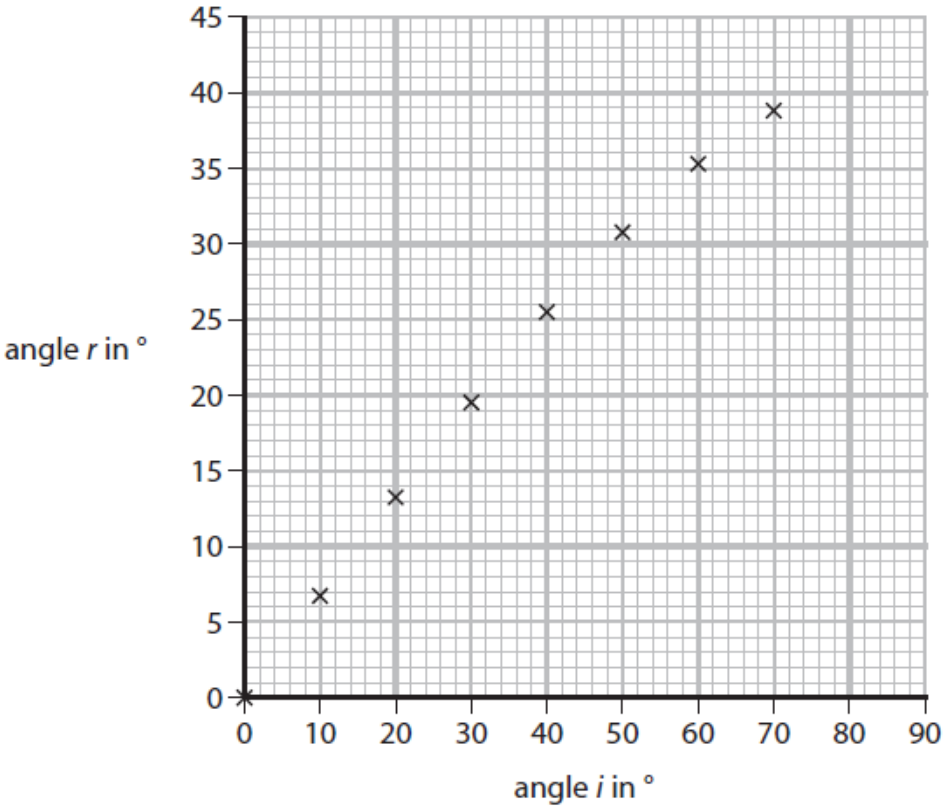


Figure 5

(i) On the graph in Figure 5, draw the best fit curve.

(1)

(ii) Use the graph in Figure 5 to estimate the value of angle *r* when angle *i* is 80°.

(1)

angle *r* = ... °

(iii) Describe how angle *r* changes with angle *i* for the results shown on the graph in Figure 5.

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

Q24.

Explain what happens to a wavelength of light when it passes from air into glass.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q25.

In Figure 6, only refraction of light is shown.

Other things happen to the light as it travels from **P** to **Q**.

The intensity (brightness) of the light at **Q** is less than the intensity of the light at **P**.

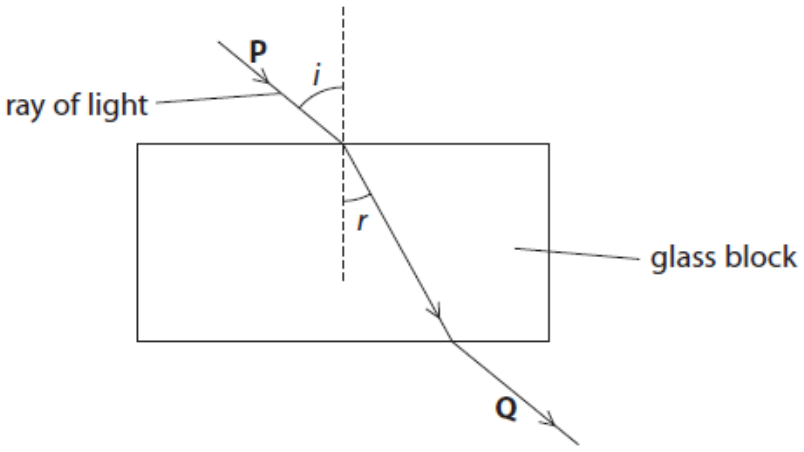


Figure 6

Explain the decrease in intensity as the light travels from **P** to **Q**.

You may add to Figure 6 to help your answer.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q26.

Explain what can happen to the body if a person has a prolonged exposure to gamma rays.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q27.

Figure 4 is a simplified diagram to show radio waves from a transmitter moving upwards, then meeting a boundary between lower and upper layers of the atmosphere.

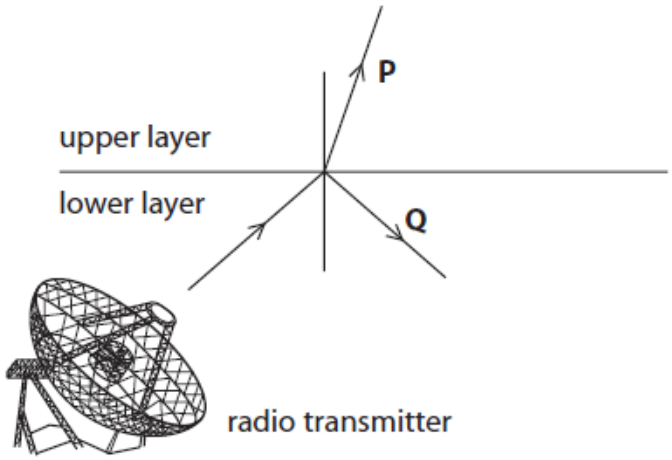


Figure 4

Explain what happens to the radio waves after they meet the boundary between the lower and upper layers as shown in Figure 4.

Your explanation should refer to changes in direction and speed of the waves.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q28.

Some television remote controls use infrared radiation and other remote controls use radio waves.

Explain why an infrared remote control may not switch on the television from behind an

armchair but a radio wave remote control always will.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q29.

Gamma radiation can be used in food processing to irradiate food.

Explain why some food is irradiated with gamma radiation.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q30.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about waves in the electromagnetic (e.m.) spectrum.

The potential danger associated with the waves of the e.m. spectrum increases as

(1)

- ☒ **A** frequency decreases
- ☒ **B** frequency increases
- ☒ **C** velocity decreases
- ☒ **D** velocity increases

(Total for question = 1 mark)