

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

4.6.2 ELECTROMAGNETIC WAVES (PACK 4)

SCORE

/59

PERCENTAGE

%

STEMUP

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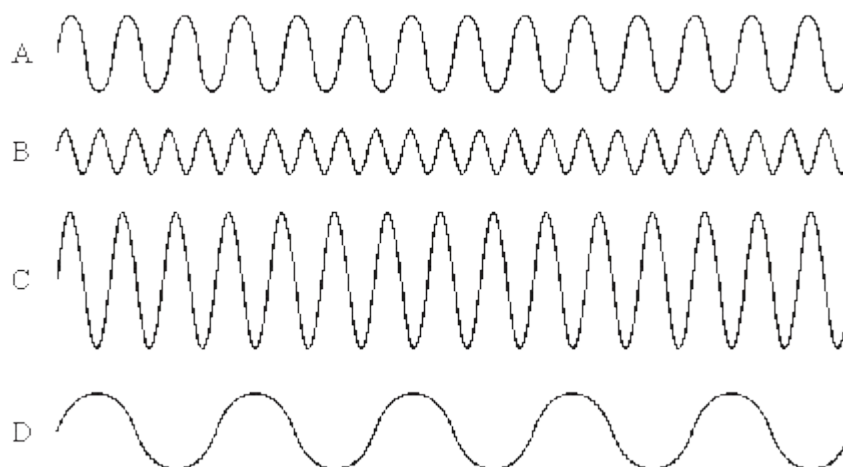
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Q1.

The diagram shows oscilloscope traces of four waves, **A**, **B**, **C** and **D**. All four waves are drawn to the same scale.



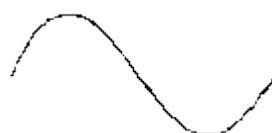
Which wave has:

- (a) the longest wavelength; _____
- (b) the greatest amplitude; _____
- (c) the highest frequency? _____

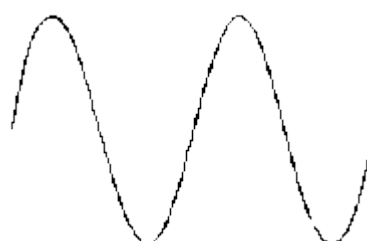
(Total 3 marks)

Q2.

Some students made a small hand-turned a.c. generator, similar to a bicycle dynamo. They connected it to the Y plates of a cathode ray oscilloscope, CRO, and turned the generator slowly. The trace on the CRO looked like this:



They then turned the generator faster and the trace looked like this:



- (a) Why did the trace on the CRO show:
 - (i) an increase in frequency;

(1)

- (ii) a decrease in wavelength;

_____ (1)

- (iii) an increase in amplitude?

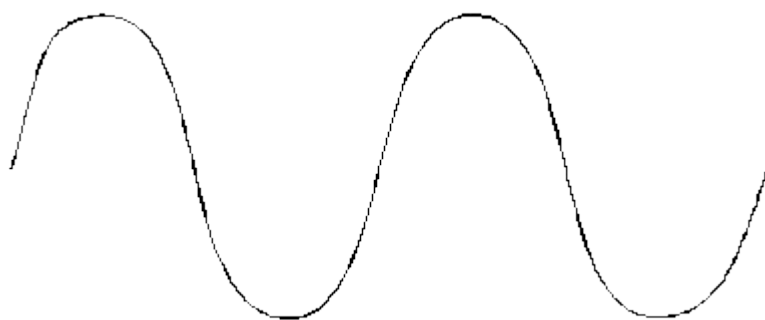
_____ (1)

- (b) One way to alter the output from the generator is to change the speed of turning. State **two** other ways to adapt parts of the generator to increase its output.

(2)
(Total 5 marks)

Q3.

- (a) On the wave drawn below, mark the amplitude and wavelength.



(2)

- (b) A wave is said to have a frequency of 25 Hz.

Explain what the term *frequency* means.

(1)

- (c) From the electromagnetic spectrum, give the name and use of a radiation of lower frequency than light.

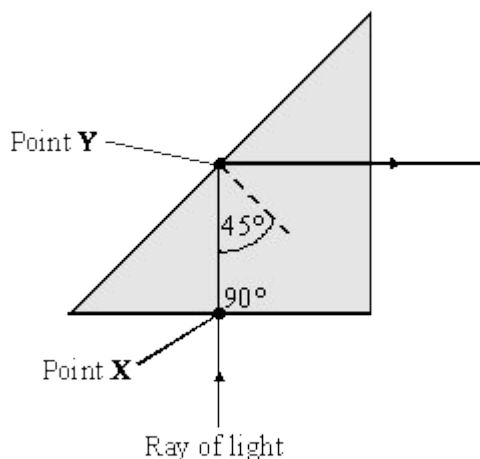
Name _____

Use _____

(2)
(Total 5 marks)

Q4.

The diagram shows a glass prism.



- (i) Explain why refraction has **not** occurred at point X.

(1)

- (ii) (A) Give the full name for the process which has occurred at point Y.

(1)

- (B) Explain why this process has occurred.

(2)

(Total 4 marks)

Q5.

- (i) Use the words frequency, wavelength and wave speed to write an equation which shows the relationship between them.

(1)

- (ii) Calculate the speed of a sound wave with a frequency of 250 Hz and a wavelength of 1.3 m.

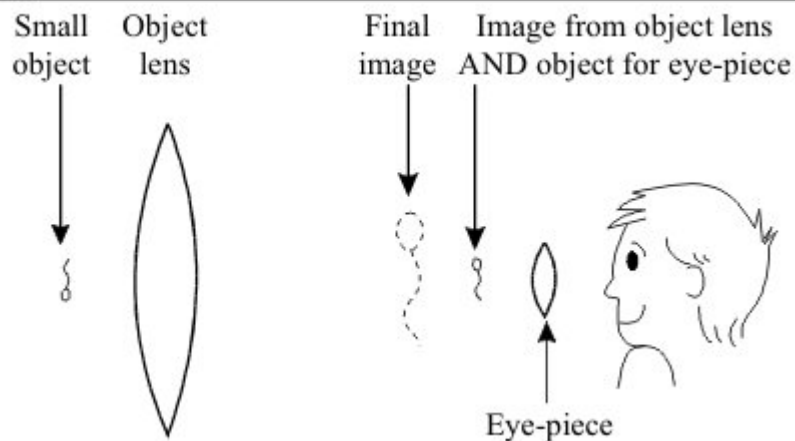
Show how you get to your answer and give the unit.

Speed = _____

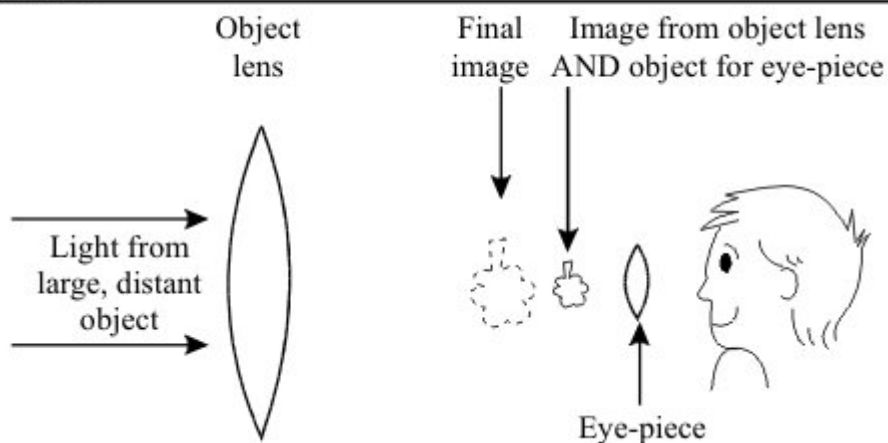
Q6.

The diagrams show how the same two lenses can be used to make a microscope **or** a telescope.

MICROSCOPE



TELESCOPE



The microscope and the telescope made from the two lenses are similar in some ways but different in others.

Complete the table to show these **similarities** and **differences**.

	Similarities	Differences
What the microscope and telescope are used for		
The job done by the eye-piece		
How the final image compares with the original object		

(Total 7 marks)

Q7.

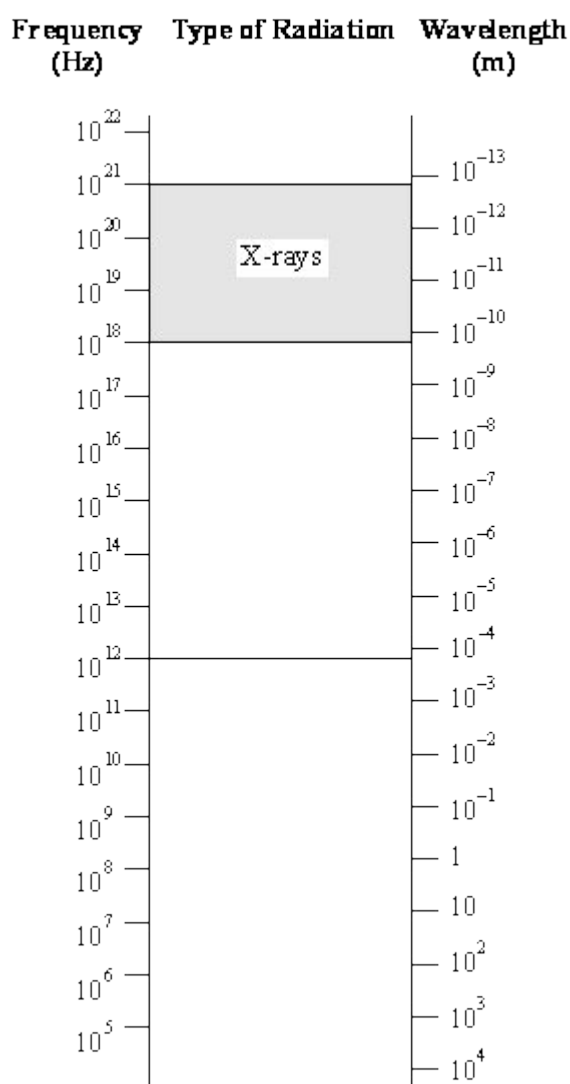
Explain fully why pregnant women should not normally have X-rays of the lower body.

(Total 4 marks)

Q8.

The diagram below shows the range of wavelengths and frequencies for all the types of radiation in the electromagnetic spectrum.

X-rays, which have frequencies in the range 10^{18} – 10^{21} Hz are already marked on the diagram.



Complete the diagram by adding the following:

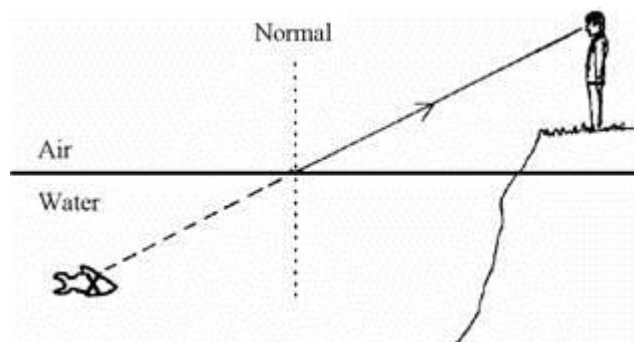
- (a) *gamma* radiation, which has shorter wavelengths than X-rays;
- (b) *radio* waves which have wavelengths longer than 0.1m;
- (c) the *visible* spectrum which has wavelengths from 400 nm (violet) to 700 nm (red);
- (d) *ultraviolet* radiation (i.e. radiation with a higher frequency than violet light);
- (e) *microwaves* which have a shorter wavelength than radio waves and *infrared* radiation which has a higher frequency than microwaves;
- (f) an *FM* radio programme on 92MHz. (Show this with an arrow ®)

(Total 7 marks)

Q9.

A man is walking along the bank of a river.

He sees a fish which seems to be at X.



- (a) Show, on the diagram, where the fish **really** is.

Complete the ray of light which goes from the fish into the man's eye.

(2)

- (b) Complete the sentence.

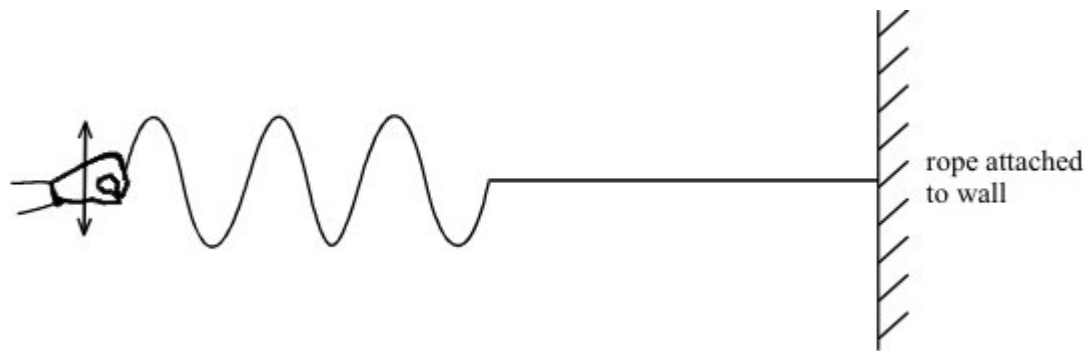
The ray of light is _____ as it passes from the water into the air.

(1)

(Total 3 marks)

Q10.

The diagram shows some waves travelling along a rope.



(a) Show on the diagram

(i) the wavelength of one of the waves

(2)

(ii) the amplitude of one of the waves

(2)

(b) The waves shown on the diagram were produced in two seconds.

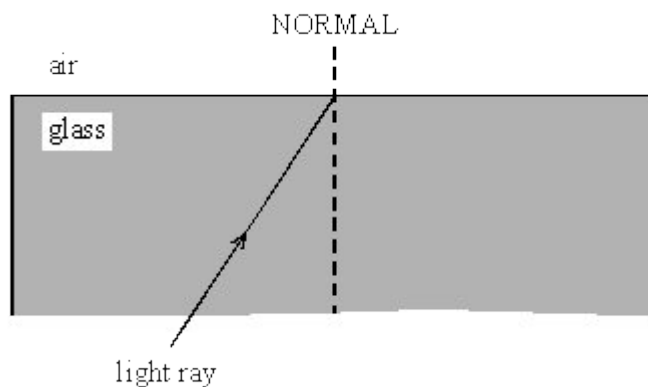
What is the frequency of the waves?

(2)

(Total 6 marks)

Q11.

The diagram shows a ray of light travelling through a glass block.



(a) Complete the diagram to show what happens to the ray of light when it comes out of the glass.

(2)

(b) Explain why this happens to the ray of light.

(2)

(Total 4 marks)

Q12.

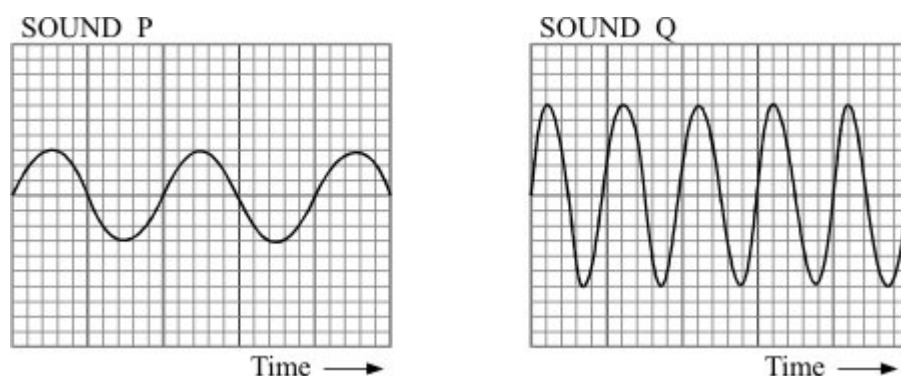
The diagram shows some of the kinds of waves in the electromagnetic spectrum. Choose words from this list to complete the empty boxes on the diagram.

Shortest wavelength				Longest wavelength	
gamma radiation		ultraviolet radiation	light		microwaves

(Total 3 marks)

Q13.

The diagram shows the oscilloscope traces of two different sounds P and Q. The oscilloscope setting is exactly the same in both cases.



P and Q **sound** different.

Write down **two** differences in the way they sound.

Explain your answers as fully as you can.

- _____
- _____

(Total 5 marks)

Mark schemes

Q1.

- | | | |
|-----|----------|---|
| (a) | D | 1 |
| (b) | C | 1 |
| (c) | B | 1 |

[3]

Q2.

- | | | | |
|-----|-------|--|---|
| (a) | (i) | more turns or waves per second
<i>accept spinning or turning or faster</i> | 1 |
| | (ii) | less time spent cutting field lines
<i>accept shorter time in field or when the frequency increases (the wavelength decreases)</i> | 1 |
| | (iii) | more energy given
<i>accept more KE put in
accept a higher voltage produced
do not credit more power</i> | 1 |
| (b) | | more coils | 1 |
| | | more powerful magnets
<i>accept put in better bearings
do not credit reduce friction or add soft iron core</i> | 1 |

[5]

Q3.

- | | | |
|-----|--|---|
| (a) | amplitude marked as approximately half a wave height
<i>great precision is not required</i> | 1 |
| | wavelength marked as a trough to trough distance or a peak to peak distance
<i>accept an equivalent repeat distance anywhere on the wave</i> | 1 |
| (b) | the number of waves each second
<i>accept cycles per second accept 25 waves pass each second</i> | 1 |

- (c) any **pair** from
- | | |
|-----------|--|
| microwave | cooking or communication or mobile phone |
| radio | communication or entertainment |
| infra-red | cooking or heating or remote control or security or night sights or thermal imaging |
- accept sensible specific uses*
- 2

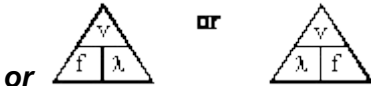
[5]

Q4.

- (i) (incident) ray along the normal
or (incident) ray at 90° (to the surface)
- 1
- (ii) (A) total internal reflection
all three words required do not credit total internal refraction
- 1
- (B) **EITHER**
angle of incidence is greater than the critical angle
or angle of incidence is greater than 42°
- 2
- OR**
angle of incidence is 45°
- 1

[4]

Q5.

- (i) (wave) speed = frequency × wavelength
or any correctly transposed version
accept $v = f \times \lambda$
or transposed version
accept $m/s = 1 / s \times m$
or transposed version
- 
- but only if subsequently used correctly*
- 1
- (i) 325
- 1
- metres per second
or m / s or 0.325 km/s for 2 marks
- 1

[3]

Q6.

makes things look bigger/clearer/nearer M used for small objects;
or to see things better T used for distant objects

magnifies **or** makes it bigger

'it' = image of object; bigger for M;
inverted/upsidedown/ other way up smaller for T
any seven for 1 mark each

[7]

Q7.

idea that X-rays cause mutations
gains 1 mark

but X-rays can cause/increase chance of mutations
gains 2 marks

mutations usually harmful/produce abnormal growth
serious effect on growing foetus/rapidly growing cells
each for 1 mark

[4]

Q8.

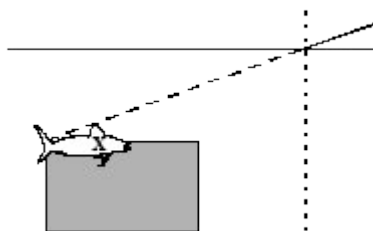
- (a) gamma rays above x-rays
for 1 mark
- (b) upper radio wave boundary correct (10^{-1}m) ($\pm 1\text{mm}$)
for 1 mark
- (c) visible radiation/light
 - within the middle third of a wavelength band
 - in the correct wavelength range ($10^{-6} - 10^{-7}\text{m}$)
each for 1 mark
- (d) ultraviolet between *visible radiation and X-rays
for 1 mark
- (e) microwaves above *radio waves and below *infra red
(*not necessarily immediately)
for 1 mark
- (f) between $10^8\text{Hz} + 10^7\text{Hz}$ and nearer to 10^8Hz than to 10^7Hz
gains 1 mark

[7]

Q9.

- (a) line (from fish) to complete ray to eye
[mark awarded even if begins outside the box]
[credit only if fish shown to left of normal]

- fish within the region shown or X or start of ray
(i. e. not necessarily directly below x) each for 1 mark



2

- (b) bent/refracted/deviated/speeded up
for 1 mark

1

[3]

Q10.

- (a) (i) a horizontal distance indicated and labelled
gains 1 mark

but

horizontal distance indicated between identical points on
adjacent waves (to within 3-4mm) and labelled
gains 2 marks

2

- (ii) peak ↔ trough indicated*
gains 1 mark

but

peak / trough ↔ mean indicated*

(* to within 1-2mm either end)

gains 2 marks

(allow 1 mark if both lines unlabelled or 2 marks if both lines
accurately drawn and unlabelled)

2

- (b) • 1.5
• hertz / Hz **or** (waves / cycles) per second
for 1 mark each
(do not allow wavelength / hertz per second)

2

[6]

Q11.

- (a) ray shown refracted (to rhs or along normal)
gains 1 mark

but

ray shown refracted away from normal
gains 2 marks

2

- (b) *idea that*
travels at a different speed
gains 1 mark

(allow refracted / travels slower in air / air is less dense) (do not allow bent)

but
travels more quickly in air
gains 2 marks

2

[4]

Q12.

X-rays $\left\{ \begin{array}{l} \text{infrared} \\ \text{radiation} \end{array} \right\}$ $\left\{ \begin{array}{l} \text{radio} \\ \text{waves} \end{array} \right\}$
for 1 mark each

[3]

Q13.

- Q is louder
- Q is higher (pitch/note but not frequency)
*[if loudness and pitch both mentioned but direction wrong /
absent credit 1 mark]*
- louder because bigger amplitude/height
- higher pitch because higher frequency/shorter wavelength/waves closer together
- factor of 2 mentioned w.r.t either
(NB converse answer for P)
each • for 1 mark

[5]