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EDEXCEL COMBINED SCIENCE PHYSICS: QUESTIONS BY TOPIC

Light and the Electromagnetic Spectrum (5)

Combined Science Physics (Foundation) Topic 5

5 questions · 39 marks · Mark schemes included

Pearson Edexcel Combined Science (9-1) Physics 1SC0, Foundation Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.
Click any row below to jump straight to that question.
On every question page, click ANSWER in the top-right corner to jump to its mark scheme.
Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION	SOURCE	MARKS	PAGE
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QUESTIONS

5 questions · 39 marks · lowest tariff first



6-MARK QUESTIONS

2 questions in this booklet



- 1 (a) Figure 1 shows the parts of the electromagnetic spectrum.

gamma rays	x-rays	J	visible	K	micro-waves	L
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Figure 1

- (i) Which row of the table names the parts **J**, **K** and **L** of the electromagnetic spectrum? (1)

	J	K	L
☐ A	infrared	radio	ultraviolet
☐ B	radio	infrared	ultraviolet
☐ C	ultraviolet	infrared	radio
☐ D	ultraviolet	radio	infrared

- (ii) All electromagnetic waves can travel in a vacuum.

Which of these is the same for all electromagnetic waves travelling in a vacuum? (1)

- ☐ **A** amplitude
☐ **B** frequency
☐ **C** speed
☐ **D** wavelength

- (b) X-rays can be useful and harmful to humans.

- (i) State **one** way that x-rays are useful to humans. (1)

- (ii) State **one** way that x-rays are harmful to humans. (1)



(c) A person warms their hands in front of a hot fire as shown in Figure 2.



(Source: © Andreas Saldavs/Shutterstock)

Figure 2

Use words from the box to complete the following sentences.

chemical infrared radio thermal ultraviolet

(2)

The electromagnetic waves that the fire mostly emits are waves.

These waves transfer energy to the hands.

(Total for Question 1 = 6 marks)

- 1 (a) Figure 1 shows how the visible spectrum of white light is shown on a screen.

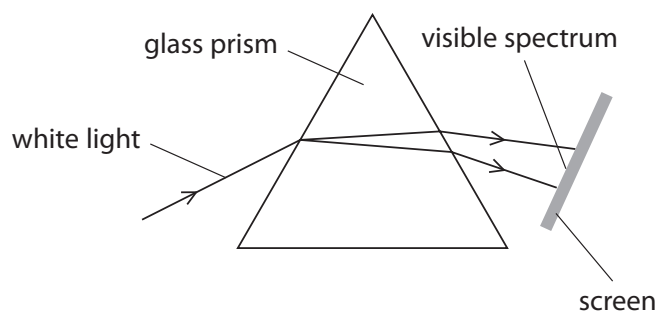


Figure 1

- (i) Which of these is the best piece of equipment to produce the white light?

(1)

- ☐ A ray box
- ☐ B ruler
- ☐ C measuring cylinder
- ☐ D ammeter

- (ii) Which colour is seen between yellow and blue in the spectrum on the screen?

(1)

- ☐ A red
- ☐ B orange
- ☐ C green
- ☐ D violet

(b) Figure 2 shows the main parts of the electromagnetic spectrum.

radio	microwaves	infrared	visible light	ultraviolet	x-rays	gamma rays
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Figure 2

Complete the following sentences using information from Figure 2. Each part of the electromagnetic spectrum may be used once, more than once or not at all.

(i) The part of the electromagnetic spectrum used to detect broken bones is (1)

.....

(ii) The part of the electromagnetic spectrum used in thermal imaging is (1)

.....

(iii) The part of the electromagnetic spectrum that

- is used to cook food

AND

- has a shorter wavelength than microwaves is (1)

.....

(iv) The part of the electromagnetic spectrum that

- is used to sterilise medical equipment

AND

- has a shorter wavelength than x-rays is (1)

.....

(Total for Question 1 = 6 marks)



7-MARK QUESTIONS

1 question in this booklet



1 This question is about the electromagnetic spectrum.

(a) X-rays and microwaves are both parts of the electromagnetic spectrum.

Use words from the box to complete the sentences.

(3)

amplitude frequency longitudinal speed transverse wavelength

X-rays and microwaves are both waves.

In a vacuum, x-rays and microwaves always have the same

X-rays always have a higher than microwaves.



(b) Figure 1 shows the full electromagnetic spectrum.

Figure 2 gives information about four of the types of electromagnetic radiation shown in Figure 1.

radio waves	microwaves	infrared	visible light	ultraviolet	x-rays	gamma rays
-------------	------------	----------	---------------	-------------	--------	------------

Figure 1

State the name of each type of radiation next to its information.

(4)

Information	Type of electromagnetic radiation
emitted by bright objects and can be detected by the human eye	
emitted by radioactive nuclei and can be used to treat cancer	
produced in an aerial and can be used for communication	
can cause skin cancer in humans and can be used to detect forged banknotes	

Figure 2

(Total for Question 1 = 7 marks)



9-MARK QUESTIONS

1 question in this booklet



- 1 (a) Draw **one** straight line from each electromagnetic radiation to its correct description.

(3)

electromagnetic radiation

description

infrared

used in night vision cameras

gamma

the least dangerous radiation

ultraviolet

may damage eyes, so
sunglasses worn as protection

radio waves

the most dangerous radiation

- (b) Different colours of light have different frequencies.

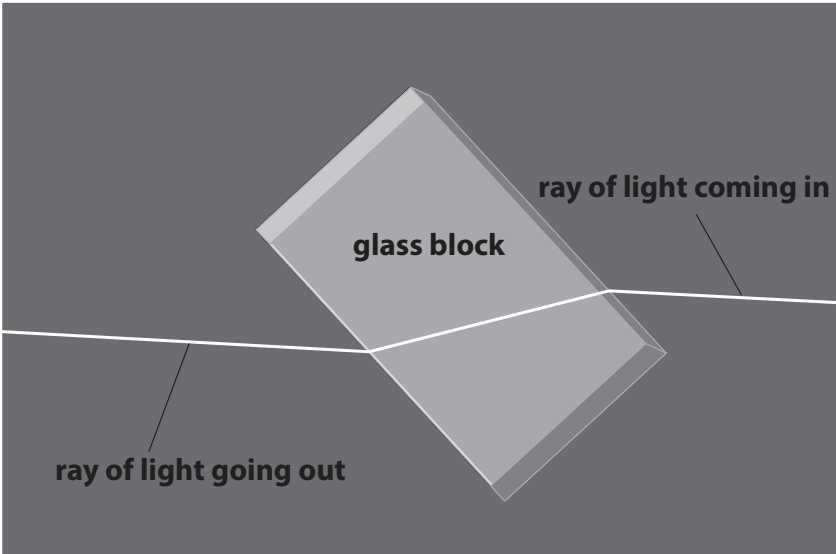
Which of these colours has the highest frequency?

(1)

- ☐ **A** blue
- ☐ **B** green
- ☐ **C** red
- ☐ **D** yellow



(c) Figure 1 is a diagram of a glass block being used to investigate the refraction of light.



(Source: © ajizai/docstoc.com)

Figure 1

The angle of incidence was varied and the angle of refraction was measured each time.

Figure 2 shows the results in a table.

angle of incidence in degrees	angle of refraction in degrees
20	13
30	20
40	25
50	31
60	35
70	39
80	41

Figure 2

Figure 3 shows a graph of these results.

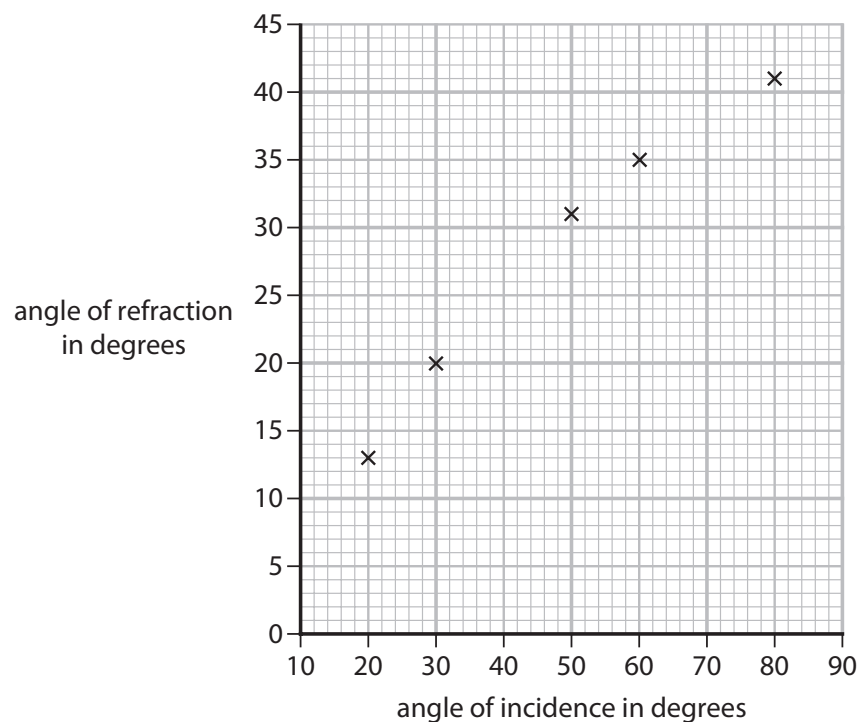


Figure 3

- (i) The two shaded rows in Figure 2 are not plotted on the graph in Figure 3.

Plot these missing results on the graph in Figure 3.

(2)

- (ii) Draw a curve of best fit through the points on the graph in Figure 3.

(1)

- (iii) Using figure 3, describe the relationship between the angle of refraction and the angle of incidence.

(2)

.....

.....

.....

.....

(Total for Question 1 = 9 marks)



11-MARK QUESTIONS

1 question in this booklet



5 (a) A student investigates what happens when light travels from air to glass.

Figure 8 shows some of the apparatus used in the investigation.

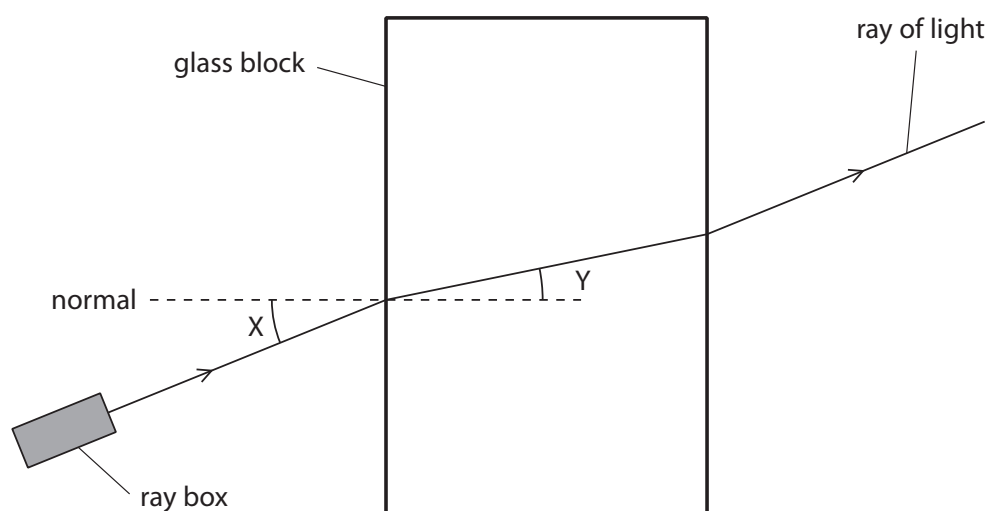


Figure 8

(i) In Figure 8, angle Y is the angle of

- ☐ A deflection
- ☐ B incidence
- ☐ C reflection
- ☐ D refraction

(1)

(ii) Figure 9 is a graph of the student's results.

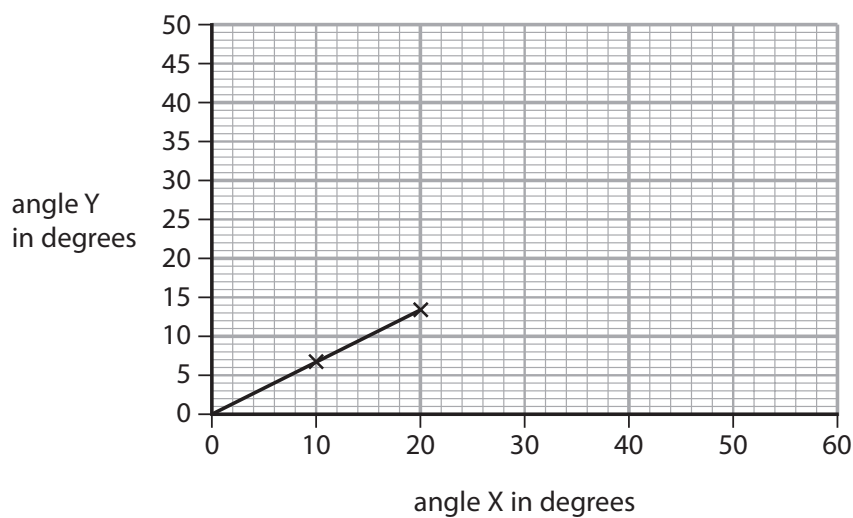


Figure 9

Use the graph to calculate a value for

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

(2)

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

(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)

.....

.....

.....

.....

.....

.....



(b) The speed of light is $3.0 \times 10^8 \text{ m/s}$.

The wavelength of yellow light is $5.8 \times 10^{-7} \text{ m}$.

Calculate the frequency of yellow light.

State the unit.

Use the equation

$$\text{frequency} = \frac{\text{speed}}{\text{wavelength}}$$

(3)

frequency = ... unit

(c) (i) Give **one** colour of light that has a longer wavelength than yellow light.

(1)

(ii) Give **one** colour of light that has a higher frequency than yellow light.

(1)

(Total for Question 5 = 11 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question number	Answer	Additional guidance	Mark			
1a(i)	C <table><tr><td>ultraviolet</td><td>infrared</td><td>radio</td></tr></table> A is incorrect infrared should be in K, radio should be in L and ultraviolet in J, B is incorrect radio should be in L and ultraviolet should be in K D is incorrect radio should be in L and infrared in K	ultraviolet	infrared	radio		(1) AO1
ultraviolet	infrared	radio				

Question number	Answer	Additional guidance	Mark
1a(ii)	C speed amplitude, frequency and wavelength are not the same for all EM waves		(1) AO1

Question number	Answer	Additional guidance	Mark
1(b)(i)	One from: seeing (broken) bones (1) radiotherapy (1) detecting cracks in metals (1) airport security (1) observing the internal structure of objects(1)	seeing inside the body	(1) AO1

Question number	Answer	Additional guidance	Mark
1(b) (ii)	One from: can cause cancer (1) can cause burns(1) { damage/kills/harms} cells/tissue (1) mutates DNA/cells (1)	harms organ(s) / foetus allow (highly) ionising	(1) AO1

Question number	Answer	Additional guidance	Mark
1(c)	infrared (1) thermal (1)	must be in first sentence space must be in second sentence space award 2 marks for answers in this order	(2) AO2

Total marks for question 1= 6 marks

Question Number	Answer	Mark
1(a)(i)	A ray box <i>B is not correct because a ruler does not produce a beam of white light</i> <i>C is not correct because a measuring cylinder does not produce a beam of white light</i> <i>D is not correct because an ammeter does not produce a beam of white light</i>	(1) AO1

Question Number	Answer	Mark
1(a)(ii)	C green <i>A is not correct because red appears at the start of the spectrum</i> <i>B is not correct because orange appears in the middle of the spectrum</i> <i>D is not correct because violet appears at the end of the spectrum</i>	(1) AO1

	Answer	Additional guidance	Mark
1(b)(i)	x-ray(s)	allow X x no mark if more than one wave given e.g. x-rays and gamma rays scores 0	(1) AO1

	Answer	Additional guidance	Mark
1(b)(ii)	infrared	allow any recognisable spelling IR ir no mark if more than one wave given e.g. infrared and gamma rays scores 0	(1) AO1



	Answer	Additional guidance	Mark
1(b)(iii)	infrared	allow any recognisable spelling IR ir no mark if more than one wave given e.g. infrared and gamma rays scores 0	(1) AO1

	Answer	Additional guidance	Mark
1(b)(iv)	gamma (rays)	allow any recognisable spelling γ no mark if more than one wave given e.g. gamma rays and UV scores 0	(1) AO1

(Total for Question 1= 6 marks)

	Answer	Additional guidance	Mark
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Question number	Answer	Additional guidance	Mark
1 (a)	transverse (1) speed (1) frequency (1)	must be in correct order. allow any recognisable spelling.	3 AO1.1

Question number	Answer	Additional guidance	Mark
1 (b)	(visible) light (1) gamma (rays) (1) radio (waves) (1) ultraviolet (waves) (1)	 γ (rays) allow microwaves UV (rays)	4 AO3.3

Total for question 1 =7 marks

Question number	Answer	Additional guidance	Mark
1 (a)	electromagnetic radiation description	1 mark for one line correct 2 marks for two or three lines correct 3 marks for four lines correct. if more than one line is drawn from or to a box, do not credit any of those lines	(3) AO1.1

Question number	Answer	Additional guidance	Mark
1 (b)	☒ A blue (1) B, C and D have lower frequencies		(1) AO1.1

Question number	Answer	Additional guidance	Mark
1 (c) i	coordinate (40, 25) plotted $\pm$ half a square (1)	judge by eye	(2) A02.1
	coordinate (70, 39) plotted $\pm$ half a square (1)	judge by eye	

Question number	Answer	Additional guidance	Mark
1 (c) ii	best fit curve touching at least four of the points (1)	do not accept tramlining (multiple curves) ignore slight shakiness in drawing ignore any curves/lines drawn before the first point or after the last point	(1) A02.1

Question number	Answer	Additional guidance	Mark
1 (c) iii	A description to include as angle of incidence increases angle of refraction increases (1) idea of non-linear (relationship) (1)	positive correlation not proportional / not directly proportional curve gets less steep (as angle of incidence increases) ignore curve unqualified	(2) A03.2

Total for Question 1 = 9 marks

Question Number	Answer	Mark
5(a)(i)	D refraction The only correct answer is D <i>A 'deflection' is an incorrect distracting description</i> <i>B 'incidence' is incorrect, that would be angle X</i> <i>C 'reflection' is incorrect, no reflection being shown in the diagram</i>	(1) AO 1 1

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	any pair of coordinates selected from the line (1) in range → 0.6(0) to 0.7(0) (1)	e.g. 20 and (13 or 14) or 10 and (6 or 7) ignore any units given award full marks for a correct answer without working	(2) AO 2 1

Question Number	Answer	Additional guidance	Mark
5(a)(iii)	an explanation linking: repeat (1) different angles / more values of X (1) for larger angles / values of X (1)	allow 'more measurements' / 'repeat experiment' / collect more data > 20°	(3) AO 3 3a

Question Number	Answer	Additional guidance	Mark
5(b)	substitution (1) $\frac{3.0 (\times 10^8)}{5.8 (\times 10^{-7})}$ evaluation (1) 5.2×10^{14} unit (1) Hz	answers that round to 5.2×10^{14} award 2 marks for a correct answer without working allow 1 mark for answers that round to 5.2 to any power of ten independent mark accept hz or s^{-1} or per sec(ond) or hertz accept kHz, MHz etc with correct power (10^{11} kHz, 10^8 MHz)	(3) AO 2 1

Question Number	Answer	Mark
5(c)(i)	red or orange	(1) AO 1 1

Question Number	Answer	Additional guidance	Mark
5(c)(ii)	green or blue or indigo or violet		(1) AO 1 1

(Total for Question 5 = 11 marks)