

Diffraction

TOPIC QUESTIONS

Level	AS Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min



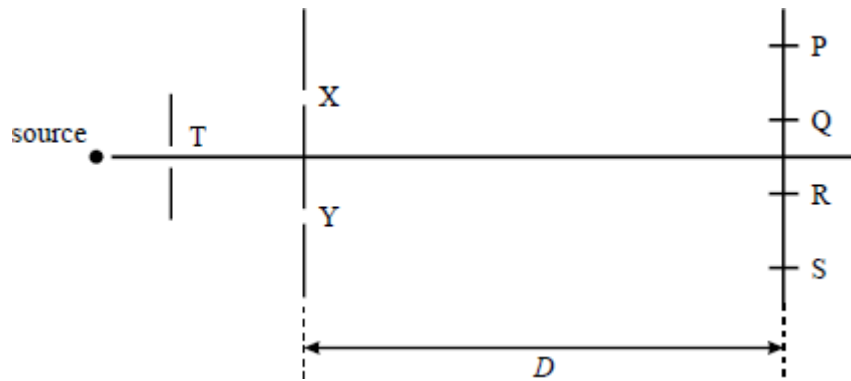
EXAM PAPERS PRACTICE

1. A narrow beam of monochromatic light falls on a diffraction grating at normal incidence. The second order diffracted beam makes an angle of 45° with the grating. What is the highest order visible with this grating at this wavelength?
- A 2
 - B 3
 - C 4
 - D 5



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2.



Coherent monochromatic light of wavelength λ emerges from the slits X and Y to form dark fringes at P, Q, R and S in a double slit apparatus. Which one of the following statements is true?

- A When the distance D is increased, the separation of the fringes increases.
- B When the distance between X and Y is increased, the separation of the fringes increases.
- C When the width of the slit T is decreased, the separation of the fringes decreases.
- D There is a dark fringe at P because $(YP - XP)$ is 2λ .

3. Monochromatic light of wavelength 590 nm is incident normally on a plane diffraction grating having 4×10^5 lines m^{-1} . An interference pattern is produced. What is the highest order visible in this interference pattern?

- A 2
- B 3
- C 4
- D 5

4. In a double slit interference arrangement the fringe spacing is w when the wavelength of the radiation is λ , the distance between the double slits is s and the distance between the slits and the plane of the observed fringes is D . In which one of the following cases would the fringe spacing also be w ?

	wave length	distance between slits	distance between slits and fringes
A	2λ	$2s$	$2D$
B	2λ	$4s$	$2D$
C	2λ	$2s$	$4D$
D	4λ	$2s$	$2D$

5. Using a diffraction grating with monochromatic light of wavelength 500 nm incident normally, a student found the 2nd order diffracted maxima in a direction at 30° to the central bright fringe. What is the number of lines per metre on the grating?

- A 2×10^4
 B 2×10^5
 C 4×10^5

D 5×10^5

6. Which line, **A** to **D**, in the table gives a correct difference between a progressive wave and a stationary wave?

	progressive wave	stationary wave
A	all the particles vibrate	some of the particles do not vibrate
B	none of the particles vibrate with the same amplitude	all the particles vibrate with the same amplitude
C	all the particles vibrate in phase with each other	none of the particles vibrate in phase with each other
D	some of the particles do not vibrate	all the particles vibrate in phase with each other

7. Stationary waves are set up on a length of rope fixed at both ends. Which one of the following statements is true?

- A** Between adjacent nodes, particles of the rope vibrate in phase with each other.
- B** The mid point of the rope is always stationary.
- C** Nodes need not necessarily be present at each end of the rope.
- D** Particles of the rope at adjacent antinodes always move in the same direction.

8. A wave of frequency 5 Hz travels at 8 km s^{-1} through a medium. What is the phase difference, in radians, between two points 2 km apart?

A 0

B $\frac{\pi}{2}$

C π

D $\frac{3\pi}{2}$

9. A source emits light of wavelength 600 nm as a train of waves lasting $0.01 \mu\text{s}$. How many complete waves are sent out?

speed of light = $3 \times 10^8 \text{ m s}^{-1}$

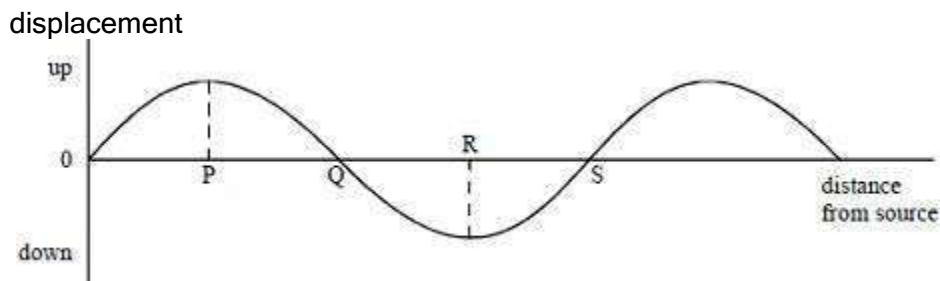
A 5×10^6

B 18×10^7

C 5×10^9

D 5×10^{22}

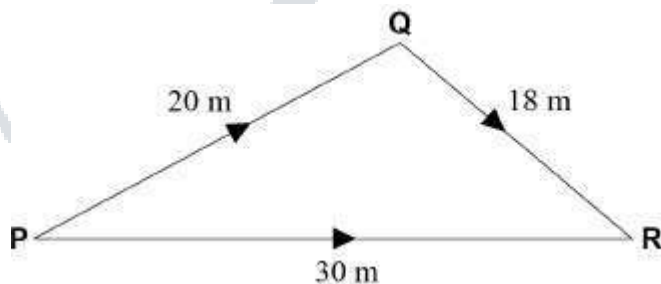
10.



The graph shows, at a particular instant, the variation of the displacement of the particles in a transverse progressive water wave, of wavelength 4 cm, travelling from left to right. Which one of the following statements is **not** true?

- A The distance PS = 3 cm.
- B The particle velocity at Q is a maximum.
- C The particle at S is moving downwards
- D Particles at P and R are in phase.

11. In the diagram, **P** is the source of a wave of frequency 50 Hz



The wave travels to **R** by two routes, **P** → **Q** → **R** and **P** → **R**. The speed of the wave is 30 m s⁻¹

What is the path difference between the two waves at **R** in terms of the wavelength λ of the waves?

- A** 4.8λ
- B** 8.0λ
- C** 13.3λ
- D** 20.0λ

12. An electromagnetic wave enters a fibre-optic cable from air. On entering the cable, the wave slows down to three-fifths of its original speed.

What is the refractive index of the core of the fibre-optic cable?

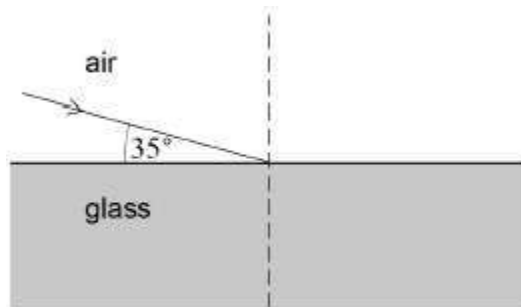
- A** 0.67
- B** 1.33
- C** 1.50
- D** 1.67

13. A diffraction grating has 500 lines per mm. When monochromatic light is incident normally on the grating the third-order spectral line is formed at an angle of 60° from the normal to the grating.

What is the wavelength of the monochromatic light?

- A** 220 nm
- B** 580 nm
- C** 960 nm
- D** 1700 nm

14. The diagram shows a ray of light travelling in air and incident on a glass block of refractive index 1.5



What is the angle of refraction in the glass?

- A 22.5°
- B 23.3°
- C 33.1°
- D 59.4°



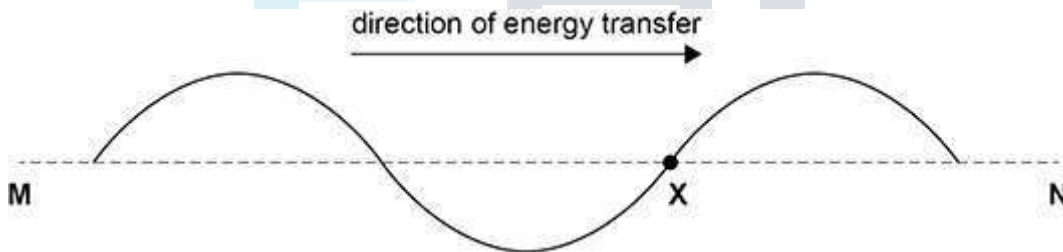
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15. When light of wavelength 5.0×10^{-7} m is incident normally on a diffraction grating the fourth-order maximum is observed at an angle of 30° .

What is the number of lines per mm on the diffraction grating?

- A 2.5×10^2
- B 2.5×10^5
- C 1.0×10^3
- D 1.0×10^6

16. A progressive wave travels along a rope in the direction **M** to **N**. **X** marks a point on the rope.



The wave has a frequency of 5.0 Hz, a wavelength of 1.0 m and an amplitude of 0.20 m.

Where will **X** be after 0.15 s?

- A below **MN** by 0.20 m
- B above **MN** by 0.20 m
- C nearer **N** by 0.15 m
- D nearer **N** by 0.75 m

17. The diagram shows a string stretched between two fixed points **O** and **R** which are 120 cm apart.

P and **Q** are points on the string.

OP = 30 cm

OQ = 90 cm

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At a certain frequency the string vibrates at its first harmonic.

P and **Q** oscillate in phase.

The frequency is gradually increased.

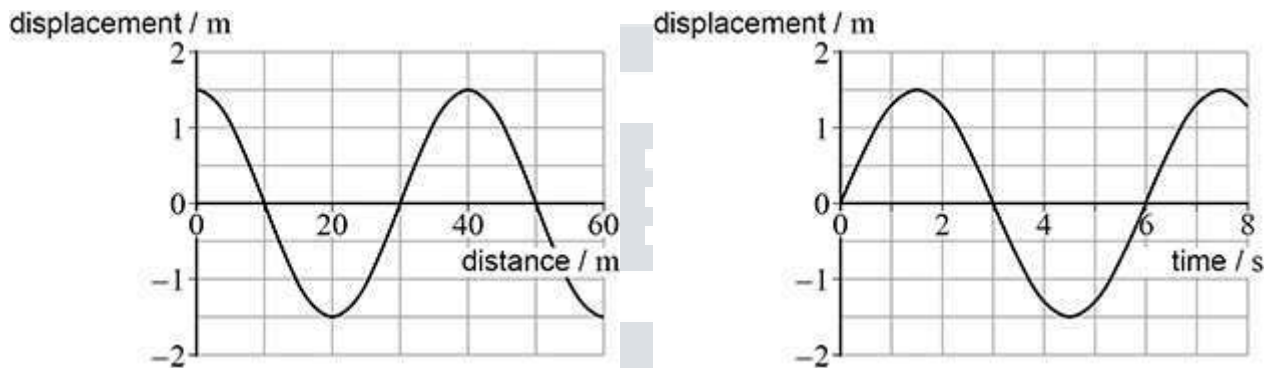


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What is the next harmonic at which **P** and **Q** will oscillate in phase?

- A second
- B third
- C fourth
- D fifth

18. The diagrams show the displacement-distance graph for a wave and the displacement-time graph for a point in the wave.



Which is correct for this wave?

- A The amplitude is 3.0 m.
- B The wavelength is 6 m.
- C The speed is 8.3 m s^{-1} .
- D The frequency is 0.17 Hz.

19. The diagram shows a stationary wave on a string at one instant in time.

P, **Q** and **R** are three points on the string.



Which row is correct?

A	P is in antiphase with R	P has the same amplitude as Q
B	P is out of phase with R	P has the same amplitude as R
C	P is in phase with Q	P has the same amplitude as R
D	P is out of phase with Q	P has a smaller amplitude than R

20. Two waves with amplitudes a and $3a$ interfere.

The ratio is

- A** 2
- B** 3
- C** 4
- D** infinit