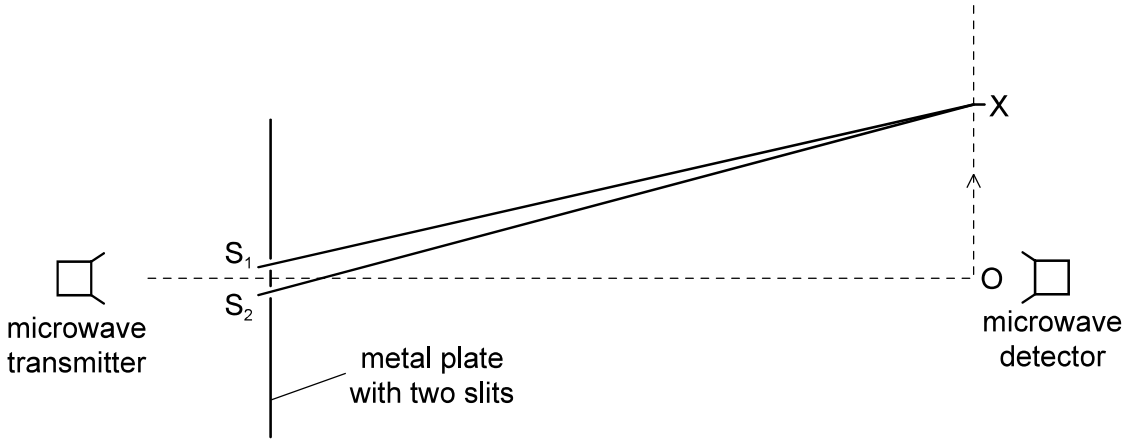
1 The diagram shows an experiment which has been set up to demonstrate two-source interference, using microwaves of wavelength λ. 9702/1/M/J/02/Q28



The detector is moved from O in the direction of the arrow. The signal detected decreases until the detector reaches the point X, and then starts to increase again as the detector moves beyond X.

Which equation correctly determines the position of X?

A $OX = \lambda/2$ **B** $OX = \lambda$ **C** $S_2X - S_1X = \lambda/2$ **D** $S_2X - S_1X = \lambda$

2 Two progressive waves of frequency 300 Hz are superimposed to produce a stationary wave in which adjacent nodes are 1.5 m apart. 9702/1/M/J/02/29

What is the speed of the progressive waves?

A $100\,m\,s^{-1}$ **B** $200\,m\,s^{-1}$ **C** $450\,m\,s^{-1}$ **D** $900\,m\,s^{-1}$

3 Coherent monochromatic light illuminates two narrow parallel slits and the interference pattern that results is observed on a screen some distance beyond the slits. 9702/1/O/N/02/Q28

Which change increases the separation between the dark lines of the interference pattern?

A using monochromatic light of higher frequency

B using monochromatic light of a longer wavelength

C decreasing the distance between the screen and the slits

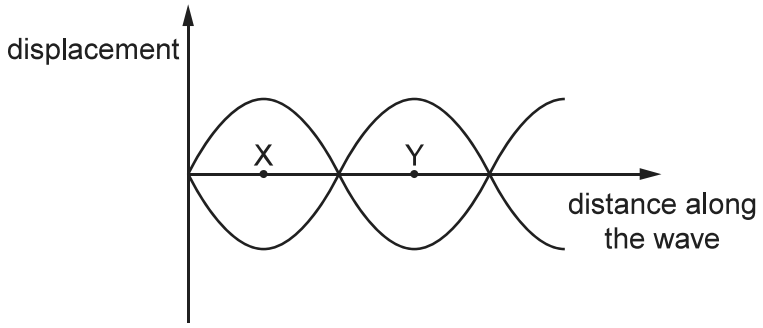
D increasing the distance between the slits

4 Monochromatic light of wavelength 590 nm is incident normally on a diffraction grating. The angle between the two second-order diffracted beams is 43°. 9702/1/O/N/02/Q29

What is the spacing of the lines on the grating?

A 0.87 µm **B** 1.6 µm **C** 1.7 µm **D** 3.2 µm

5 The graph represents a stationary wave at two different times. 9702/01/M/J/03/Q24



What does the distance XY represent?

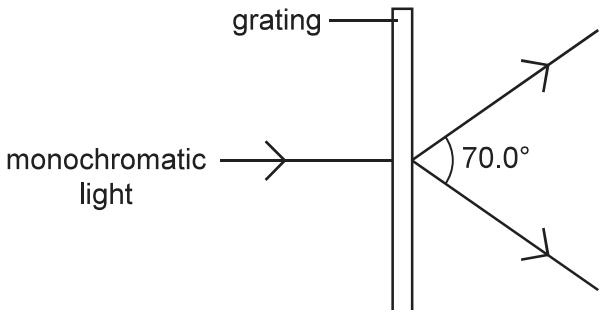
A half the amplitude

B half the frequency

C half the period

D half the wavelength

6 A diffraction grating is used to measure the wavelength of monochromatic light, as shown in the diagram. 9702/01/M/J/03/Q28



The spacing of the slits in the grating is 1.00×10^{-6} m. The angle between the first order diffraction maxima is 70.0°.

What is the wavelength of the light?

A 287 nm **B** 470 nm **C** 574 nm **D** 940 nm

7 When the light from two lamps falls on a screen, no interference pattern can be obtained. 9702/01/M/J/03/Q27

Why is this?

A The lamps are not point sources.

B The lamps emit light of different amplitudes.

C The light from the lamps is not coherent.

D The light from the lamps is white.

8 A stationary sound wave has a series of nodes. The distance between the first and the sixth node is 30.0 cm. 9702/01/O/N/03/Q24

What is the wavelength of the sound wave?

A 5.0 cm **B** 6.0 cm **C** 10.0 cm **D** 12.0 cm

9 Which of the following may be used to produce stationary waves? 9702/01/O/N/03/Q26

A blowing air over the top of an empty bottle

B making a loud sound near a mountain

C passing monochromatic light through a double slit

D passing water waves through a narrow slit

10 In an interference experiment, two slits are illuminated with white light. 9702/01/O/N/03/Q27

What is seen on the screen?

A The central fringe is black with black and white fringes on each side.

B The central fringe is black with coloured fringes on each side.

C The central fringe is white with black and white fringes on each side.

D The central fringe is white with coloured fringes on each side.

11 Microwaves of wavelength 3.00 cm are incident normally on a row of parallel metal rods. The separation of the rods is 8.00 cm. The first order diffraction maximum is observed at an angle of 22.0° to the direction of the incident waves. 9702/01/O/N/03/Q28

What is the angle between the first and second order diffraction maxima?

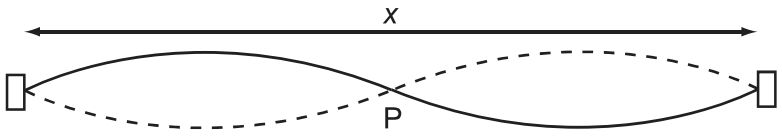
A 22.0° **B** 26.6° **C** 44.0° **D** 48.6°

12 **e ines o a i raction grating a e a s acing o 1 6 1 ^{6} m A eam o ig t is inci ent norma on t e grating e irst or er ma imum ma es an ange o 2 ^{o} it t e un e iate eam** **97 2 1 4**/Q28

at is t e a e engt o t e inci ent ig t

A 21 nm B 27 nm C 42 nm D nm

13 e iagram re resents a stationar a e on a stretc e string 97 2 1 4/Q27



at is re resente oint an t e engt

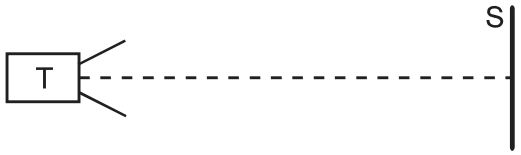
	oint	engt
A	antino e	one a e engt
B	antino e	t o a e engt s
C	no e	one a e engt
D	no e	t o a e engt s

14 ringes o se aration are o ser e on a screen 1 m rom a oung s s it arrangement t at is i uminate e o ig t o a e engt 6 nm 97 2 1 4/Q28

At ic istance rom t e s its ou ringes o t e same se aration e o ser e en using ue ig t o a e engt 4 nm

A m B 67 m C 7 m D 1 m

15 is a micro a e transmitter ace at a i e istance rom a at re ecting sur ace 97 2 1 /Q27



A sma micro a e recei er is mo e stea i rom to ar s an recei es signa s o a ternate ma ima an minima o intensit

e istance et een successi e ma ima is 1 mm

at is t e re uenc o t e micro a es

A 1 1 ^{7}

B 2 1 ^{7}

C 1 1 ^{1}

D 2 1 ^{1}

16 A narro eam o monoc romatic ig t is inci ent norma on a i raction grating ir or er i racte eams are orme at ang es o 4 ° to t e origina irection 97 2 1 7/Q25

at is t e ig est or er o i racte eam ro uce t is grating

A r B 4t C t D 6t

17 A soun a e is set u in a ong tu e c ose at one en e engt o t e tu e is a uste unti t e soun rom t e tu e is ou est

97 2 1 /Q26

at is t e nature o t e soun a e in t e tu e

A ongitu ina an rogressi e

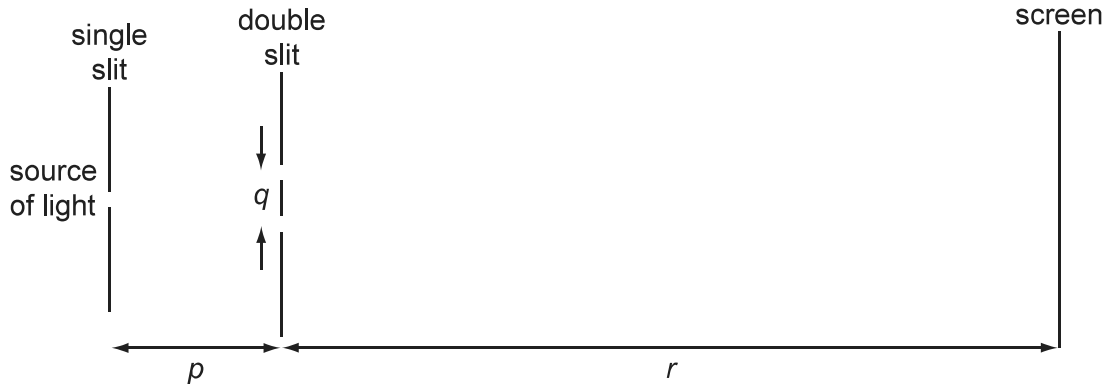
B ongitu ina an stationar

C trans erse an rogressi e

D trans erse an stationar

18 A teac er sets u t e a aratus s o n to emonstrate a t o s it inter erence attern on t e screen

97 2 1 /Q28



ic c ange to t e a aratus i increase t e ringe s acing

A ecreasing t e istance

B ecreasing t e istance

C ecreasing t e istance r

D ecreasing t e a e engt o t e ig t

19 A ara e eam o ite ig t is inci ent norma on a i raction grating t is note t at t e secon or er an t ir or er s ectra artia o er a

97 2 1 /Q29

ic a e engt in t e t ir or er s ectrum a ears at t e same ang e as t e a e engt o 6 nm in t e secon or er s ectrum

A nm B 4 nm C 6 nm D 9 nm

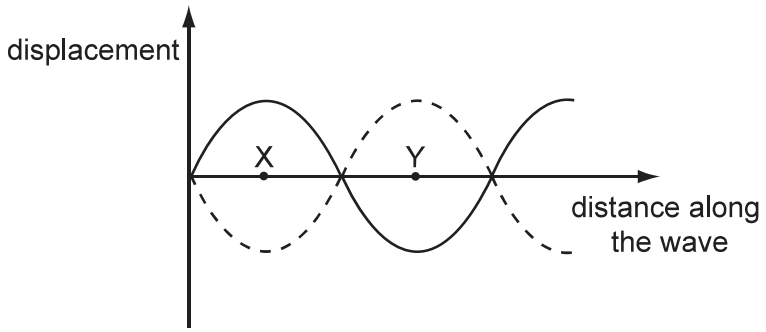
20 ig t o a e engt 7 nm is inci ent on a air o s its orming ringes mm a art on a screen

at is t e ringe s acing en ig t o a e engt nm is use an t e s it se aration is ou e

97 2 1 /Q28

A 7 mm B 1 mm C mm D 6 mm

21 e gra re resents a stan ing a e att o i erent times 97 2 1 /Q26



at oes t e istance re resent

A a t e am itu e

B a t e re uenc

C a t e erio

D a t e a e engt

22 n ic situation oes i raction occur 97 2 1 /Q27

A A a e ounces ac rom a sur ace

B A a e asses rom one me ium into anot er

C A a e asses t roug an a erture

D a es rom t o i entica sources are su er ose

23 ere in a stan ing a e o t e i rations o t e me ium occur 97 2 1 6/Q26

A on at t e no es

B on at t e antino es

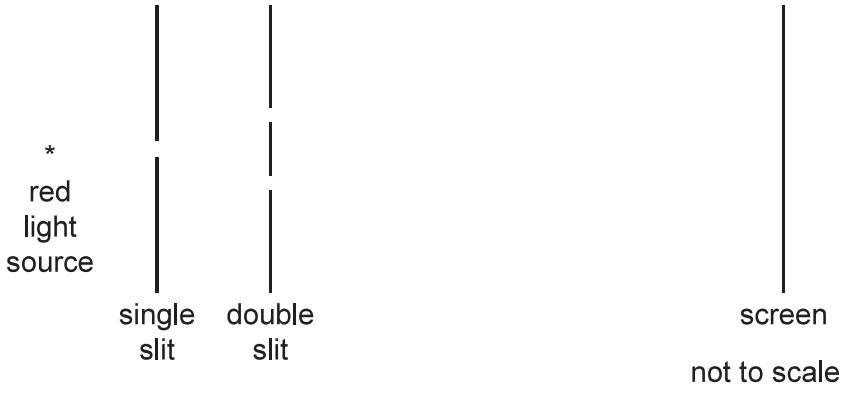
C at a oints et een t e no es

D at a oints et een t e antino es

24 onoc romatic ig t is inci ent on a i raction grating an a i raction attern is o ser e ic ine o t e ta e gi es t e e ect o re acing t e grating it one t at as more ines er metre 97 2 1 6/Q27

	num er o or ers o i raction isi e	ang e et een irst an secon or ers o i raction
A	ecreases	ecreases
B	ecreases	increases
C	increases	ecreases
D	increases	increases

25 **A ou e s it inter erence e eriment is set u as s o n** **97 2 1 6/Q28**



ringes are orme on t e screen e istance et een successi e rig t ringes is oun to e 4 mm

o c anges are t en ma e to t e e erimenta arrangement e ou e s it is re ace anot er ou e s it ic as a t e s acing e screen is mo e so t at its istance rom t e ou e s it is t ice as great

at is no t e istance et een successi e rig t ringes

A 1 mm B 4 mm C 8 mm D 16 mm

26 **Continuous ater a es are i racte t roug a ga in a arrier in a ri e tan** **97 2 1 6/Q26**

ic c ange i cause t e i raction o t e a es to increase

A increasing t e re uenc o t e a es

B increasing t e i t o t e ga

C re ucing t e a e engt o t e a es

D re ucing t e i t o t e ga

27 **e inter erence atterns rom a i raction grating an a ou e s it are com are** **97 2 1 6/Q27**

sing t e i raction grating e o ig t o t e irst or er is seen at to t e norma to t e grating

e same ig t ro uces inter erence ringes on a screen 1 m rom t e ou e s it e s it se aration is times greater t an t e ine s acing o t e grating

at is t e ringe se aration on t e screen

A 2 1 ^{7} m

B 1 1 m

C 1 1 m

D 1 1 ^{1} m

28 at ma e use to ro uce stationar a es 97 2 1 6/Q28

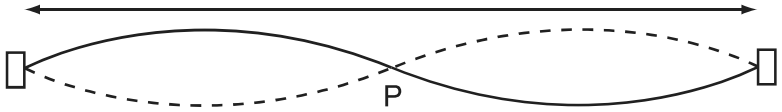
A o ing air o er t e to o an em t ott e

B ma ing a ou soun near a mountain

C assing monoc romatic ig t t roug a ou e s it

D assing ater a es t roug a narro s it

29 e iagram re resents a stationar a e on a stretc e string 97 2 1 7/Q25



at is re resente oint an t e engt

	oint	engt
A	antino e	one a e engt
B	antino e	t o a e engt s
C	no e	one a e engt
D	no e	t o a e engt s

30 A t o s it arrangement is set u to ro uce inter erence ringes on a screen e ringes are too c ose toget er or con enient o ser ation en a monoc romatic source o io et ig t is use 97 2 1 7/Q26

n ic a ou it e ossi e to increase t e se aration o t e ringes

A Decrease t e istance et een t e screen an t e s its

B ncrease t e istance et een t e t o s its

C ncrease t e i t o eac s it

D se a monoc romatic source o re ig t

31 onoc romatic ig t i uminates t o narro ara e s its e inter erence attern ic resu ts is o ser e on a screen some istance e on t e s its 97 2 1 7/Q24

ic c ange increases t e se aration et een t e ar ines o t e inter erence attern

A ecreasing t e istance et een t e screen an t e s its

B increasing t e istance et een t e s its

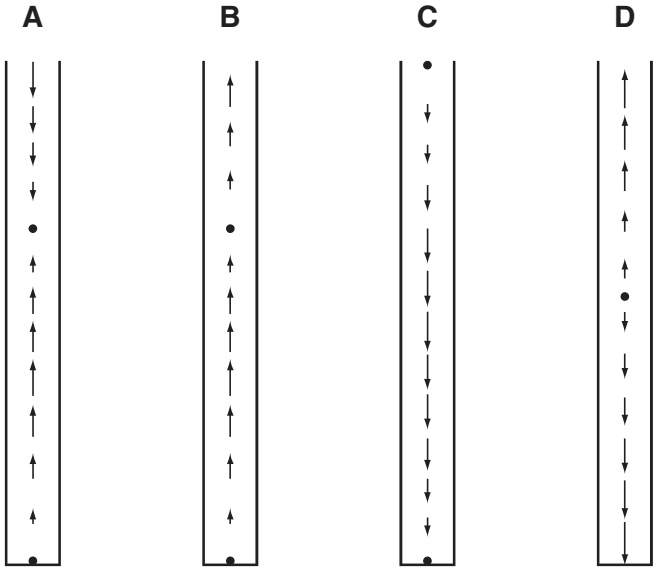
C using monoc romatic ig t o ig er re uenc

D using monoc romatic ig t o onger a e engt

32 A stationar ongitu ina a e is set u in a i e 97 2 1 7/Q27

n t e iagrams e o t e engt o eac arro re resents t e am itu e o t e motion o t e air mo ecu es an t e arro ea s o s t e irection o motion at a articu ar instant

ic iagram s o s a stationar a e in ic t ere are t o no es an t o antino es



33 oun a es emitte a sma ou s ea er are re ecte a a 97 2 1 8/Q27

e re uenc o t e a es is a uste unti a stationar a e is orme it t e antino e nearest t e a at a istance rom t e a

ic e ression gi es in terms o an t e s ee o soun c

A $\frac{4c}{}$ B $\frac{2c}{}$ C $\frac{c}{2}$ D $\frac{c}{4}$

34 A i raction grating as ines er unit engt an is ace at 9 to monoc romatic ig t o a e engt λ 97 2 1 8/Q28

at is t e e ression or θ t e ang e to t e norma to t e grating at ic t e t ir or er i raction ea is o ser e

A $\sin\theta \quad \frac{1}{\lambda}$ B $\sin\theta \quad \lambda$ C $\sin\theta \quad \frac{\lambda}{}$ D $\sin\theta \quad \frac{\lambda}{}$

35 ig t o a e engt 7 nm is inci ent on a air o s its orming ringes mm a art on a screen

at is t e ringe s acing en ig t o a e engt nm is use an t e s it se aration is ou e 97 2 1 8/Q29

A 7 mm B 1 mm C mm D 6 mm

36 **is a micro a e transmitter ace at a i e istance rom a at re ecting sur ace** **97 2 1 8**/Q27

A sma micro a e recei er is mo e rom to ar s an recei es signa s o a ternate ma ima an minima o intensit

e istance et een one ma imum an t e ne t is 1 mm

at is t e re uenc o t e micro a es

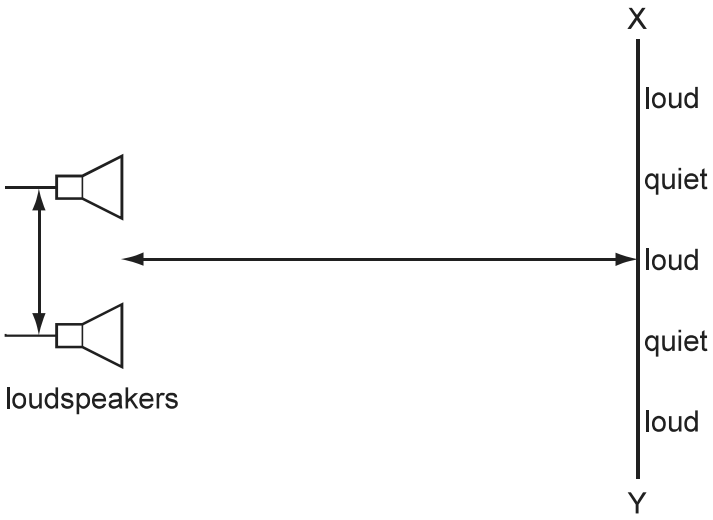
A 1 1 7

B 2 1 7

C 1 1 1

D 2 1 1

37 **e iagram s o s t o ou s ea ers ro ucing soun a es t at are in ase** **97 2 1 8**/Q28



As a stu ent mo es rom to t e intensit o t e note s e ears is a ternate ou an uiet

e istance et een a acent ou an uiet regions ma e re uce

A ecreasing istance

B increasing istance

C ecreasing t e am itu e

D increasing t e re uenc

38 Di raction is t e name gi en to t e 97 2 1 9/Q22

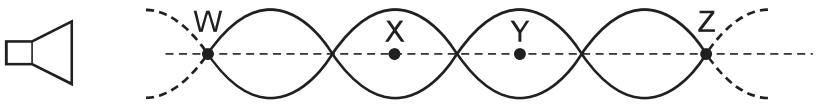
A a ition o t o co erent a es to ro uce a stationar a e attern

B en ing o a es roun an o stac e

C c ange o irection en a es cross t e oun ar et een one me ium an anot er

D s itting o ite ig t into co ours

39 e iagram re resents t e attern o stationar a es orme t e su er osition o soun a es rom a ou s ea er an t eir re ection rom a meta s eet not s o n 97 2 1 9/Q24



an are our oints on t e ine t roug t e centre o t ese a es

ic statement a out t ese stationar a es is correct

A An antino e is orme at t e sur ace o t e meta s eet

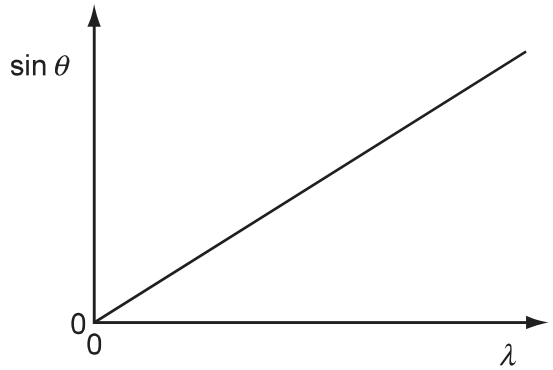
B A no e is a uarter o a a e engt rom an a acent antino e

C e osci ations at are in ase it t ose at

D e stationar a es osci ate at rig t ang es to t e ine

40 A i raction grating it ines er metre is use to e ect ig t o arious a e engt s λ

e iagram s o s a re ation et een t e e ection ang es θ or i erent a ues o λ in t e n^{t} or er inter erence attern 97 2 1 9/Q25



at is t e gra ient o t e gra

A n B $\frac{}{n}$ C $\frac{n}{}$ D $\frac{1}{n}$

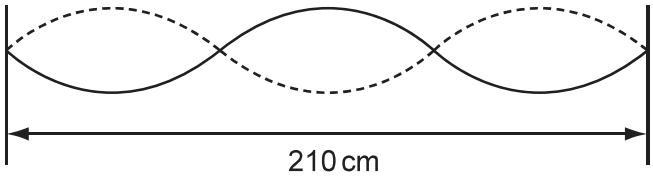
41 A ara e eam o ig t o a e engt 4 nm a s norma on a i raction grating ic as ines mm 97 2 11 9/Q26

at is t e tota num er o transmitte ma ima

A 7 B 8 C 14 D 1

42 **A stationar a e o re uenc 8 is set u on a stretc e string o engt 21 cm**

97 2 1 9/Q26

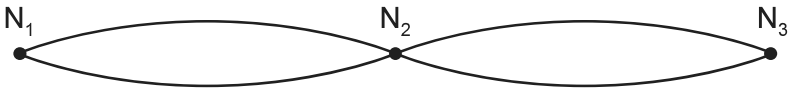


at is t e s ee o t e a est at ro uce t is stationar a e

A 6 ms 1 B 112 ms 1 C 6 ms 1 D 11 2 ms 1

43 **e iagram s o s a stan ing a e on a string e stan ing a e as t ree no es 1 2 an**

97 2 11 9/Q25



ic statement is correct

A A oints on t e string i rate in ase

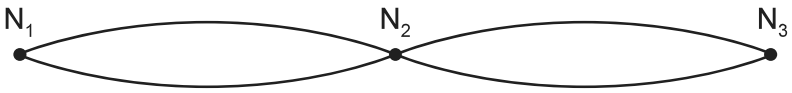
B A oints on t e string i rate it t e same am itu e

C oints e ui istant rom 2 i rate it t e same re uenc an in ase

D oints e ui istant rom 2 i rate it t e same re uenc an t e same am itu e

44 **e iagram s o s a stan ing a e on a string e stan ing a e as t ree no es 1 2 an**

97 2 12 9/Q24



ic statement is correct

A A oints on t e string i rate in ase

B A oints on t e string i rate it t e same am itu e

C oints e ui istant rom 2 i rate it t e same re uenc an in ase

D oints e ui istant rom 2 i rate it t e same re uenc an t e same am itu e

45 **A ara e eam o ig t o a e engt 4 nm a s norma on a i raction grating ic as ines mm**

97 2 12 9/Q25

at is t e tota num er o transmitte ma ima

A 7 B 8 C 14 D 1

46 sing monoc romatic ig t inter erence ringes are ro uce on a screen ace a istance D rom a air o s its o se aration a e se aration o t e ringes is

97 2 11 1 /Q23

Bot a an D are no ou e

at is t e ne ringe se aration

A $\frac{}{2}$ B C 2 D 4

47 Diagram 1 s o s a ri e tan e eriment in ic ane a es are i racte t roug a narro s it in a meta s eet

97 2 11 1 /Q24

Diagram 2 s o s t e same tan it a s it o greater i t

n eac case t e attern o t e a es inci ent on t e s it an t e emergent attern are s o n

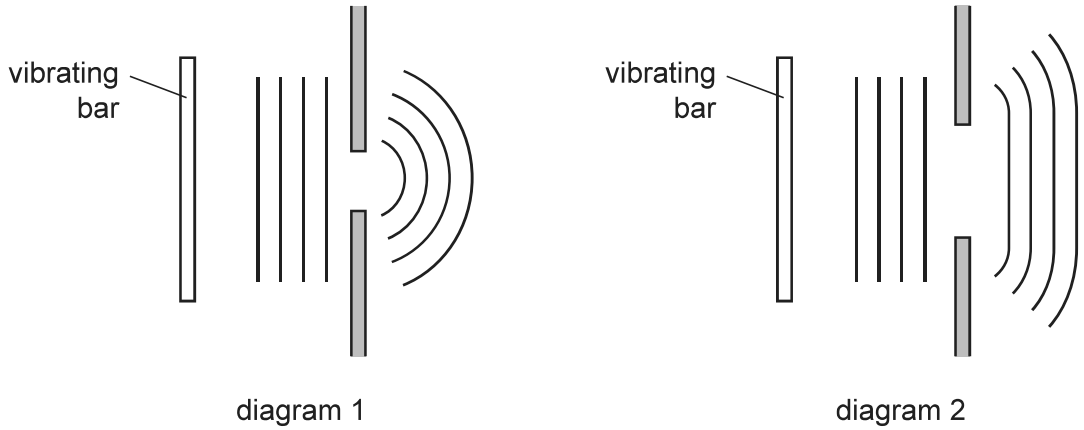


diagram 1 diagram 2

ic action ou cause t e a es in iagram 1 to e i racte ess an so ro uce an emergent attern c oser to t at s o n in iagram 2

A increasing t e re uenc o i ration o t e ar

B increasing t e s ee o t e a es ma ing t e ater in t e tan ee er

C re ucing t e am itu e o i ration o t e ar

D re ucing t e engt o t e i rating ar

48 ectromagnetic a es rom an un no n source in s ace ere oun to e signi icant i racte en assing t roug ga s o t e or er o 1 m

97 2 12 1 /Q24

ic t e o a e are t e most i e to e

A ra io a es

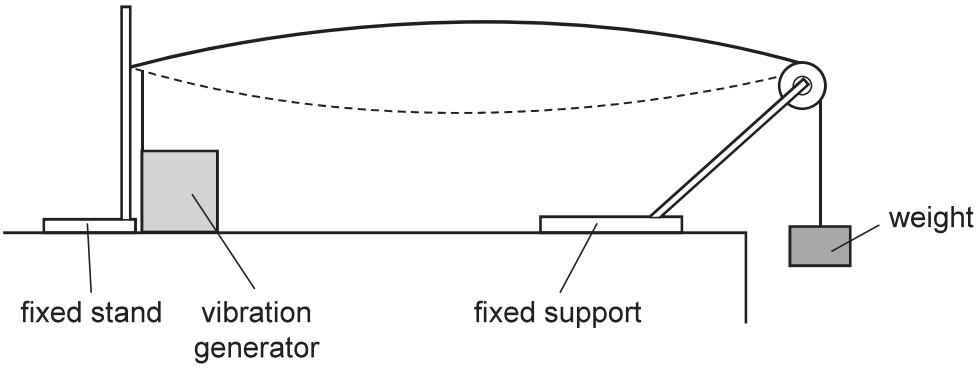
B micro a es

C in ra re a es

D u tra io et a es

49 e iagram s o s a stee ire c am e at one en an tensione att e ot er a eig t ung o er a u e

97 2 11 1 /Q25



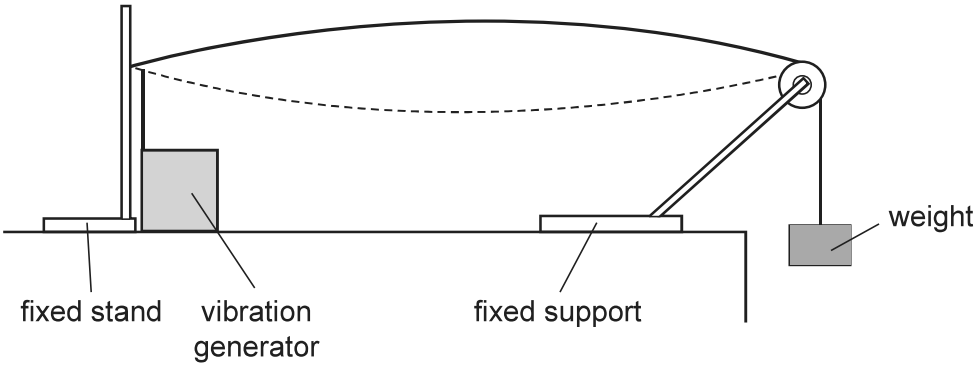
A i ration generator is attac e to t e ire near t e cam e en A stationar a e it one oo is ro uce e re uenc o t e i ration generator is

ic re uenc s ou e use to ro uce a stationar a e it t o oo s

A $\frac{}{4}$ B $\frac{}{2}$ C 2 D 4

50 e iagram s o s a stee ire c am e at one en an tensione att e ot er a eig t ung o er a u e

97 2 12 1 /Q22



A i ration generator is attac e to t e ire near t e cam e en A stationar a e it one oo is ro uce e re uenc o t e i ration generator is

ic re uenc s ou e use to ro uce a stationar a e it t o oo s

A $\frac{}{4}$ B $\frac{}{2}$ C 2 D 4

51 sing monoc romatic ig t inter erence ringes are ro uce on a screen ace a istance D rom a air o s its o se aration a e se aration o t e ringes is

97 2 12 1 /Q25

Bot a an D are no ou e

at is t e ne ringe se aration

A $\frac{}{2}$ B C 2 D 4

52 **Diagram 1 s o s a ri e tan e eriment in ic ane a es are i racte t roug a narro s it in a meta s eet** **97 2 12 1** /Q23

Diagram 2 s o s t e same tan it a s it o greater i t

n eac case t e attern o t e a es inci ent on t e s it an t e emergent attern are s o n

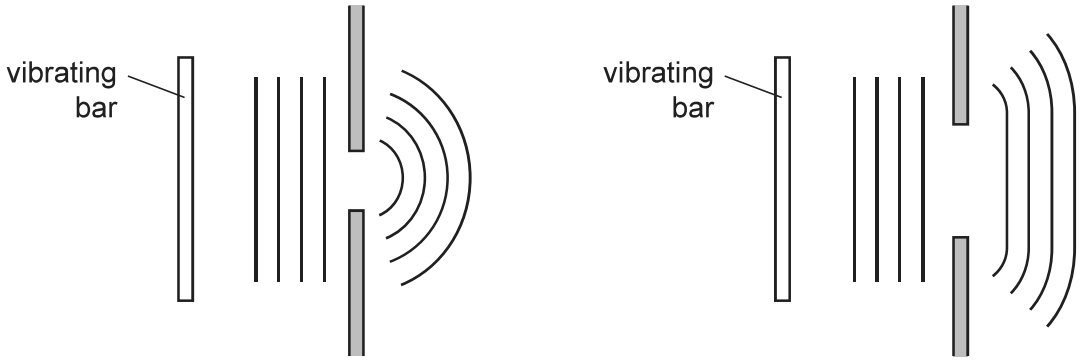


diagram 1 diagram 2

ic action ou cause t e a es in iagram 1 to e i racte ess an so ro uce an emergent attern c oser to t at s o n in iagram 2

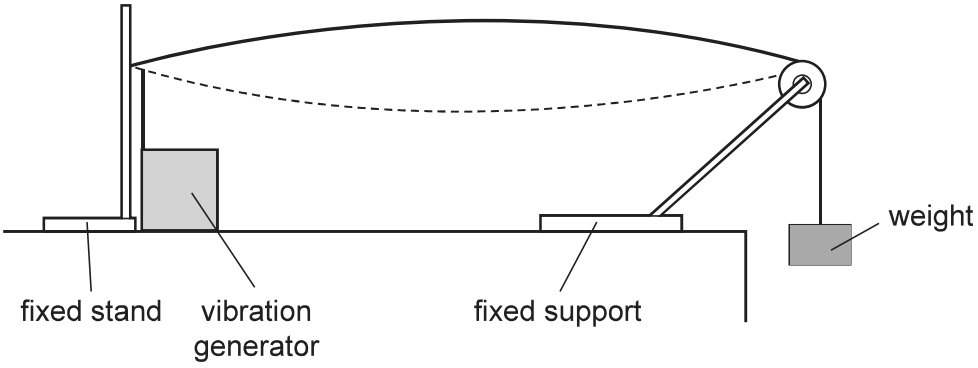
A increasing t e re uenc o i ration o t e ar

B increasing t e s ee o t e a es ma ing t e ater in t e tan ee er

C re ucing t e am itu e o i ration o t e ar

D re ucing t e engt o t e i rating ar

53 **e iagram s o s a stee ire c am e at one en an tensione att e ot er a eig t ung o er a u e** **97 2 1 1** /Q24



A i ration generator is attac e to t e ire near t e c am e en A stationar a e it one oo is ro uce e re uenc o t e i ration generator is

ic re uenc s ou e use to ro uce a stationar a e it t o oo s

A $\frac{}{4}$ **B** $\frac{}{2}$ **C 2** **D 4**

54 ectromagnetic a es rom an un no n source in s ace ere oun to e signi icant i racte en assing t roug ga s o t e or er o 1 m

97 2 1 1 /Q23

ic t e o a e are t e most i e to e

A ra io a es

B micro a es

C in ra re a es

D u tra io et a es

55 Diagram 1 s o s a ri e tan e eriment in ic ane a es are i racte t roug a narro s it in a meta s eet

97 2 1 1 /Q25

Diagram 2 s o s t e same tan it a s it o greater i t

n eac case t e attern o t e a es inci ent on t e s it an t e emergent attern are s o n

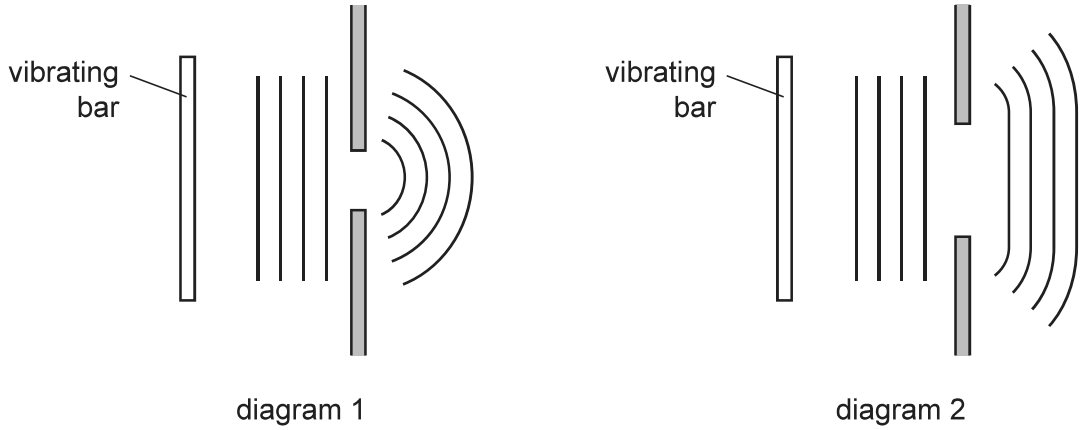


diagram 1 diagram 2

ic action ou cause t e a es in iagram 1 to e i racte ess an so ro uce an emergent attern c oser to t at s o n in iagram 2

A increasing t e re uenc o i ration o t e ar

B increasing t e s ee o t e a es ma ing t e ater in t e tan ee er

C re ucing t e am itu e o i ration o t e ar

D re ucing t e engt o t e i rating ar

56 ic e ectromagnetic a e ou cause t e most signi icant i raction e ect or an atomic attice o s acing aroun 1 ^{1} m

97 2 11 1 /Q27

A in ra re

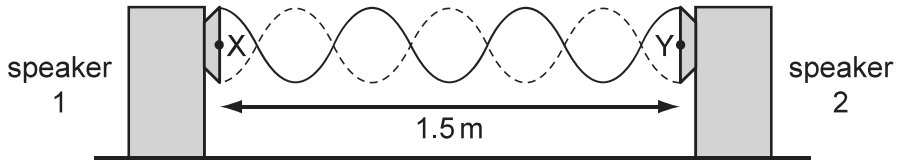
B micro a e

C u tra io et

D ra

57 A stationar a e is ro uce t o ou s ea ers emitting soun o t e same re uenc

97 2 11 1 /Q26



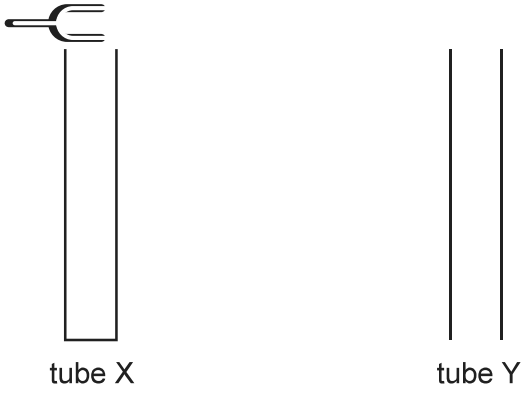
en a micro one is mo e et een an a istance o 1 m si no es an se en antino es are etecte

at is t e a e engt o t e soun

A m B 4 m C 2 m D 21 m

58 e iagram s o s t o tu es

97 2 12 1 /Q25



e tu es are i entica e ce t tu e is c ose at its o er en i e tu e is o en at its o er en Bot tu es a e o en u er en s

A tuning or ace a o e tu e causes resonance o t e air at re uenc o resonance is oun at an o er re uenc t an it tu e

ic tuning or i ro uce resonance en ace ust a o e tu e

A a or o re uenc $\frac{}{2}$

B a or o re uenc $\frac{2}{}$

C a or o re uenc $\frac{}{2}$

D a or o re uenc 2

59 ic e ectromagnetic a e enomenon is nee e to e ain t e s ectrum ro uce en ite ig t a s on a i raction grating

97 2 11 11/Q26

A co erence

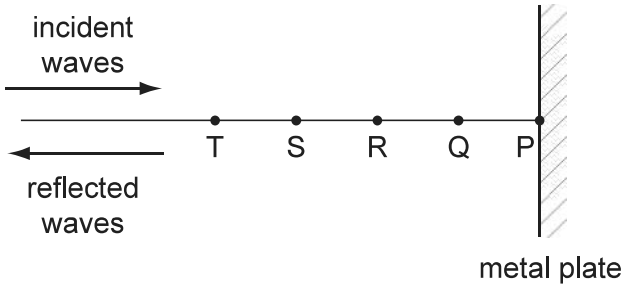
B inter erence

C o arisation

D re raction

60 A micro a e transmitter emits a es to ar s a meta ate e a es stri e t e ate an are re ecte ac a ong t eir origina at

97 2 12 1 /Q26



A micro a e etector is mo e a ong t e ine

oints an are t e ositions ere minima o intensit are o ser e ese oints are oun to e 1 mm a art

at is t e re uenc o t e micro a es

A B 6 7 C 1 D 2

61 A ou e s it e eriment using ig t o a e engt 6 nm resu ts in ringes eing ro uce on a screen e ringe se aration is oun to e 1 mm

97 2 12 1 /Q27

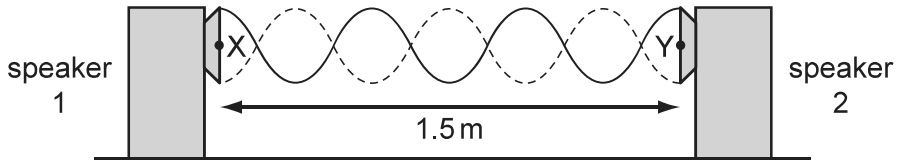
en t e istance et een t e ou e s its an t e ie ing screen is increase 2 m t e ringe se aration increases to mm

at is t e se aration o t e ou e s its ro ucing t e ringes

A 4 mm B 6 mm C 9 mm D 1 2 mm

62 A stationar a e is ro uce t o ou s ea ers emitting soun o t e same re uenc

97 2 1 1 /Q23



en a micro one is mo e et een an a istance o 1 m si no es an se en antino es are etecte

at is t e a e engt o t e soun

A m B 4 m C 2 m D 21 m

63 ic e ectromagnetic a e ou cause t e most signi icant i raction e ect or an atomic attice o s acing aroun 1 ^{1} m

97 2 1 1 /Q26

A in ra re

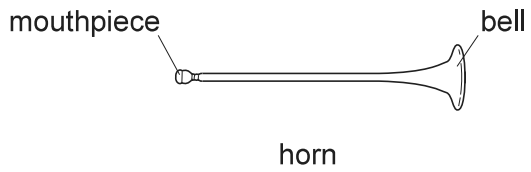
B micro a e

C u tra io et

D ra

64 e asic rinci e o note ro uction in a orn is to set u a stationar a e in an air co umn

97 2 11 11/Q25



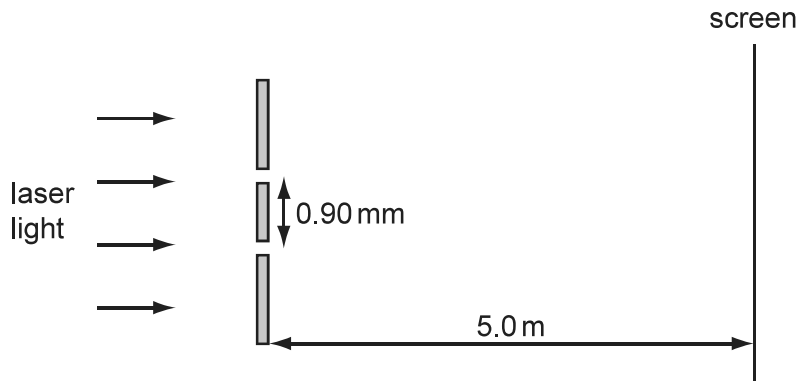
or t e o est note ro uce a orn a no e is orme at t e mout iece an t e antino e is orme at t e e e re uenc o t is note is 7

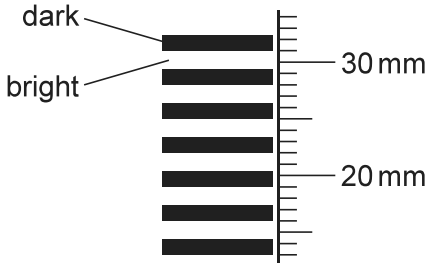
at are t e re uencies o t e ne t t o ig er notes or t is air co umn

	irst ig er note	secon ig er note
A	11	1
B	1	22
C	1	
D	22	7

65 e iagrams s o t e arrangement o a aratus or a oung s s its e eriment an a so art o t e attern orme on t e screen it a ru er ace ne t to it

97 2 12 11/Q29

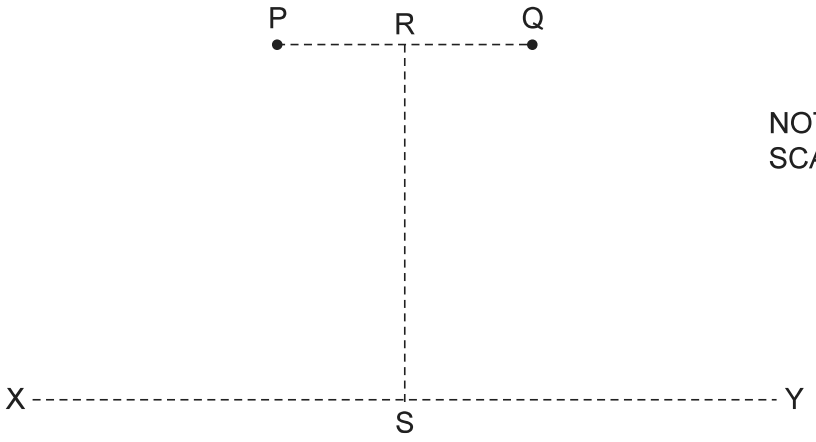




at is t e a e engt o t e ig t

A 4 8 1 ^{7}m B 4 1 ^{7}m C 2 1 ^{6}m D 4 1 ^{6}m

66 **Co erent a es are ro uce at an at an tra e out ar s in a irections e ine is a a et een an an er en icu ar to t e ine oining an e istance is muc greater t an t e istance** **97 2 11 11/Q30**



A ong ic ine or ines is an inter erence attern o ser e

A ot an

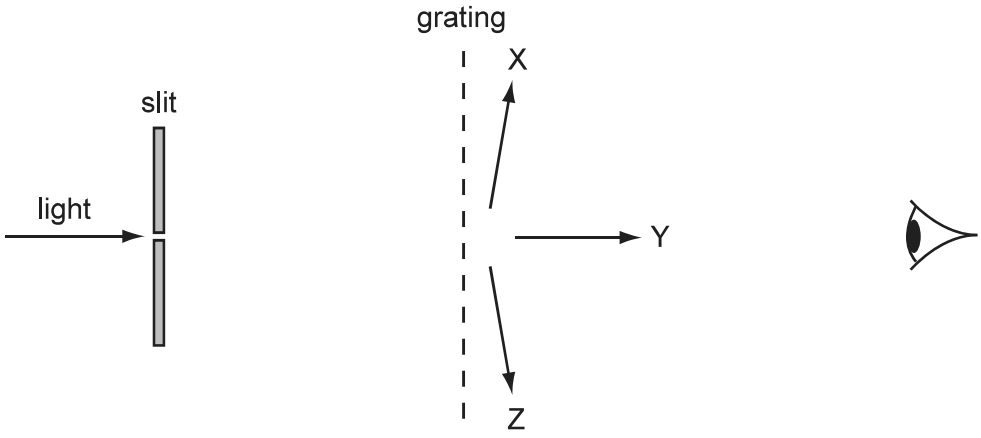
B on

C on

D neit er nor

67 **A i raction grating it ines er mm is use to o ser e i raction o monoc romatic ig t o a e engt 6 nm** **97 2 1 11/Q26**

e ig t is asse t roug a narro s it an t e grating is ace so t at its ines are ara e to t e s it ig t asses t roug t e s it an t en t e grating

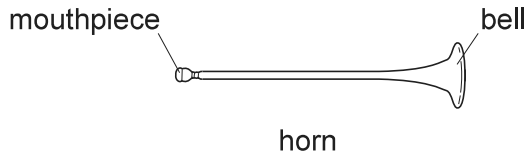


An o ser er ie s t e s it t roug t e grating at i erent ang es mo ing is ea rom ara e to t e grating t roug o osite t e s it to ara e to t e grating on t e o osite si e

o man images o t e s it oes e see

A B 4 C 6 D 7

68 e asic rinci e o note ro uction in a orn is to set u a stationar a e in an air co umn
97 2 1 11/Q27

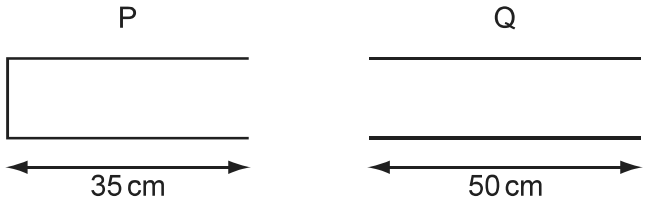


or t e o est note ro uce a orn a no e is orme at t e mout iece an t e antino e is orme at t e e e re uenc o t is note is 7

at are t e re uencies o t e ne t t o ig er notes or t is air co umn

	irst ig er note	secon ig er note
A	11	1
B	1	22
C	1	
D	22	7

69 ra e ing a es o a e engt 2 cm are create in t e air co umns in a c ose i e an an o en i e e engt s o t e i es are s o n
97 2 11 11/Q29



n ic i e or i es are stationar a es orme

A an

B on

C on

D neit er nor

70 o ig t sources ro uce isi e inter erence ringes on in certain circumstances 97 2 12 11/Q28

ic con ition ena es isi e inter erence ringes to e orme

A using a ite ig t source

B using inco erent sources

C using one ig t source ic is o arise at rig t ang es to ig t rom t e ot er source

D using sources rom ic t e ig t oes not o er a

71 n ic situation oes i raction occur

97 2 12 11/Q28

A A a e ounces ac rom a sur ace

B A a e asses rom one me ium into anot er

C A a e asses t roug an a erture

D a es rom t o i entica sources are su er ose

72 ic e ectromagnetic a e enomenon is nee e to e ain t e s ectrum ro uce en ite ig t a s on a i raction grating

97 2 1 11/Q25

A co erence

B inter erence

C o arisation

D re raction

73 A soun a e is set u in a ong tu e c ose at one en e engt o t e tu e is a uste unti t e soun rom t e tu e is ou est

97 2 12 11/Q27

at is t e nature o t e soun a e in t e tu e

A ongitu ina an rogressi e

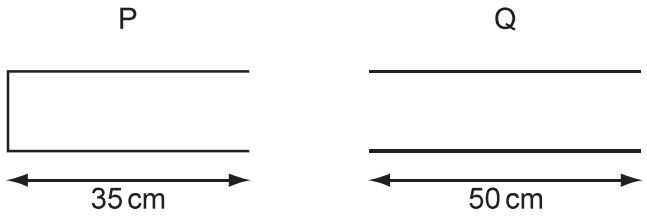
B ongitu ina an stationar

C trans erse an rogressi e

D trans erse an stationar

74 ra e ing a es o a e engt 2 cm are create in t e air co umns in a c ose i e an an o en i e e engt s o t e i es are s o n

97 2 1 11/Q30



n ic i e or i es are stationar a es orme

A an

B on

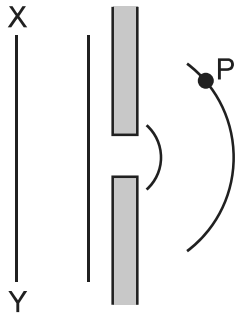
C on

D neit er nor

75 A monoc romatic ane a e o s ee c an a e engt λ is i racte at a sma a erture

97 2 12 12/Q29

e iagram i ustrates successi e a e ronts

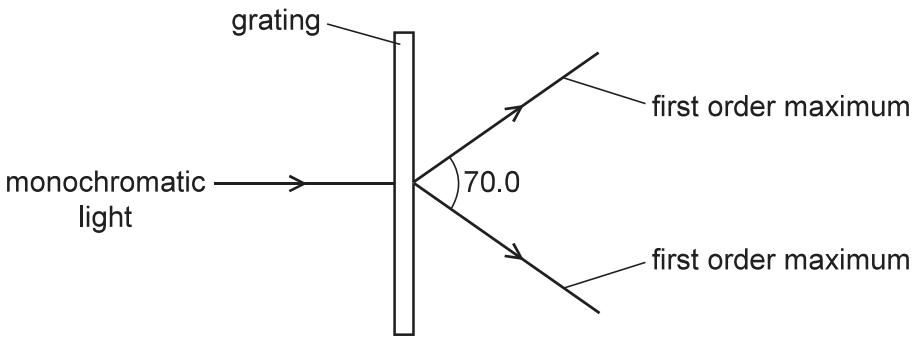


A ter at time i some ortion o t e a e ront reac oint

A $\frac{\lambda}{2c}$ B $\frac{2\lambda}{c}$ C $\frac{\lambda}{c}$ D $\frac{4\lambda}{c}$

76 A i raction grating is use to measure t e a e engt o monoc romatic ig t as s o n in t e iagram

97 2 11 12/Q30



e s acing o t e s its in t e grating is 1 1 ^{6}m e ang e et een t e irst or er i raction ma ima is 7

at is t e a e engt o t e ig t

A 287 nm B 47 nm C 74 nm D 94 nm

77 o ro uce a stationar a e t o a es must tra e in o osite irections t roug t e same s ace

97 2 1 12/Q30

ic statement a out t e ro erties o t e t o a es must a so e true

A e a es must a e e ua re uenc ut a i erent s ee an a e engt

B e a es must a e e ua s ee ut a i erent a e engt an re uenc

C e a es must a e e ua s ee re uenc an a e engt

D e a es must a e e ua a e engt ut a i erent s ee an re uenc

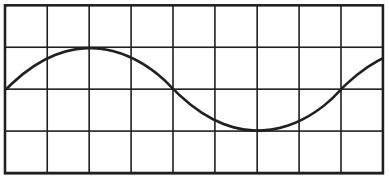
78 **A stan ing soun a e is set u et een a ou s ea er an a a** **97 2 12 12/Q30**

A micro one is connecte to a cat o e ra osci osco e c r o an is mo e a ong a ine irect et een t e ou s ea er an t e a e am itu e o t e trace on t e c r o rises to a ma imum at a osition a s to a minimum an t en rises once again to a ma imum at a osition

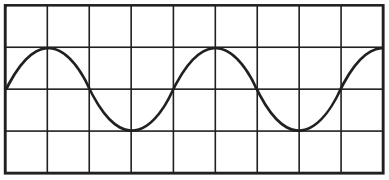
e istance et een an is cm e s ee o soun in air is m s ^{1}

ic iagram re resents t e c r o trace o t e soun recei e at

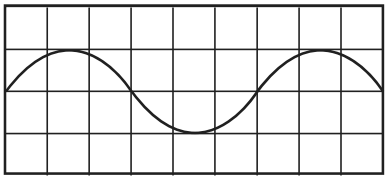
A



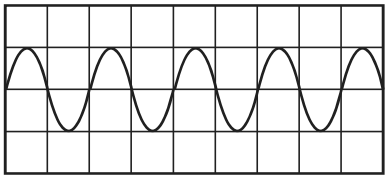
B



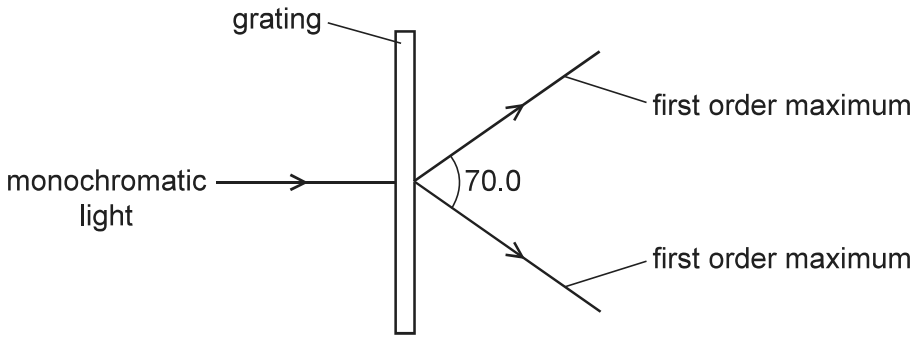
C



D



79 **A i raction grating is use to measure t e a e engt o monoc romatic ig t as s o n in t e iagram** **97 2 1 12/Q28**

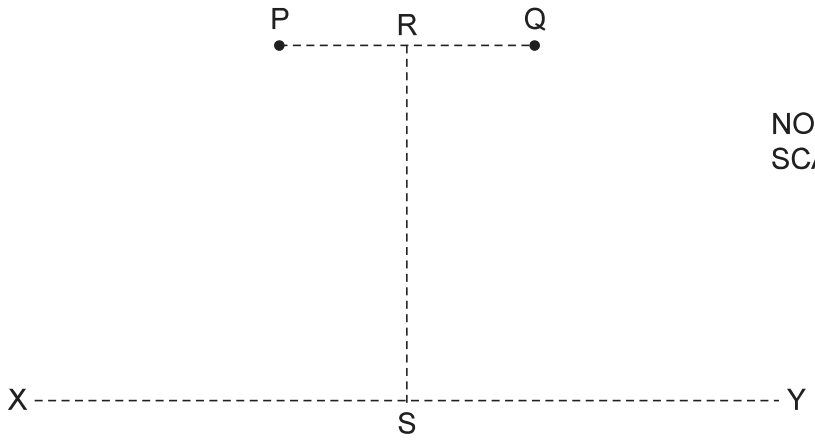


e s acing o t e s its in t e grating is 1 1 ^{6}m e ang e et een t e irst or er i raction ma ima is 7

at is t e a e engt o t e ig t

A 287 nm B 47 nm C 74 nm D 94 nm

80 **Co erent a es are ro uce at an at an tra e out ar s in a irections e ine is a a et een an an er en icu ar to t e ine oining an e istance is muc greater t an t e istance** **97 2 1 11**/Q29



A ong ic ine or ines is an inter erence attern o ser e

A ot an

B on

C on

D neit er nor

81 **o ro uce a stationar a e t o a es must tra e in o osite irections t roug t e same s ace** **97 2 11 12**/Q29

ic statement a out t e ro erties o t e t o a es must a so e true

A e a es must a e e ua re uenc ut a i erent s ee an a e engt

B e a es must a e e ua s ee ut a i erent a e engt an re uenc

C e a es must a e e ua s ee re uenc an a e engt

D e a es must a e e ua a e engt ut a i erent s ee an re uenc

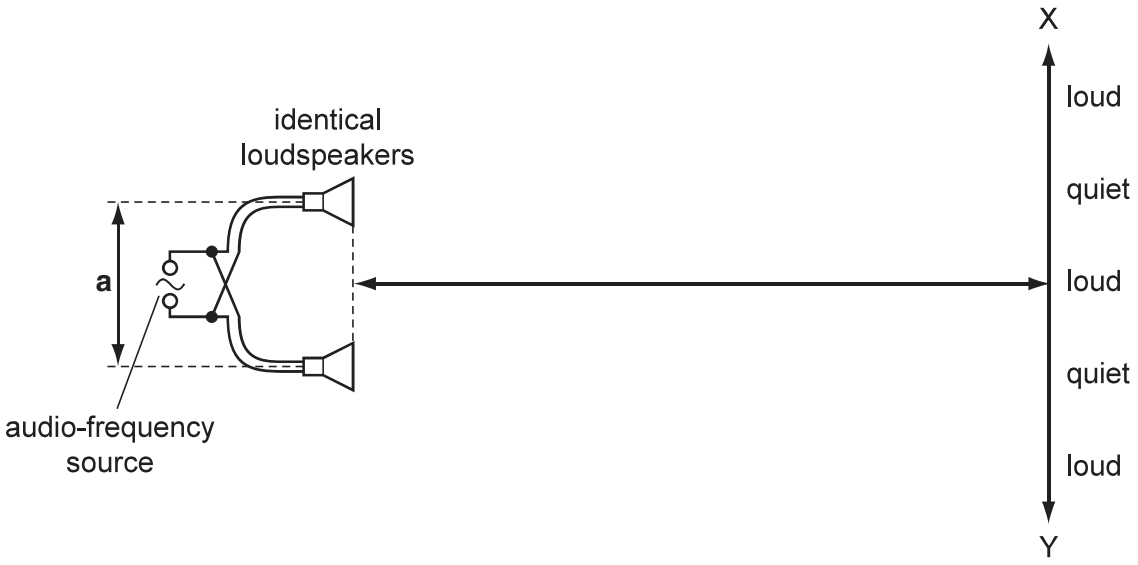
82 **A musica organ ro uces notes o ing air into a set o i es t at are o en at one en an c ose at t e ot er** **97 2 11 12**/Q28

at is t e o est re uenc o soun ro uce a i e o engt 1 m e s ee o soun in t e i e is 2 ms^{1}

A 4 B 8 C 16 D 2

83 e iagram s o s t o i entica ou s ea ers ri en in ase a common au io re uenc source

97 2 12 12/Q28



en a stu ent mo es a ong ine s e notices t at t ere are ariations in t e ou ness o t e soun e regions in ic t e soun is ear are a ternate ou an uiet as in icate on t e iagram

o ma t e istance et een ou regions e re uce

A ecreasing t e istance a et een t e s ea ers

B increasing istance

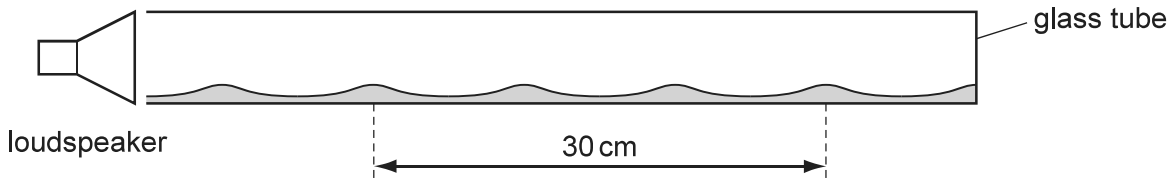
C increasing t e re uenc o t e au io re uenc source

D increasing t e o er out ut rom t e au io re uenc source

84 A ori onta g ass tu e c ose at one en as a a er o ust ai insi e it on its o er si e oun is emitte rom a ou s ea er t at is ace near t e o en en o t e tu e 97 2 12 12/Q29

e re uenc o t e soun is arie an at one re uenc a stationar a e is orme insi e t e tu e so t at t e ust orms sma ea s

e istance et een our ea s o ust is cm



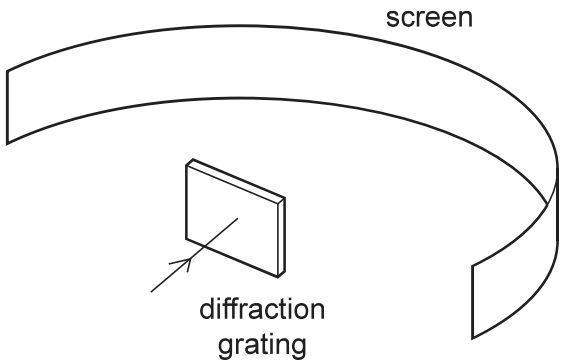
e s ee o soun in t e tu e is ms ^{1}

at is t e re uenc o t e soun emitte t e ou s ea er

A 16 B 22 C D 66

85 onoc romatic ig t o a e engt 69 nm asses t roug a i raction grating it ines er mm ro ucing a series o ma ima on a screen

97 2 12 12/Q30

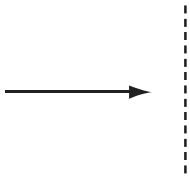


at is t e greatest num er o ma ima t at can e o ser e

A 4 B C 8 D 9

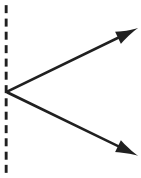
86 onoc romatic ig t is irecte at a i raction grating as s o n

97 2 11 12/Q29

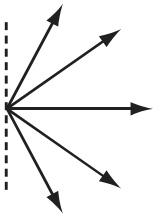


ic iagram s o s a t e ossi e irections o t e ig t a ter assing t roug t e grating t at gi e ma imum intensit

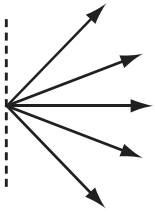
A



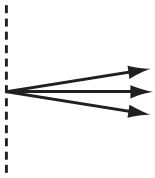
B



C



D



87 Di raction can e o ser e en a a e asses an o struction e i raction e ect is greatest en t e a e engt an t e o struction are simi ar in si e

97 2 1 12/Q28

or a es tra e ing t roug air at is t e com ination o a e an o struction t at cou est emonstrate i raction

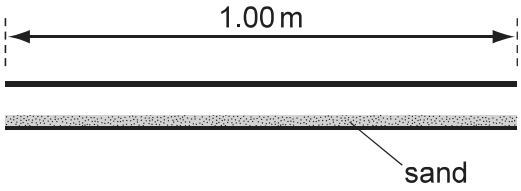
A micro a es assing a stee ost

B ra io a es assing a co er ire

C soun a es assing a uman air

D isi e ig t a es assing a gate ost

88 e iagram s o s an air i e i e o en at ot en s e engt o t e i e is 1 m an t e o er sur ace o t e insi e o t e i e is co ere it a a er o ine san 97 2 1 12/Q26



en a source o soun o a sing e re uenc is ut near one en o t e i e t e air in t e i e is oun to resonate an a attern in t e san s o s t at a stan ing a e containing t ree no es is orme it in t e i e

e s ee o soun in air is m s ^{1}

at is t e re uenc o t e soun

A B 49 C 99 D 1 2

89 A stationar soun a e is orme in a measuring c in er o ing across t e to as s o n 97 2 1 12/Q27

ic statement is correct

A e un amenta re uenc o t e stationar a e ecreases en some ater is a e to t e c in er

B e stationar a e in t e c in er is cause t e su er osition o t o a es mo ing in o osite irections

C e stationar a e in t e c in er is o arise

D e stationar a e i a e an antino e at t e ottom o t e c in er

90 A ara e eam o re ig t o a e engt 7 nm is inci ent norma on a i raction grating t at as 4 ines er mi imetre 97 2 1 1 /Q27

at is t e tota num er o transmitte ma ima

A B 4 C 6 D 7

91 onoc romatic ig t o a e engt 1 [7] m is inci ent norma on a i raction grating e irst or er ma imum is o ser e at an ange o 1 4 to t e irection o t e inci ent ig t

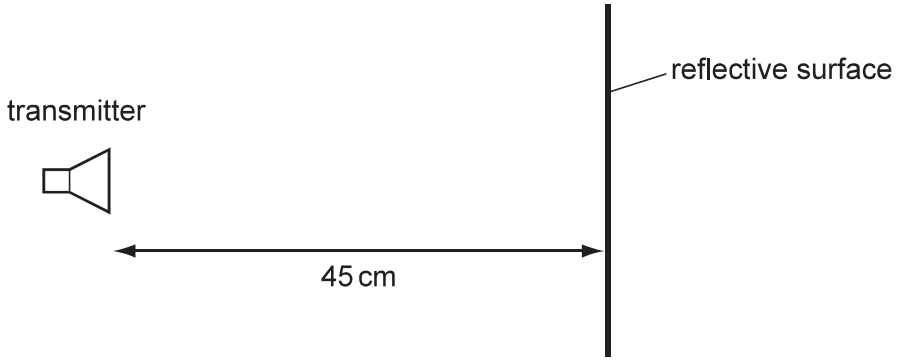
97 2 12 1 /Q29

at is t e ang e et een t e irst an secon or er i raction ma ima

A 7 6 B 1 4 C 16 7 D 2

92 A transmitter o e ectromagnetic a es is ace 4 cm rom a re ecti e sur ace

97 2 12 1 /Q27



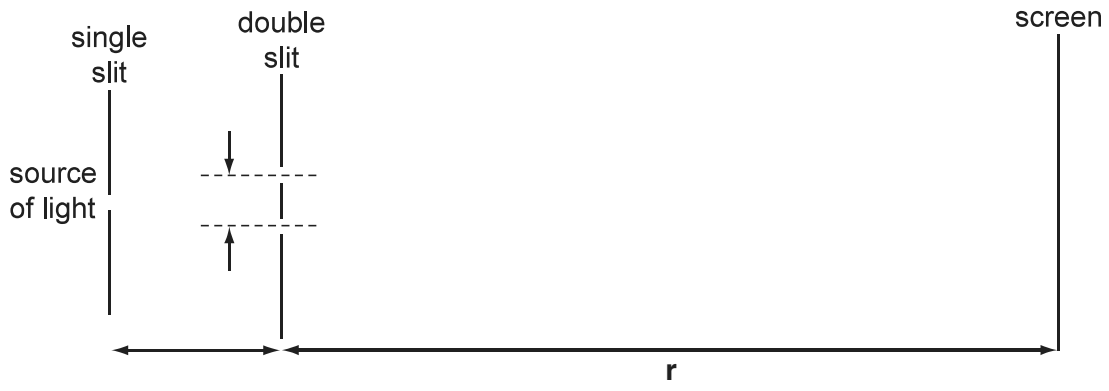
e emitte a es a e a re uenc o 1 A stationar a e is ro uce it a no e at t e transmitter an a no e at t e sur ace

o man antino es are in t e s ace et een t e transmitter an t e sur ace

A 1 B 2 C D 4

93 A teac er sets u t e a aratus s o n to emonstrate a t o s it inter erence attern on t e screen

97 2 12 1 /Q28



ic c ange to t e a aratus i increase t e ringe s acing

A ecreasing t e istance

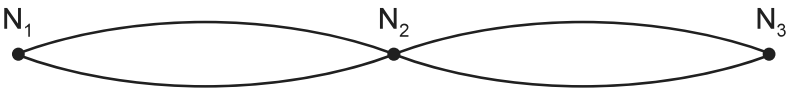
B ecreasing t e istance

C ecreasing t e istance r

D ecreasing t e a e engt o t e ig t

94 e iagram s o s a stan ing a e on a string e stan ing a e as t ree no es $_1$ $_2$ an

97 2 1 1 /Q28



ic statement is correct

A A oints on t e string i rate in ase

B A oints on t e string i rate it t e same am itu e

C oints e ui istant rom $_2$ i rate it t e same re uenc an in ase

D oints e ui istant rom $_2$ i rate it t e same re uenc an t e same am itu e

95 ig t o a e engt 6 nm is inci ent on a air o s its ringes it a s acing o 4 mm are orme on a screen

97 2 11 1 /Q27

at i e t e ringe s acing en t e a e engt o t e ig t is c ange to 4 nm an t e se aration o t e s its is ou e

A 1 mm

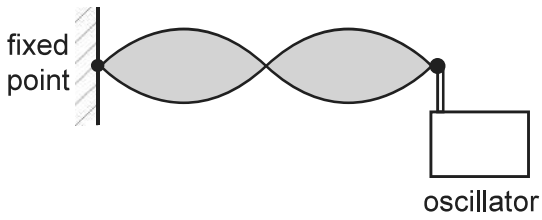
B mm

C mm

D 12 mm

96 e s ee o a trans erse a e on a stretc e string can e c ange a usting t e tension o t e string A stationar a e attern is set u on a stretc e string using an osci ator set at a re uenc o 6

97 2 11 1 /Q28



o must t e a e e c ange to maintain t e same stationar a e attern i t e a ie re uenc is increase to 7

A Decrease t e s ee o t e a e on t e string

B Decrease t e a e engt o t e a e on t e string

C ncrease t e s ee o t e a e on t e string

D ncrease t e a e engt o t e a e on t e string

97 oise re uction ea ones acti e ro uce t eir o n soun a es in or er to cance out e terna soun a es

97 2 11 1 /Q29

A micro one in t e ea ones recei es a es o one re uenc A ou s ea er in t e ea ones t en ro uces a a e o t at re uenc ut o a i erent ase

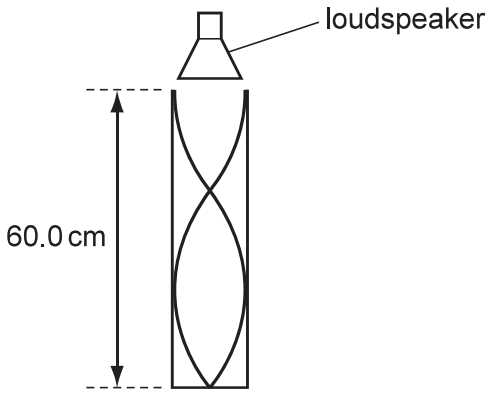
at is t e ase i erence et een t e e terna soun a e an t e a e ro uce t e ou s ea er in t e ea ones

A 9 B 18 C 27 D 6

98 e soun rom a ou s ea er ace a o e a tu e causes resonance o t e air in t e tu e

97 2 11 1 /Q27

A stationar a e is orme it t o no es an t o antino es as s o n



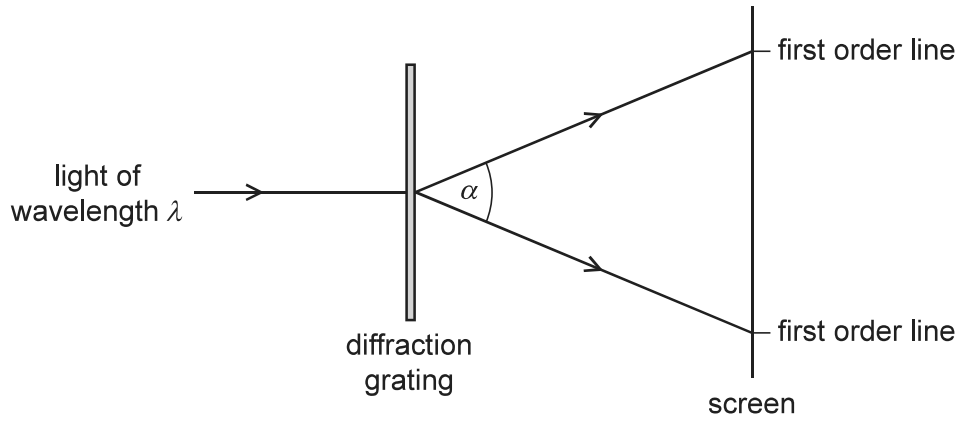
e s ee o soun in air is ms ^{1}

at is t e re uenc o t e soun

A 41 B C 8 D 16

99 ig t o a e engt λ asses t roug a i raction grating it s it s acing A series o ines is o ser e on a screen

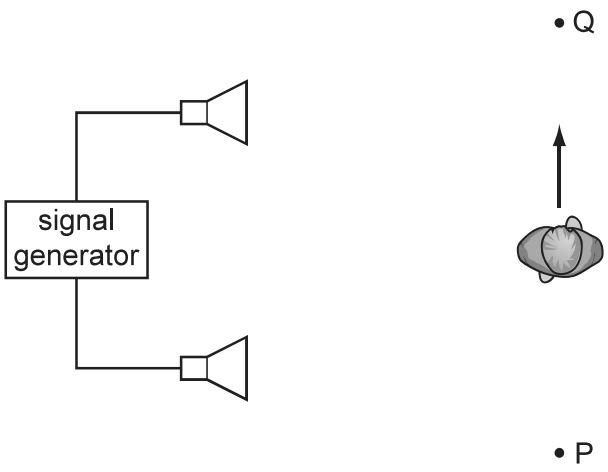
97 2 11 1 /Q28



at is t e ange α et een t e t o irst or er ines

A $\sin^{1}\left(\frac{\lambda}{2}\right)$ B $\sin^{1}\left(\frac{\lambda}{}\right)$ C $2\sin^{1}\left(\frac{\lambda}{2}\right)$ D $2\sin^{1}\left(\frac{\lambda}{}\right)$

100 **A stu ent connects t o ou s ea ers to a signa generator** **97 2 11 1** /Q29



As t e stu ent a s rom to e notices t at t e ou ness o t e soun rises an a s re eate

at causes t e ou ness o t e soun to ar

A i raction o t e soun a es

B inter erence o t e soun a es

C o arisation o t e soun a es

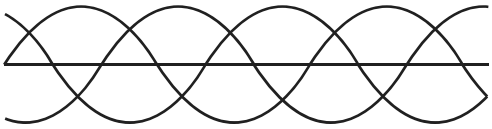
D re ection o t e soun a es

101 **e t ree a es s o n in eac iagram a e t e same am itu e an re uenc ut i er in ase** **97 2 1 1** /Q26

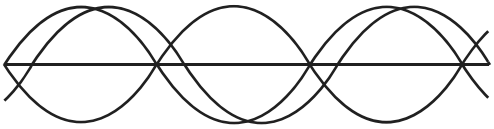
e are a e toget er to gi e a resu tant a e

n ic case is t e resu tant a e ero

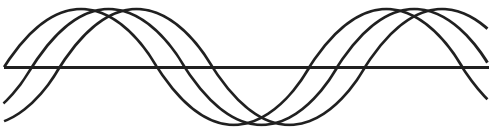
A



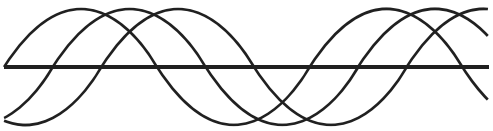
B



C

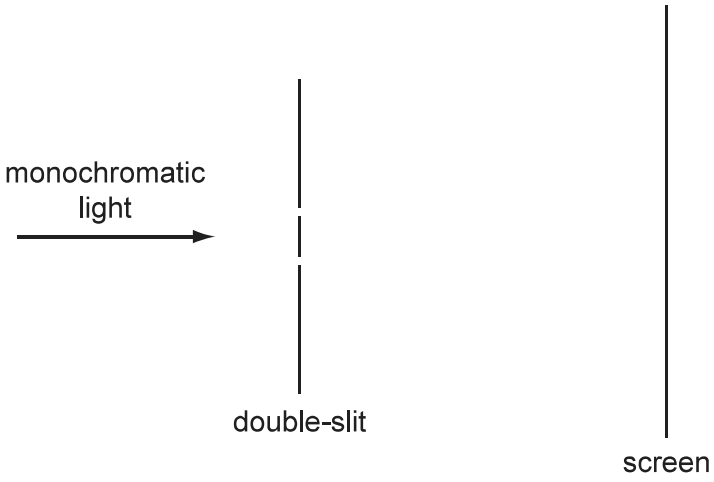


D



102 **A stu ent sets u a aratus to o ser e t e ou e s it inter erence o monoc romatic ig t as s o n**

97 2 1 1 /Q29



nter erence ringes are orme on t e screen

ic c ange ou increase t e istance et een a acent ringes

A Decrease t e istance et een t e t o sits

B Decrease t e i t o eac s it

C o e t e screen c oser to t e ou e s it

D se ig t o a ig er re uenc

103 **A stationar soun a e as a series o no es e istance et een t e irst an t e si t no e is cm**

97 2 1 1 /Q27

at is t e a e engt o t e soun a e

A cm B 6 cm C 1 cm D 12 cm

104 **at is meant i raction**

97 2 1 1 /Q28

A A ition o t o co erent a es to ro uce a stationar a e attern

B Ben ing o a es roun an o stac e

C C ange o irection en a es cross t e oun ar et een one me ium an anot er

D itting o ite ig t into co ours

105 A stu ent attem ts to s o t e inter erence o ig t using t o i entica green Ds 97 2 1 14/Q28

ic statement e ains t e e eriement i not succee

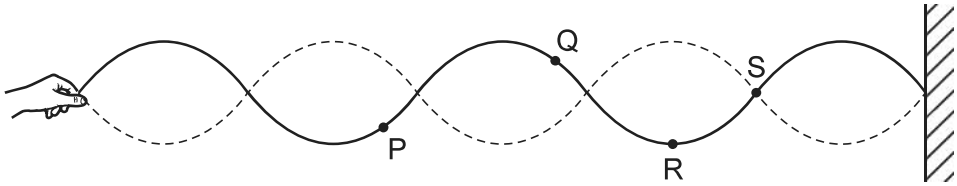
A e ig t a es rom t e sources are not co erent

B e ig t a es rom t e sources o not a e t e same am itu e

C e ig t a es rom t e sources a e a range o a e engt s

D e ig t a es rom t e sources are not monoc romatic

106 A stationar a e is set u on a stretc e string as s o n 97 2 1 14/Q29



ic statement a out t e oints on t e string is correct

A oint i rates it t e argest am itu e

B oints an i rate in ase

C oint is an antino e

D e ori onta istance et een an is a t e a e engt

107 onoc romatic ig t is inci ent on a i raction grating an a i raction attern is o ser e

ic ine o t e ta e gi es t e e ect o re acing t e grating it one t at as more ines er metre

97 2 1 14/Q30

	num er o or ers o i raction isi e	ang e et een irst an secon or ers o i raction
A	ecreases	ecreases
B	ecreases	increases
C	increases	ecreases
D	increases	increases

108 A ara e eam o ite ig t asses t roug a i raction grating range ig t o a e engt 6 nm in t e ourt or er i raction ma imum coinci es it ue ig t in t e i t or er i raction ma imum

97 2 11 14/Q26

at is t e a e engt o t e ue ig t

A 4 nm B 48 nm C nm D 7 nm

109 e rinci e o su er osition states t at a certain uantit is a e en t o or more a es meet at a oint

97 2 12 14/Q25

at is t is uantit

A am itu e

B is acement

C intensit

D a e engt

110 ig t asses t roug a i raction grating ru e at 1 ines er cm an t e same a e engt o ig t a so asses t roug t o narro s its mm a art Bot situations ro uce intensit ma ima an minima on a screen

97 2 12 14/Q26

ic statement a out t e se aration o t e ma ima on t e screen an t e s ar ness o t e ma ima is correct

A e i raction grating ma ima are ess i e s ace an are ess s ar t an t e t o sit ma ima

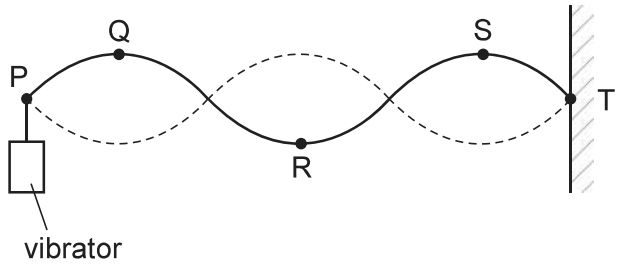
B e i raction grating ma ima are ess i e s ace an are s ar er t an t e t o sit ma ima

C e i raction grating ma ima are more i e s ace an are ess s ar t an t e t o sit ma ima

D e i raction grating ma ima are more i e s ace an are s ar er t an t e t o sit ma ima

111 A stationar a e on a stretc e string is set u et een t o oints an

97 2 11 14/Q25



ic statement a out t e a e is correct

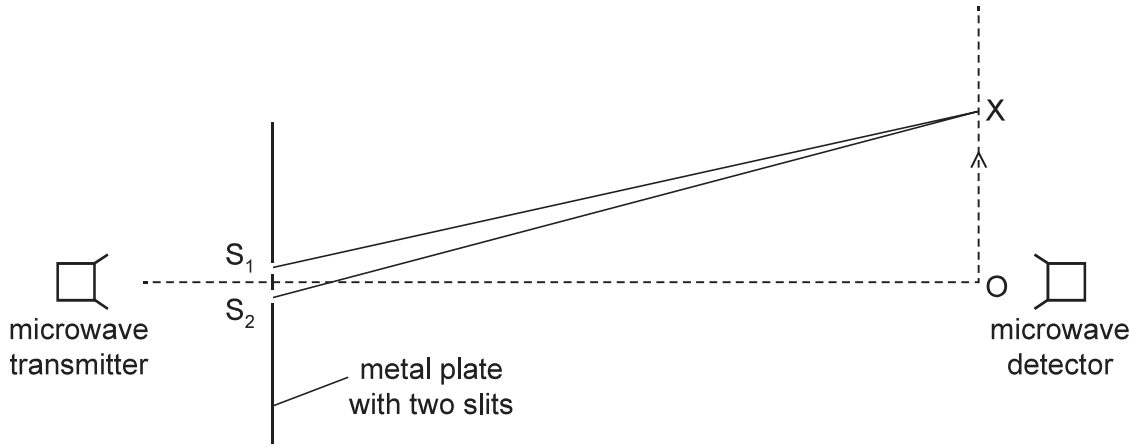
A oint is at a no e

B oints an i rate in ase

C e istance et een an is t ree a e engt s

D e a e s o n as t e o est ossi e re uenc

112 e iagram s o s an e eriment ic as een set u to emonstrate t o source inter erence icro a es o a e engt λ ass t roug t o s its 1 an 2 **97 2 12 14**/Q27



e etector is mo e rom oint in t e irection o t e arro e signa etecte ecreases unti t e etector reac es oint an t en starts to increase again as t e etector mo es e on

ic e uation correct etermines t e osition o

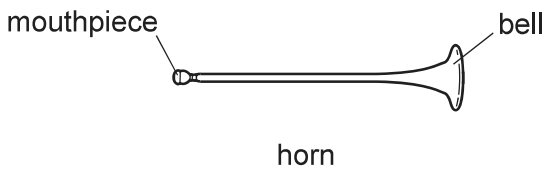
A λ

B λ 2

C 2 1 λ

D 2 1 λ 2

113 e asic rinci e o note ro uction in a orn is to set u a stationar a e in an air co umn **97 2 11 14**/Q27



or an note ro uce t e orn a no e is orme at t e mout iece an an antino e is orme at t e e e re uenc o t e o est note is 7

at are t e re uencies o t e ne t t o ig er notes or t is air co umn

	irst ig er note	secon ig er note
A	11	1
B	1	22
C	1	
D	22	7

114 A stationar soun a e is ro uce in a tu e 97 2 11 14/Q25

ic statement escri es t e a e s ee

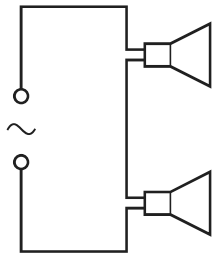
A t is t e istance et een t o a acent no es i i e t e erio o t e a e

B t is t e s ee at ic energ is trans erre rom one antino e to an a acent antino e

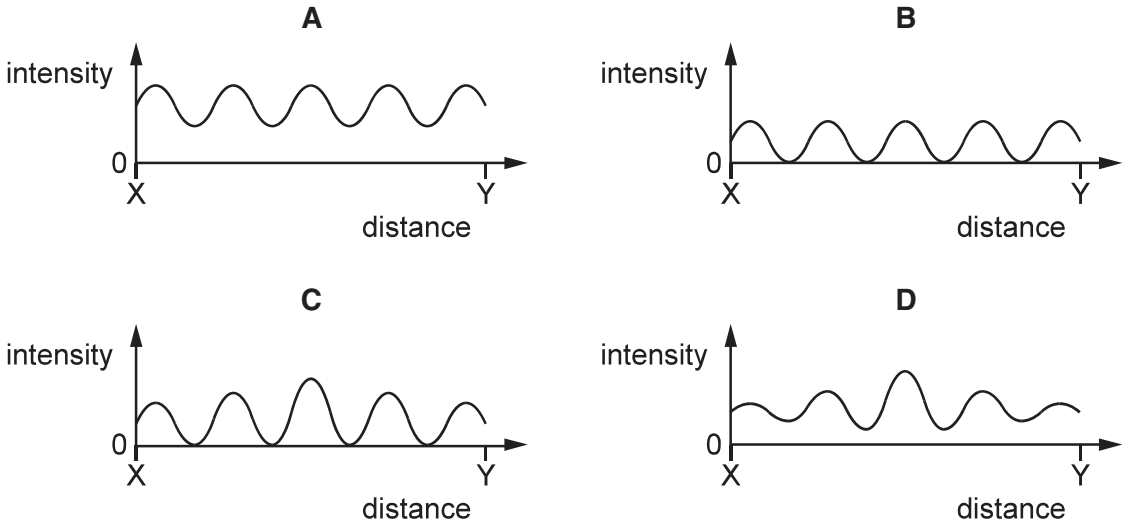
C t is t e s ee o a artic e at an antino e

D t is t e s ee o one o t e rogressi e a es t at are ro ucing t e stationar a e

115 o i entica ou s ea ers are connecte in series to an a c su as s o n 97 2 11 14/Q26



ic gra est s o s t e ariation o t e intensit o t e soun it istance a ong t e ine



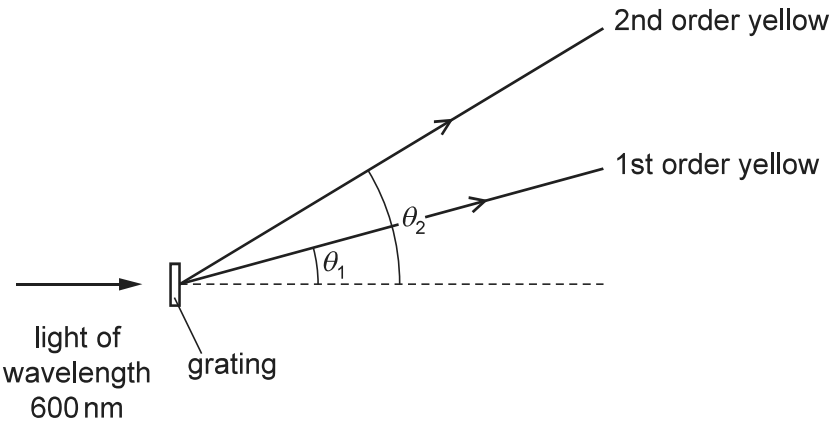
116 nter erence ringes are ro uce on a screen ou e s it inter erence using ig t o a e engt 6 nm e ringe se aration is 4 mm an t e se aration o t e s its is 6 mm

97 2 1 14/Q30

at is t e istance et een t e ou e s it an t e screen

A 2 m B 4 m C 2 m D 4 m

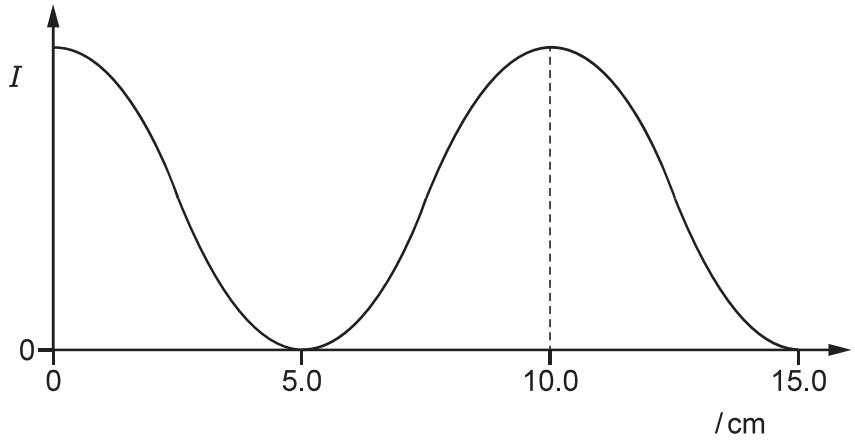
117 **A i raction grating e eriment is set u using e o ig t o a e engt 6 nm e grating as a s it se aration o 2 m** 97 2 11 14/Q27



at is t e angu ar se aration θ_2 θ_1 et een t e irst an secon or er ma ima o t e e o ig t

A 17 **B 19 4** **C 6 9** **D 4**

118 **e ariation it istance o t e intensit a ong a stationar soun a e in air is s o n t e o o ing gra** 97 2 1 14/Q27



e s ee o soun in air is 4 m s ^{1}

at is t e re uenc o t e soun a e

A 17 **B 227** **C 4** **D 68**

119 **An organ i e o engt is o en at ot en s otes are ro uce t e i e en stationar a es are set u** 97 2 1 14/Q29

e s ee o soun in t e air co umn is

at is t e o est un amenta re uenc o t e note ro uce t e i e

A $\frac{2}{}$ **B $-$** **C $\frac{}{2}$** **D $\frac{}{4}$**

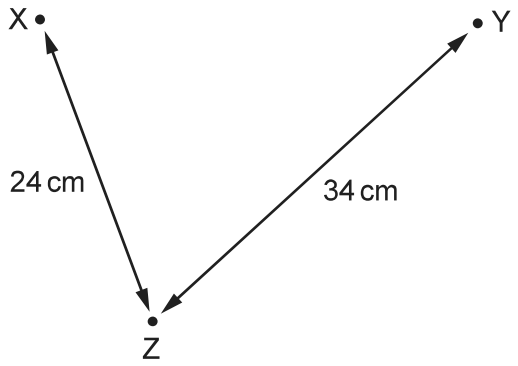
120 e ta e contains statements a out stationar an rogressi e a es 97 2 1 1 /Q27

ic ro is correct

	stationar a e	rogressi e a e
A	a artic es i rate it t e same am itu e	a artic es i rate it t e same am itu e
B	energ is trans erre a ong t e a e	energ is trans erre a ong t e a e
C	artic es in a acent oo s i rate in anti ase	artic es i rate in ase it t eir imme iate neig ours
D	artic es one a e engt a art i rate in ase	artic es one a e engt a art i rate in ase

121 a e generators at oints an ro uce ater a es o t e same a e engt At oint t e a es rom a e t e same am itu e as t e a es rom Distances an are as s o n

97 2 1 1 /Q29



en t e a e generators o erate in ase t e am itu e o osci ation at is ero at cou e t e a e engt o t e a es

A 2 cm B cm C 4 cm D 6 cm

122 at is not an essentia con ition or an o ser a e inter erence attern to occur et een t e a es rom t o sources

97 2 12 1 /Q26

A e re uencies o t e t o sources must e e ua

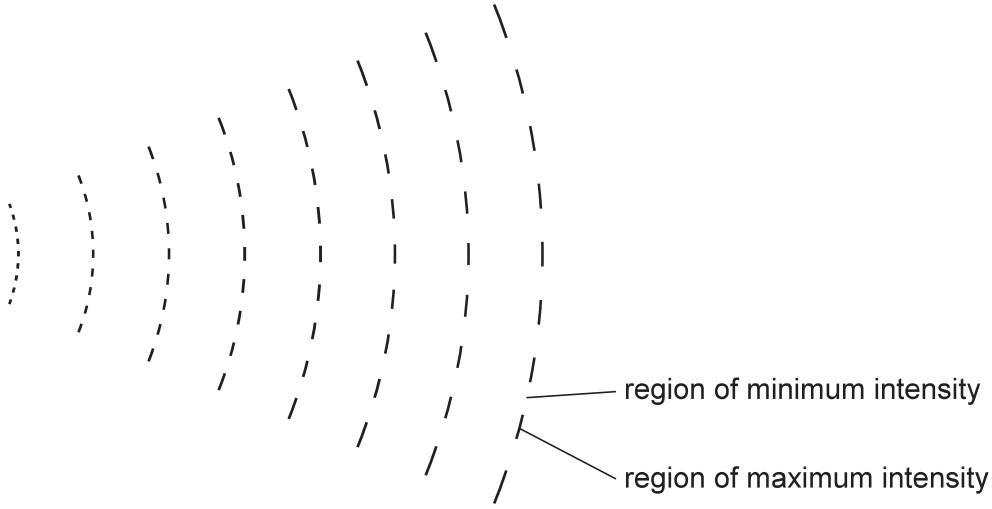
B e sources must e co erent

C e sources must emit a es o e ua am itu e

D e a es rom t e t o sources must o er a

123 **A attern o a es as o ser e it out eing a e to ie t e source o t e a es e attern is re resente in t e iagram**

97 2 12 1 /Q28



at can cause t is attern

A co erence on

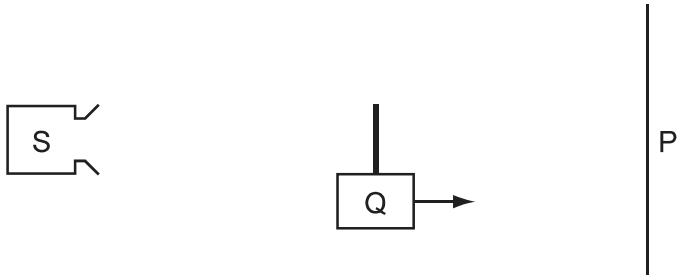
B i raction an inter erence

C i raction on

D inter erence on

124 **ource emits micro a es it a constant am itu e e micro a es it a meta screen an are re ecte A stationar a e is orme et een an e a e engt o t e micro a es is muc sma er t an t e istance et een an**

97 2 12 1 /Q27



A etector is mo e at a s o constant s ee rom to

at a ens to t e am itu e o t e signa etecte

A ecreases stea i

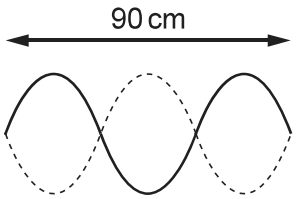
B increases an ecreases regu ar

C increases stea i

D remains constant

125 e iagram s o s a stationar a e on a string at t o instants o ma imum ertica is acement

97 2 11 1 /Q28



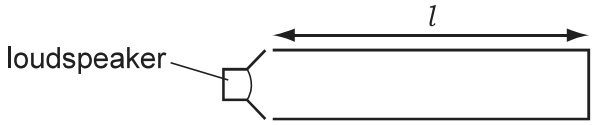
e re uenc o t e a e is 12

at is t e s ee o t e a e

A 6 ms 1 B 7 2 ms 1 C 6 ms 1 D 72 ms 1

126 A ou s ea er emitting soun o re uenc is ace att e o en en o a i e o engt ic is c ose att e ot er en A stan ing a e is set u in t e i e

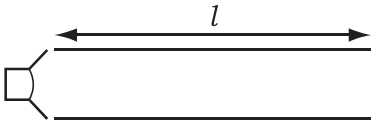
97 2 11 1 /Q29



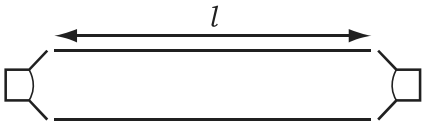
A series o i es are t en set u it eit er one or t o ou s ea ers o re uenc e airs o ou s ea ers i rate in ase it eac ot er

ic i e contains a stan ing a e

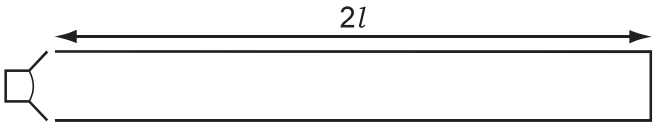
A



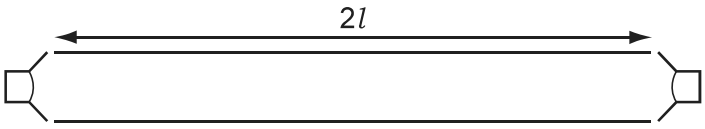
B



C



D



127 n a ou e s it e eriment t e istance et een t e ringes on a screen as too sma to measure

97 2 11 1 /Q30

at ou increase t e istance et een t e ringes

A increasing t e istance et een t e ig t source an t e s its

B increasing t e istance et een t e s its an t e screen

C increasing t e istance et een t e s its

D increasing t e re uenc o t e ig t source