

## PHC01 Assessment-II, Gr H [08.05.2021]

Answer all the questions

Identify the correct statements from the following:

1 point

- ☐ amplitude resonance occurs at a frequency equal to natural frequency and velocity resonance occurs at a frequency slightly more than natural frequency
- ☐ velocity resonance occurs at natural frequency and amplitude resonance occurs at a frequency slightly less than natural frequency
- ☐ velocity resonance occurs at a frequency slightly less than natural frequency and amplitude resonance occurs at natural frequency
- ☐ amplitude resonance occurs at a frequency slightly more than the natural frequency

Give an example of a solid state LASER.

1 point

- ☐ Dye Laser
- ☐ Nd:YAG Laser
- ☐ He-Ne Laser
- ☐ CO<sub>2</sub> Laser

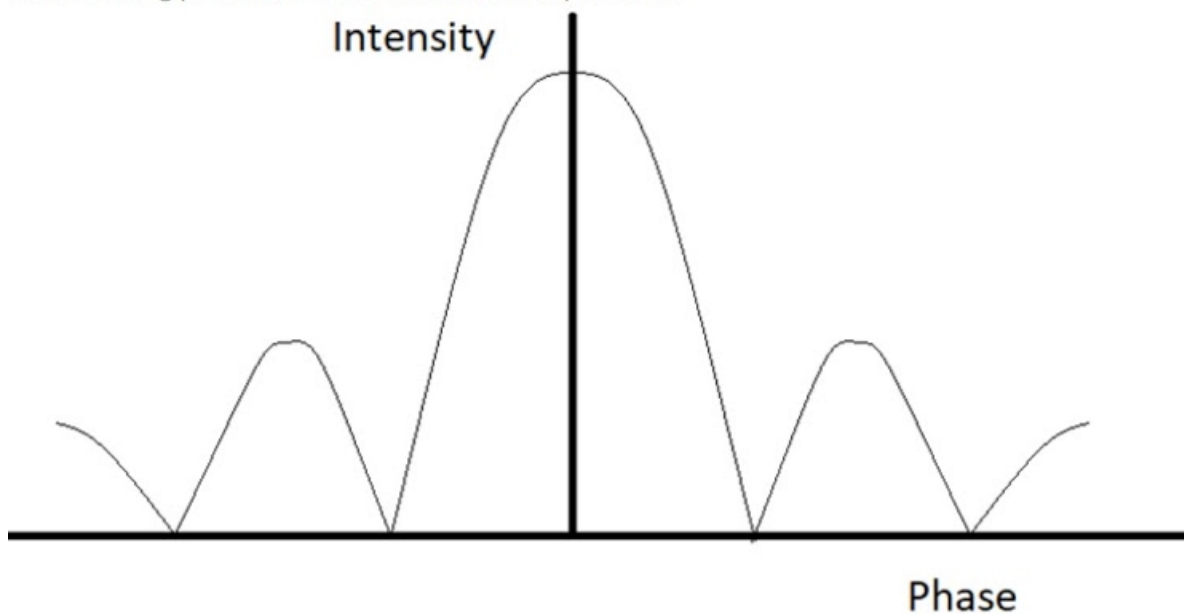


A screen is placed 2m away from the lens to obtain the diffraction pattern in the focal plane of the lens in a single slit diffraction experiment. What will be the slit width if the first minimum lies 5 mm on either side of the central maximum when plane light waves of wavelength  $4000 \text{ \AA}$  are incident on the slit? 2 points

- ☐ 0.16 mm
- ☐ 0.36 mm
- ☐ 0.46 mm
- ☐ 0.26 mm

1 point

The following pattern is observed for which experiment?



- ☐ Single Slit Fraunhofer Diffraction
- ☐ Double Slit Fraunhofer Diffraction

- ☒ Fabry-Perot Interferometer
- ☐ Fresnel Diffraction

A particle oscillating in SHM (natural frequency 100Hz) is subjected to a periodic force such that for very low driving frequency, its amplitude increases from 1 mm to 2 cm. What is the relaxation time of the driven oscillator?

2 points

- ☐ a)  $1/100 \pi$
- ☐  $1/10 \pi$
- ☐  $\pi/100$
- ☐  $10 \pi$

Which of the following is a unique property of LASER?

1 point

- ☐ Wavelength
- ☐ Coherence
- ☐ Directional
- ☐ Speed

What is the need to achieve population inversion?

1 point

- ☐ To achieve stable condition
- ☐ To bring most of the atoms to ground state
- ☐ To excite most of the atoms
- ☐ None of them



A block of mass 2 Kg is vertically suspended by a spring such that it stretches by 2.45 cm downwards. If the top end of the spring is oscillated with an amplitude of 2 mm, and the Q-value of the system is 15, the natural frequency of the system is about

2 points

- ☐ 20 Hz
- ☐ 10 Hz
- ☐ 21 Hz
- ☐ 11 Hz

The sharpness of velocity resonance curve is more if

1 point

- ☐  $\gamma$  is large
- ☐  $\gamma$  is small
- ☐ none of these
- ☐  $\gamma$  is medium

In case of a forced oscillator, transient beats are observed in

1 point

- ☐ none of these
- ☐ middle state
- ☐ steady state
- ☐ early stage



In Rayleigh's Criterion for Resolution, two images would be just resolved when \_\_\_\_\_ 1 point

- ☐ The central maxima of one image do not coincide with the first minimum of other
- ☐ The central maxima of one image coincides with the first minimum of the other
- ☐ The central maxima of one image coincide with central maxima of the other
- ☐ The central maxima of one do not coincide with central maxima of the other

What is the Q-value of an oscillator having its width given by 1/10th of its resonant frequency? 1 point

- ☐ 10
- ☐ 1
- ☐ 1/10
- ☐ 100

Two simple harmonic oscillations operate on a particle: one along the X-axis and the other at 45 degree angle with the X-axis. The amplitudes of oscillations for the two motions are 1 m and ( $\sqrt{2}$ ) m, respectively and they oscillate with an angular frequency of  $2\pi$  radian. If the initial phase difference is zero then the resultant amplitude of the motion is 2 points

- ☐  $\sqrt{3}$  m
- ☐  $\sqrt{5}$  m
- ☐ 2 m
- ☐ 1 m





What changes are observed in a diffraction pattern if the whole apparatus is immersed in water? 1 point

- ☐ The Wavelength of light increases
- ☐ Width of central maximum increases
- ☐ Frequency of light decreases
- ☐ Width of central maximum decreases

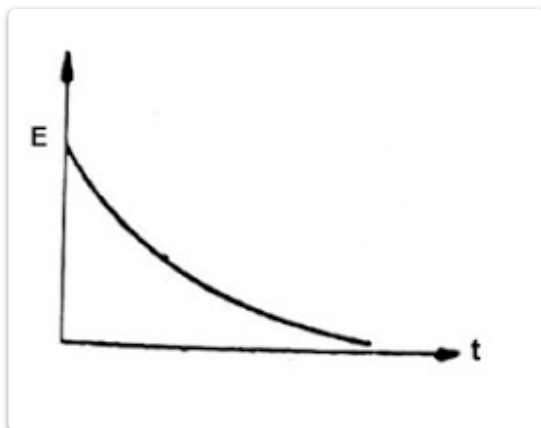
An incandescent lamp is operating at a temperature of 1000 K at an operating frequency of  $5.2 \times 10^{14}$  Hz. Calculate the ratio of stimulated emission rate to spontaneous emission rate. 2 points

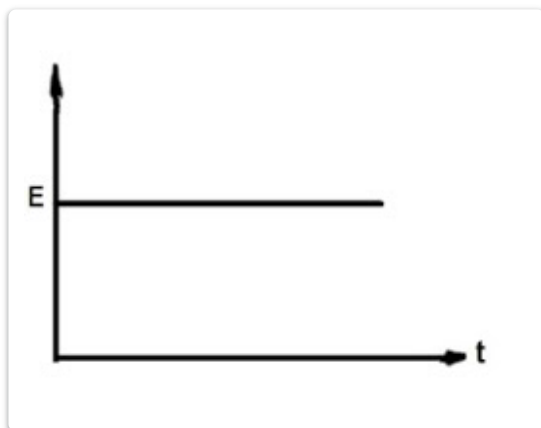
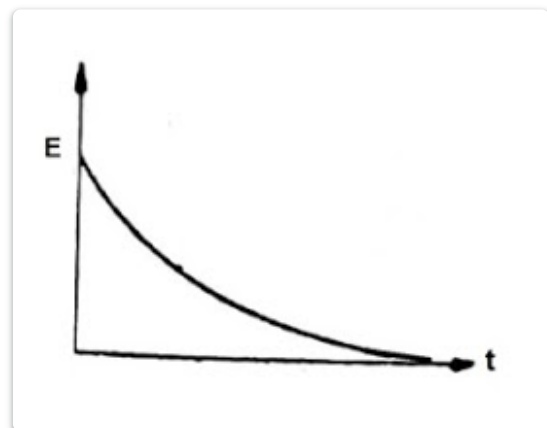
- ☐  $1.47 \times 10^{-11}$
- ☐  $3 \times 10^{-13}$
- ☐  $2 \times 10^{-12}$
- ☐  $1.5 \times 10^{-13}$



A particle of mass 1 Kg, having natural frequency of 1 Hz is vibrating in a medium under a damping force having damping coefficient of  $1 \text{ Nm}^{-1}\text{s}$ . Which of the following curves represents the energy of the particle?

1 point


☐ Option 4 : None

☐ Option 2

☐ Option 3

☐ Option 1

What is the value of logarithmic decrement for a damped oscillator whose amplitude reduces from 16 cm to 1 cm after 100 cycles? 2 points

☐  $16 \ln (1/100)$ 
☐  $100 \ln (1/16)$ 


☐ In (16/100)

☐ In 16/100

A grating containing 4000 slits per centimeter is illuminated with a monochromatic light and produces the second-order bright line at a  $30^\circ$  angle. What is the wavelength of the light used? ( $1 \text{ \AA} = 10^{-10} \text{ m}$ )

2 points

☐ 6893 A

☐ 6250 A

☐ 5496 A

☐ 5893 A

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