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المادة:	**Waves and Acoustics**	**القائم بالتدريس**	**أ.د/محمود عويضة** **د/ هاجر الخولي**
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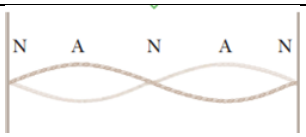
Answer the following questions: **عدد صفحات الإمتحان: (3)**

Question 1:

A) choose the correct answer (40 degree – 2 for each point)

1	**A man is standing beside the road when a source of sound moves away from him. This source has a frequency of 1800Hz, and the source moves away from him at 6m/s. What frequency does the man hear? Assume the temperature is 20 Celsius.** (a) 1770 Hz (b) 1800 Hz (c) 1831 Hz
2	**A noisy grinding machine in a factory produces a sound intensity of 1×10^{-5}W/m^2, the decibel level of this machine equals……** (a) 50 dB (b) 70 dB (c) 90 dB
3	**Which of the following actions will increase the speed of sound in air……..** (a) decreasing air temperature (b) increasing frequency of sound (c) increasing air temperature
4	The general equation that describes the relation between the speed (V), wavelength (λ) and frequency (*f*) of a wave is …… (a) V=f λ (b) f=V λ (c) V=f/ λ
5	If a standing wave having 3 nodes and 2 antinodes is formed within 1.21 A distance, then the wavelength of the standing wave will be..... (a) 1.21 A (b) 2.42 A (c) 4.84 A
6	**An ambulance siren moving toward you will have a ..... pitch than when it is traveling toward you.** (a) higher (b) lower (c) the same
7	**…….. is an oscillatory motion in a system where the restoring forces is proportional to the displacement, which acts in the direction opposite to the displacement** (a) Forced motion (b) damped motion (c) simple harmonic motion
8	**The relative intensity of a sound is called the intensity level or decibel level, defined by…….** (a)$\beta = \log\left(\frac{I}{I_o}\right)$ (b) $\beta = 10\log\left(\frac{I_o}{I}\right)$ (c) $\beta = 10\log\left(\frac{I}{I_o}\right)$
9	**Tacoma Narrows Bridge collapsed as result of ……..** (a) Doppler effect (b) Resonance (c) damped coefficient
10	**When the amplitude of the vibrating system is gradually dissipating by friction and other resistances, this kind of vibrations is called……** (a) SHM (b) damped oscillations (c) forced oscillation
11	**The general expression for the speed of all mechanical waves is……** (a) $v = \sqrt{\frac{elastic\ \ property}{internal\ \ property}}$ (b) $v = \sqrt{\frac{internal\ \ property}{elastic\ \ property}}$ (c) $v = internal\ property * elastic\ property$
12	**If an oscillator oscillates with a frequency of 0.064 (Hz), the periodic time is ……. (s)** (a) 15.625 (b) 1.5625 (c) 0.15625
13	**A sound wave has a wavelength of 3 m and its speed is 343 m/s, the frequency of the wave if it is a sound wave equals ……..** (a) $1 \times 10^8 Hz$ (b) $11.4 \times 10^8 Hz$ (c) $114\ Hz$

14	**When two or more travelling waves encounter each other while moving through the medium , the resultant wave is found by adding together the displacement of individual waves point by point this is the……..** (a) Reflection principle (b) Refraction principle (c) Superposition principle
15	**Whenever a travelling wave reaches a boundary, part or all of the wave would be …….** (a) diffracted (b) reflected (c) superimposed
16	**The type of waves in which the elements of the medium undergo displacements in a direction perpendicular to the wave motion is……** (a) Transverse wave (b) Longitudinal wave (c) Shock wave
17	**A 4Kg block is attached to a spring constant 400 N/m, the time period of the oscillation is …….** (a) π (b) 0.2 π (c) 4 π
18	**For a shock wave, The envelope of the wave fronts forms a cone whose apex half-angle is given by……..** (a) $\sin\theta = \frac{v}{v_s}$ (b) $\sin\theta = \frac{v_s}{v}$ (c) $\sin\theta = v \times v_s$
19	**The figure shows a standing wave in a stretched string of length L, which produces its ……. harmonic**  (a) first (b) second (c) third
20	**The loudest tolerable sounds have intensities about …..times greater than the faintest detectable sounds.** (a) 1×10^{12} (b) 1×10^{-12} (c) 2×10^{-10}

B) Complete each of the following: **(30 degree, 2 for each point)**

1- The periodic time for oscillation of a simple pendulum can be calculated using the equation …(1)…and the periodic time of a physical pendulum can be determined using…(2)..

2- When an external force is applied on an oscillating particle and reduces the amplitude of the oscillation of the particle then called..... (3).....

3- The total force (F) that acts on an oscillator undergoes a simple harmonic motion (SHM) is described by the equation …(4)….., while the equation that describes the total force that acts on a damped oscillator is …(5)…and that the equation that describe the total force that acts on an oscillator that undergoes a forced oscillations is …….(6)…….

4- There are three categories of sound waves which are ….(7).. , … (8)…. and …(9)…

5- The loudest sound the ear can tolerate have intensity of about 1 W/m^2 and is called .... (10)…..

6- The speed of sound wave depends on ……(11)……. and …… (12) …….

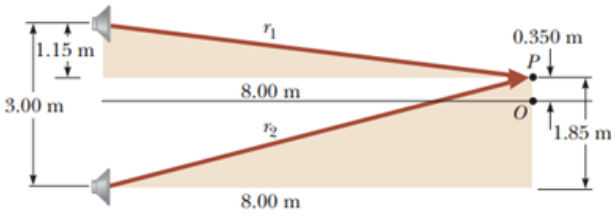
7- The speed of sound in a solid rod can be calculated using the equation.…(13)…while in fluids it could be calculated using the equation…(14)….

8- The change in frequency heard by an observer whenever there is relative motion between a source of sound and the observer is called……(15)……..

Question 3:

A) **(30 degree)**

Two speakers placed 3 m a part are driven by the same oscillator as shown in the figure. A listener is originally at point O, which is located 8 m from the center of the line connecting the two speakers. The listener then walks to point P, which is a perpendicular distance 0.35 m from O, before reaching the first minimum in sound intensity. What is the frequency of the oscillator? Assume that the speed of sound in air equals 343 m/s.



B) Copy the table below to your answer sheet and write down in front of each case, the equation that describes the relation between apparent and real frequency (i.e., the Doppler effect):

(20 degree)

no	The case	Doppler effect equation
1	If the source is moving towards a stationary observer	
2	If the source is moving away from a stationary observer	
3	If the observer is moving toward stationary source	
4	If the observer is moving away from stationary source	

Question 4:

A) An explosion occurs 275 m above a 867 m thick ice sheet that lies over ocean water. If the air temperature is (– 7) ^{o}C, how long does it takes the sound wave to reach a research vessel 1250 m below the ice?
Neglect, any changes in bulk modulus and density with temperature and depth.
Assume that: $\mathbf{B_{ice}}$= 9.2×10^{9} Pa, $\boldsymbol{\rho_{ice}}$=917 kg/m^{3}, $\boldsymbol{v_{water}}$=1533 m/s **(30 degree)**

B) Find the frequencies of the fundamental and second harmonics of a steel wire 1 m long with a mass per unit length of 2×10^{-3}kg/m and under a tension of 80 N, then **find the wavelength** of the sound waves created by the vibrating wire for these two modes, assume the speed of sound in air is 345 m/s. **(20 degree)**

انتهت الأسئلة
مع أطيب التمنيات بالتوفيق والنجاح

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