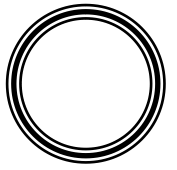


RYERSON UNIVERSITY  
DEPARTMENT OF PHYSICS  
**PCS 130 MID-TERM EXAMINATION**



Please put the initial of your **last** name inside the circle.

March 2<sup>nd</sup>, 2012

**Student Number**

**PRINT first name**

**PRINT family name**

**Circle your instructor's name:**

**TORONOV      HU**

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**READ THESE INSTRUCTIONS CAREFULLY:**

- The duration of this test is 1 hour and 30 minutes (90 minutes)
- The test consists of 18 multiple choice questions (18 marks)
- For each multiple choice question you need to show, in the space provided, a justification for your answer. If no work or correct argument is shown, the resultant mark may be zero even if the answer on the bubble sheet is correct.
- This is a closed book exam. This exam, pens, pencils, erasers, non-programmable calculators and your ID are the only allowed items on your desk. Sharing of pens, erasers or calculators with other students is **not** permitted.
- **PDA's, phones and pagers must be turned off and out of reach.** Coats, jackets, hats and bags must be placed out of reach.
- Talking to another student or glancing over another student's paper is not permitted and may result in a charge of academic misconduct.
- Your Ryerson photo ID must be on your desk **at all times**.

Please sign here indicating you have read and understood the above instructions.

Signature: \_\_\_\_\_

**(Please sign above.)**

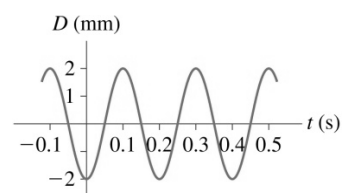
**DO NOT OPEN THE EXAM UNTIL YOU ARE TOLD TO DO SO.**

## **MULTIPLE CHOICE QUESTIONS (worth 1 mark each)**

1. Your friend is talking to you at a sound level of 50dB. At the same time, a mosquito is buzzing near your ear. If the combined sound intensity perceived by you is  $1.10 \times 10^{-7} \text{ W/m}^2$ , what is the sound level (in dB) of the buzzing mosquito?  
(Given  $I_0 = 1.0 \times 10^{-12} \text{ W/m}^2$ )
- (a) 20                      (b) 90                      (c) 50                      (d) 40                      (e) 4
2. A source is emitting sound equally in all directions. A decrease of the intensity of the sound you are hearing from it by a factor of 36 can be achieved by increasing your distance from the source by a factor of
- (a) 3 and reducing the amplitude by a factor of 12.  
(b) 3 and reducing the amplitude by a factor of 4.  
(c) 3 and reducing the amplitude by a factor of 2.  
(d) 4 and reducing the amplitude by a factor of 3.  
(e) 12 and reducing the amplitude by a factor of 3.
3. The motion of a particle connected to a spring is described by  $x(t) = 10\sin(\pi t)$ . At what time is the potential energy equal to the kinetic energy?
- (a) 0s                      (b) 0.25s                      (c) 0.50s                      (d) 0.75s                      (e) 1.00s

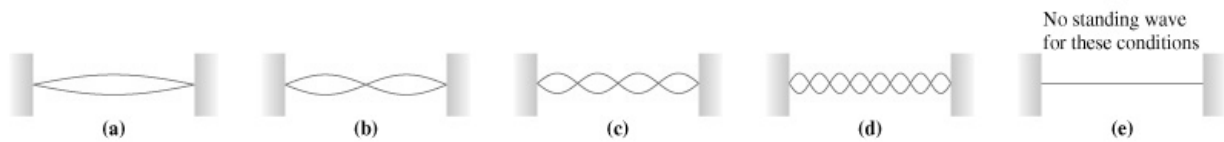
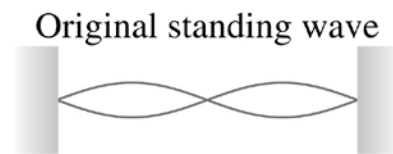
4. A sinusoidal wave travels along a stretched string. A particle on the string has a maximum velocity of  $2\text{m/s}$  and a maximum acceleration of  $200\text{m/s}^2$ . What is the frequency of the wave?
- (a)  $100\text{ Hz}$       (b)  $0.628\text{ Hz}$       (c)  $628.3\text{ Hz}$       (d)  $15.9\text{ Hz}$       (e)  $225\text{ Hz}$
5. A student attaches a length of nylon fishing line to a fence post. She stretches it out and shakes the end of the rope in her hand back and forth to produce waves on the line. The most efficient way for her to increase the wavelength is to
- (a) increase the tension on the hose and shake the end more times per second.  
(b) decrease the tension on the hose and shake the end more times per second.  
(c) increase the tension on the hose and shake the end fewer times per second.  
(d) decrease the tension on the hose and shake the end fewer times per second.  
(e) keep the tension and frequency the same but increase the length of the hose.
6. The security alarm on a parked car goes off and produces a frequency of  $960\text{ Hz}$ . The speed of sound is  $343\text{ m/s}$ . As an observer drives toward this parked car, passes it, and drives away, he observes the frequency to change by  $95\text{ Hz}$ . At what speed is he driving?
- (a)  $34\text{ m/s}$       (b)  $31\text{ m/s}$       (c)  $17\text{ m/s}$       (d)  $13\text{ m/s}$       (e)  $15\text{ m/s}$

7. Figure on the right is a history graph at  $x = 0$  m of a wave traveling in the negative  $x$ -direction at 5.0m/s. Write the displacement equation for this wave.



- (a)  $0.002 \sin \frac{\pi}{2}(4x + 20t + 1)$
- (b)  $0.002 \sin \frac{\pi}{2}(4x + 5t - 1)$
- (c)  $0.002 \sin \frac{\pi}{2}(4x + 20t - 1)$
- (d)  $0.002 \sin \frac{\pi}{2}(4x + 10t - 1)$
- (e)  $0.002 \sin 2\pi(x + 5t + 1)$
8. A 6.0 kg block hangs from a spring with spring constant 2400N/m. The block is pulled down 4.0cm from the equilibrium position and given an initial velocity of 2m/s back toward equilibrium. What is the amplitude of the motion?
- (a) 0.04m                      (b) 0.02m                      (c) 0.32m                      (d) **0.11m**                      (e) 0.22m
9. Orange light with a wavelength of 600nm is incident upon a 1.20-mm-thick plastic slide. How many wavelengths of the orange light are inside the slide if the orange light speed in the plastic is  $2.5 \times 10^8$  m/s ?
- (a) 2500                      (b) 240                      (c) 1667                      (d) **2400**                      (e) 167

10. A standing wave on a string vibrates as shown at the right. Suppose the mass of the string is quadrupled while the frequency and the length of the string are held constant. Which standing wave pattern is produced? (b) **(Is the tension also quadrupled?)**



11. A 0.335 m string is clamped at both ends. If the lowest standing wave frequency in the string is 326 Hz, what is the wave speed?

(a) **218 m/s**      (b) 240 m/s      (c) 412 m/s      (d) 331 m/s      (e) 167 m/s

12. What is the thinnest film of the 1.30 refractive index works best as an anti reflecting coating at 520 nm on top of the lens having the refractive index of 1.5?

(a) 120 nm      (b) 140 nm      (c) 130 nm      (d) 90 nm      **(e) 100 nm**

13. The sound from two loudspeakers is received by a microphone at a point far away along the line through both speakers. The microphone registers maximum intensity when the speakers are 20 cm apart. The sound intensity decreases as the distance between the speakers is increased, reaching zero at a separation of 91 cm. If the distance between the speakers continues to increase, at what separation will the sound intensity again be a maximum?
- (a) 182 cm      (b) 141 cm      (c) 162 cm      (d) 190 cm      (e) 200 cm
14. Which of the following experiments do not necessarily reveal the wave nature of light?
- (a) the observation of the fringe pattern on a viewing screen behind a double-slit screen with very narrow slits.  
(b) the observation of the fringe pattern on a viewing screen illuminated by light reflected from the diffraction grating.  
(c) the observation of the fringe pattern on a viewing screen behind a single-slit screen with a very narrow slit.  
(d) the observation of the rectangular bright area created on the viewing screen by light passing through a rectangular aperture.  
(e) all of a, b, and c
15. A 2-slit arrangement with  $60.3 \mu\text{m}$  separation between the slits is illuminated with  $482.0 \text{ nm}$  light. Assuming that a viewing screen is located  $2.14 \text{ m}$  from the slits find the distance from the first dark fringe on one side of the central maximum to the second dark fringe on the other side.
- (a) 20.2 cm      (b) 34.2 mm      (c) 16.2 mm      (d) 19.0 mm      (e) 200 mm

16. Suppose the viewing screen used to observe the double-slit interference is moved closer to the double slit. What happens to the interference fringes?
- (a) They fade out and disappear.
  - (b) They get out of focus.
  - (c) They get brighter and closer together.
  - (d) They get brighter and farther apart.
  - (e) They get brighter but otherwise do not change.
17. Two sources of light illuminate a double slit simultaneously. One has wavelength 570 nm and the second has an unknown wavelength. The  $m = 5$  bright fringe of the unknown wavelength overlaps the  $m = 4$  bright fringe of the light of 570 nm wavelength. What is the unknown wavelength?
- (a) 720 nm      (b) 640 nm      (c) 580 nm      (d) 456 nm      (e) 390 nm
18. Light from a lamp, which emits light at several discrete different wavelengths, illuminates an 800 line/mm diffraction grating. A screen is placed 50.0 cm behind the grating where the light is observed. Light of wavelength 501.5 nm creates a first-order bright fringe 21.90 cm from the central maximum. What is the wavelength of the bright fringe that is 34.20 cm from the central maximum?
- (a) 620 nm      (b) 540 nm      (c) 852 nm      (d) 783 nm      (e) 706 nm