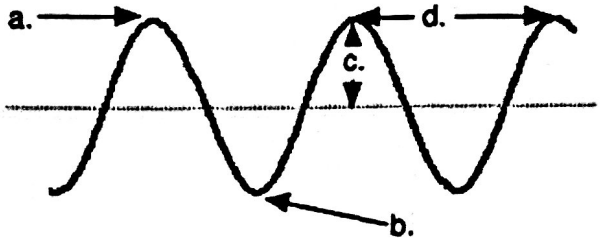
Physics 1 Practice Midterm

Name: Solutions

Equations				v is velocity	f is frequency	T is period
$f = 1/T$	$T = 1/f$	$v = \lambda f$	$v = \lambda/T$	λ is wavelength	g is gravity	x is stretch
$KE = \frac{1}{2} mv^2$	$GPE = mgh$	$EPE = \frac{1}{2} kx^2$	$F_g = mg$	m is mass	v is velocity	k is spring constant
$p = mv$				p is momentum	F_g is force of gravity	

Topic 1: Waves

Questions 1-4: use the image below.



1. Which of the letters above represents the **wavelength**? d
2. Which of the letters above represents the **amplitude**? c
3. Which of the letters above represents the **peak**? a
4. Which of the letters above represents the **trough**? b

5. In a ___ wave the particles and wave move perpendicular to one another.
a. Transverse b. Velocity c. Longitudinal d. Trough

6. The amount of time it takes one wave to pass is the ___. The units are seconds.
a. Frequency b. Energy c. Longitudinal d. Period

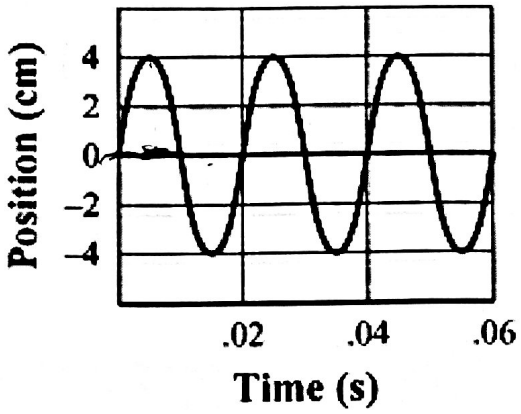
7. A ___ wave is a wave where the wave and particles in the wave move in the same direction.
a. Transverse b. Velocity c. Longitudinal d. Trough

8. ___ is how many waves pass by in one second. The units are Hertz.
a. Frequency b. Crest c. Longitudinal d. Period

9. The rate at which a wave travels from one place to another is the ___. The units are m/s.
a. Amplitude b. Velocity c. Longitudinal d. Trough

10. All waves carry ___ from one place to another.
a. Amplitude b. Velocity c. Energy d. Trough

Questions 11-14: Examine the waveform below.



11. How many waves are in the graphic above?

a. 1 b. 2 c. 3 d. 4

12. What is the amplitude of the wave above?

a. 0 cm b. 2 cm c. 4 cm d. 6 cm

13. What is the period of the wave?

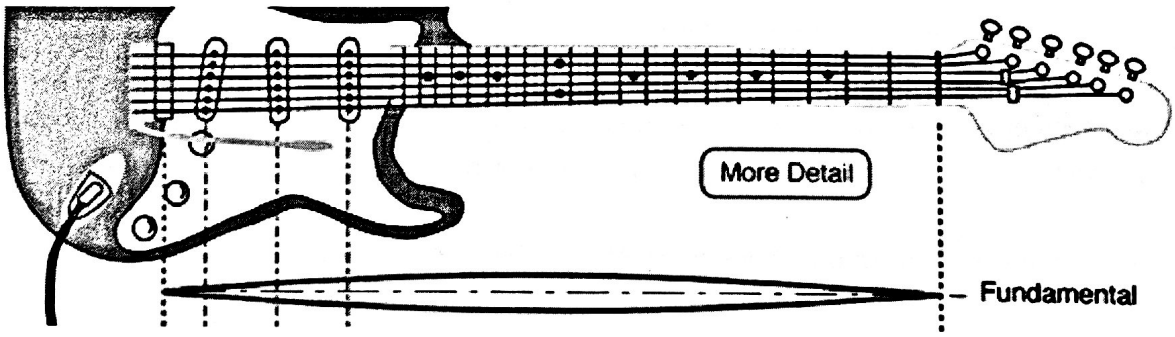
a. 0.02 s b. 0.06 s c. 50 Hz d. 17Hz

14. What is the frequency of the wave?

a. 0.02 s b. 0.6 s c. 50 Hz d. 17Hz $f = \frac{1}{T} = \frac{1}{0.02}$

Questions 15-17: Use the information below.

A musician plucks a guitar string to play a "middle C" note, which has a frequency of 261.6 Hz. The speed of the wave on the guitar string is 600 m/s. The string above vibrates at the fundamental frequency as shown in the picture below.



15. How many wavelengths fit in the length of the string?

a. 1/4 b. ½ c. 1 d. 2

16. Calculate the wavelength of the note.

a. 2.3 m b. 4.6 m c. 0.57 m d. 1.2 m $v = \lambda f \quad \lambda = \frac{v}{f} = \frac{600\ m/s}{261.6} = 2.3$

17. Determine the length of the string.

a. 2.3 m b. 4.6 m c. 0.57 m d. 1.2 m 2 wavelengths fit on the string (1st harmonic)

Topic 2: Energy

18. ~~A 2kg bat~~ flies through the air at a velocity of 20 m/s with a kinetic energy of 2,000 J. What is the bat's mass? ? Typo

a. 10 kg b. 5 kg c. 500 kg d. 1000 kg $KE = \frac{1}{2}mv^2$ $m = \frac{2KE}{v^2} = \frac{2(2000)}{(20)^2}$

19. A 0.5 kg hummingbird is hovering in place at a height of 4 meters. What is the hummingbirds potential energy?

a. 2 J b. 4 J c. 20 J d. 40 J $GPE = mgh = (0.5)(9.8)(4) = 19.6$

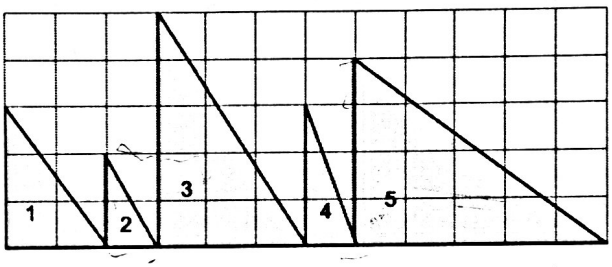
20. A 0.25 kg piece of jerk chicken is flying at a height of 2 meters with a velocity of 4 m/s. What is the jerk chicken's TOTAL energy?

a. 5 J b. 2 J c. 7 J d. 4 J Total Energy: $KE + GPE = \frac{1}{2}mv^2 + mgh =$ $= \frac{1}{2}(0.25)(4)^2 + (0.25)(9.8)(2) \approx 7$ J

21. A cat falls from a tree and lands on a trampoline. If the trampoline stretches 1 m and the k constant of the trampoline is 10 N/m. What is the cat's elastic potential energy?

a. 5 J b. 2 J c. 10 J d. 4 J $EPE = \frac{1}{2}kx^2 = \frac{1}{2}(10)(1)^2$

Questions 22-24: Use the information below.



If you released a car from the top of these ramps, rank these ramps from the fastest velocity at the bottom of the ramp to the slowest velocity at the bottom of these ramps in the questions below.

GPE → KE
$mgh \rightarrow \frac{1}{2}mv^2$

Taller ramp = more velocity at bottom

22. Which is the fastest ramp?

a. 1 b. 2 c. 3 d. 5

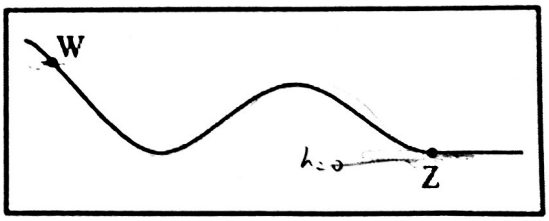
23. Which is the slowest ramp?

a. 1 b. 2 c. 3 d. 5 Shortest ramp (2 units)

24. Which ramp has double the potential energy of ramp 2?

a. 1 b. 2 c. 3 d. 5 twice as high (4 units)

25. The diagram shows the path of a student on a sled starting from rest at point W. The student slides down frictionless, snow-covered hill past point Z, which is at ground level. Which of the following statements best describes the energy of the student and sled from point W to point Z?



a

a. The potential energy at point W becomes all kinetic energy at point Z.
b. The total energy at point W is greater than at point Z.
c. The total energy at point W is less than at point Z.
d. The kinetic energy at point W becomes all potential energy at point Z.

Topic 3: Momentum

26. Linear momentum is the product of an object's _____ and _____ traveling in a straight line.

a. velocity and mass b. mass and volume c.velocity and speed d. energy and mass

27. T/F: A golf ball will always have less momentum than a bowling ball, if they are going at different speeds.

$p = m \cdot v$

a. True b. False

28. Linear momentum is _____ in an inelastic collision.

a. Conserved b. Not conserved

29. Which of the following objects has the smallest momentum? $p = mv$

a. A 2 kg trombone traveling at 2 m/s 4 kg m/s
b. A 5 kg cat traveling at 3 m/s 15 kg m/s
c. A 0.5 kg baseball traveling at 10 m/s 5 kg m/s
d. A 1000 kg cow moving at 0.1 m/s 100 kg m/s

30. A 70 kg football player is running with a speed of 5 m/s. Another football player, with a mass of 80 kg, is running towards him with a velocity of -4 m/s. What is the total momentum of the system of both football players?

$p_1 + p_2 = m_1 v_1 + m_2 v_2$

$= (70)(5) + (80)(-4)$

$350 + -320 = 30$ kg m/s

a. 30 kg*m/s b. 30 m/s c. 670 kg*m/s d. 670 kg

31. T/F: The law of conservation of momentum states that the momentum before a collision will always be less than the momentum after a collision. False

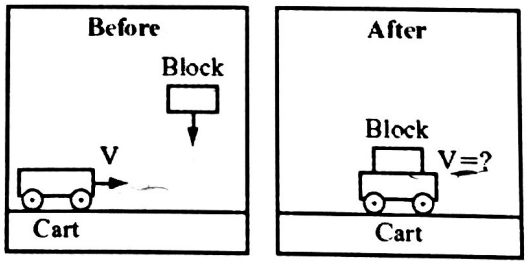
32. The diagrams below show a cart moving with a velocity, V, on a frictionless surface as a wooden block is being dropped. The block then falls straight down onto the moving cart. Which of the following statements describes what will happen after the block lands on the moving cart?

Momentum is conserved

$p = m v$

same ↑ ↓

If mass increases, & momentum stays the same, the velocity has to decrease



a. The cart will move to the left at a velocity less than the original velocity of the cart.
b. The cart will move to the left at a velocity greater than the original velocity of the cart.
c. The cart will move to the right at a velocity less than the original velocity of the cart.
d. The cart will move to the right at a velocity greater than the original velocity of the cart.

33. A 150 kg panther is running with a speed of 4 m/s. The panther tackles a 100 kg warthog that is moving at 1 m/s. The two stay together after the collision. What will their speed be after the collision?

a. 2.8 m/s
b. 2 m/s
c. 3.33 m/s
d. 6 m/s

perfectly inelastic → same final velocity

$m_1 v_{0_1} + m_2 v_{0_2} = (m_1 + m_2) v_f$

$(150)(4) + (100)(1) = (150 + 100) v_f$

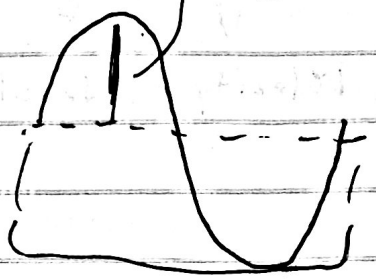
$600 + 100 = (250) v_f$

$v_f = \frac{700}{250} \approx 2.8$ m/s

Top of wave — crest / peak

Amplitude

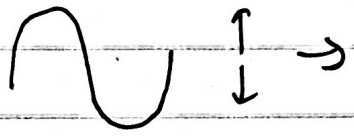
Wave



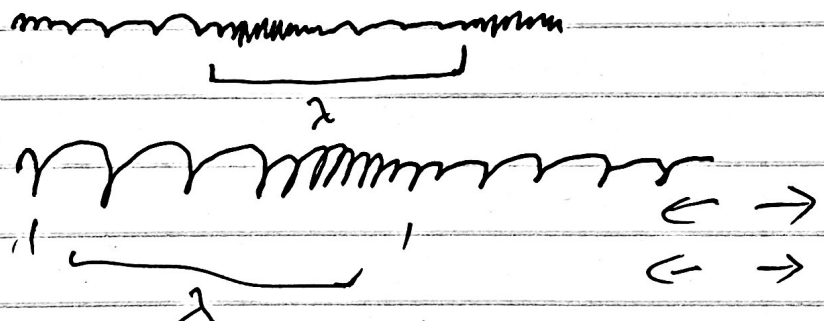
bottom Trough

Wavelength length of one wave (up & down)

Transverse



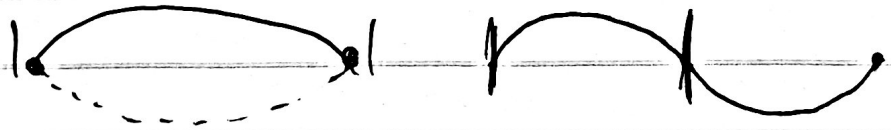
Longitudinal



(T) **Period** time for one wave/oscillation

(f) **frequency** - waves per sec

$$T = \frac{1}{f} \qquad f = \frac{1}{T}$$



$\lambda = 2L$ for fundamental frequency

Wave equation $v = \lambda f$

Velocity = (Wavelength) (frequency)

is