FinalExam copy

Student: _____

1. An object is moving in a circular path with a radius of 4.00 m. If the object moves through an angle of 45.0 degrees, then the angle is:

   A. 0.25 radians.
   B. 0.53 radians.
   C. 0.79 radians.
   D. 1.02 radians.
   E. 1.44 radians.

2. An object is moving in a circular path with a radius of 5.00 m. If the object moves through an angle of 270 degrees, then the tangential distance traveled by the object is:

   A. 2.04 m.
   B. 2.52 m.
   C. 3.44 m.
   D. 4.02 m.
   E. 4.71 m.

3. A CD has a diameter of 12.0 cm. If the CD is rotating at a constant angular velocity of 20.0 radians per second, then the period of the rotational motion is:

   A. 0.314 s.
   B. 0.441 s.
   C. 0.582 s.
   D. 0.698 s.
   E. 0.750 s.

4. The units of momentum are:

   A. ML/T.
   B. M/T.
   C. L/T^2.
   D. ML/T^2.
   E. ML^2/T^2.

5. A 2.0 kg ball is moving at 4.0 m/s WEST. The momentum of the ball is:

   A. 4.00 kg•m/s WEST.
   B. 6.00 kg•m/s WEST.
   C. 8.0 kg•m/s WEST.
   D. 10 kg•m/s WEST.
   E. 12 kg•m/s WEST.

6. If the momentum of a ball is doubled, then the kinetic energy is:

   A. 0.5 times larger.
   B. 2 times larger.
   C. 3 times larger.
   D. 4 times larger.
   E. 5 times larger.

7. An astronaut in a space suit is motionless in outer space. The propulsion unit strapped to her back ejects some gas with a velocity of 50 m/s. The astronaut recoils with a velocity of 1.0 m/s. If the mass of the astronaut and space suit after the gas is ejected is 120 kg, the mass of the gas ejected is:

   A. 1.0 kg.
   B. 1.9 kg.
   C. 2.4 kg.
   D. 3.00 kg.
   E. 3.6 kg.

8. A 120 kg mass is blown apart into an 80 kg piece and a 40 kg piece. After the blast, the two masses are moving apart with a relative velocity of 60 m/s. The total kinetic energy after the explosion is:

   A. 21 kJ.
   B. 35 kJ.
   C. 48 kJ.
   D. 56 kJ.
   E. 82 kJ.

9. A 3.00 kg mass is located at x = 2.0 cm and y = 0.0. A 3.00 kg mass is located at x = 0.0 and y = 2.0 cm. A 4.00 kg mass is located at x = 3.0 cm and y = -3.0 cm. Where is the location of the center of mass?

   A. (+1.8 cm, -0.60 cm)
   B. (+1.8 cm, + 0.60 cm)
   C. (+0.60 cm, -1.8 cm)
   D. (+3.5 cm, -0.6 cm)
   E. (+1.8 cm, + 1.6 cm)

10. A rifle fires a bullet. Immediately after the bullet is fired, which of the following is not true?

    A. The rifle and the bullet have the same magnitude of momentum.
    B. The force on the rifle due to the bullet and the force on the bullet due to the rifle have the same magnitude.
    C. The impulse on the rifle due to the bullet and the impulse on the bullet due to the rifle have the same magnitude.
    D. The rifle and the bullet do not have the same kinetic energy.
    E. The rifle and the bullet have the same kinetic energy.

11. A centrifuge has a rotational inertia of 5.50×10^{-3} kg•m^2. How much energy must be supplied to bring it from rest to 500 rad/s?

    A. 627 J
    B. 570 J
    C. 688 J
    D. 743 J
    E. 583 J

12. A 20.0 cm wrench is used to generate a torque at a bolt. A force of 50 N is applied perpendicularly at the end of the wrench. The torque generated at the bolt is:

    A. 8.0 N•m.
    B. 10 N•m.
    C. 14 N•m.
    D. 22 N•m.
    E. 37 N•m.

13. A 10 kg object has a moment of inertia of 1.25 kg•m^2. If a torque of 2.5 N•m is applied to the object, the angular acceleration is:

    A. 10 rad/s^2
    B. 8.0 rad/s^2.
    C. 6.0 rad/s^2.
    D. 4.0 rad/s^2.
    E. 2.0 rad/s^2.

14. A 4.00 kg hollow sphere ($I = 2/3\ MR^2$) is spinning with an angular velocity of 10.0 rad/s. The diameter of the sphere is 20.0 cm. The angular kinetic energy of the spinning sphere is:

    A. 1.75 J.
    B. 1.50 J.
    C. 1.33 J.
    D. 0.90 J.
    E. 0.75 J.

15. An ice dancer with her arms stretched out starts into a spin with an angular velocity of 1.00 rad/s. Her moment of inertia with her arms stretched out is 2.48 kg•m^2. What is the increase in her rotational kinetic energy when she pulls in her arms to make her moment of inertia 1.40 kg•m^2?

    A. 0.957 J
    B. 0.902 J
    C. 0.870 J
    D. 0.750 J
    E. 0.690 J

16. Water has a density of 1000 kg/m^3. The column of water that would produce a pressure of 1.0135×10^5 N/m^2 is:

    A. 7.3300 m.
    B. 9.8200 m.
    C. 10.340 m.
    D. 15.720 m.
    E. 20.010 in.

17. A submarine is at a depth of 500 m under the water. The force on a circular hatch of 1.00 m in diameter due to the seawater (density = 1,025 kg/m^3) pressure from outside the submarine is:

    A. 2.45×10^6 N.
    B. 3.95×10^6 N.
    C. 4.94×10^6 N.
    D. 5.50×10^6 N.
    E. 6.34×10^6 N.

18. The car lift in a gas station operates with an air pressure of 2000 kPa. The piston of the car lift has a diameter of 30.0 cm. What is the mass of the largest car that the lift can raise?

    A. 8,750 kg
    B. 9,450 kg
    C. 10,300 kg
    D. 14,400 kg
    E. 17,500 kg

19. A hydraulic lift has a small piston with a diameter 5.0 cm piston and the large piston with a diameter of 25 cm. What force must be applied on the small piston in order to lift a car on the large piston that weighs 13,000 N?

    A. 520 N
    B. 5200 N
    C. 260 N
    D. 2600 N

20. Water is flowing through a pipe with a constriction. The area of the narrow section is one-half the area of the wide section. If the velocity of the incompressible fluid is 3.2 m/s in the wide section, then what is the velocity of the fluid in the narrow section?

    A. 6.4 m/s
    B. 5.9 m/s
    C. 5.0 m/s
    D. 4.7 m/s
    E. 4.2 m/s

21. A 10 kg ball weighs 98 N in air and weighs 75 N when submerged in water. The buoyant force of the water on the ball is:

    A. 32 N.
    B. 30 N.
    C. 24 N.
    D. 23 N.
    E. 19 N.

22. A 1.5 kg ball is floating in water. The volume displaced by the ball is:

    A. 0.0015 m^3.
    B. 0.0027 m^3.
    C. 0.0036 m^3.
    D. 0.0040 m^3.
    E. 0.0051 m^3.

23. A small hole is cut in the bottom of a water storage tank. The initial depth of the water is 8.00 m. If the diameter of the small hole in the bottom of the tank is 1.00 cm, then what is the flow rate of the water leaving the tank?

    A. 9.83×10^{-4} m^3/s
    B. 8.75×10^{-4} m^3/s
    C. 8.21×10^{-4} m^3/s
    D. 7.45×10^{-4} m^3/s
    E. 7.21×10^{-4} m^3/s

24. What is the gravitational force between two nuclei, each of mass 3.20×10^{-27} kg and separated by a distance of 10.6×10^{-11} m? ($G = 6.67 \times 10^{-11}$ N m^2/kg^2)

    A. 6.08×10^{-47} N
    B. 6.08×10^{-46} N
    C. 6.08×10^{-45} N
    D. 6.08×10^{-44} N

25. The weight of a 1.00 kg on the surface of the moon is, ($G = 6.67 \times 10^{-11}$ N m^2/kg^2, R of the moon is 1.74×10^6 m, mass of the moon is 7.35×10^{22} kg)

    A. 9.82 N
    B. 7.52 N
    C. 1.62 N
    D. 0.980 N
    E. 0.540 N

26. A 2.0 kg mass is connected to a spring with a spring constant of 9.0 N/m. The displacement is given by the expression $x(t) = 12.0 \text{ cm } \sin(\omega t)$. What is the maximum displacement of the simple harmonic motion?

    A. 8.0 cm
    B. 12 cm
    C. 20 cm
    D. 24 cm
    E. 30 cm

27. An equation that describes the displacement in Simple Harmonic Motion is: $x(t) = 1.20 \text{ m } \sin(2.40 \text{ rad/s } t)$, What is the maximum velocity of the SHM?

    A. 5.32 m/s
    B. 4.82 m/s
    C. 3.68 m/s
    D. 2.88 m/s
    E. 2.03 m/s

28. A transverse wave travels at 250 m/s along the z-axis. If the frequency of the periodic vibrations of the wave is 440 Hz, then what is the wavelength of the wave?

    A. 21.9 cm
    B. 26.7 cm
    C. 35.7 cm
    D. 56.8 cm
    E. 73.7 cm

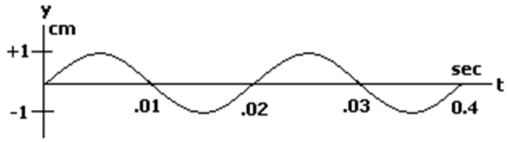
29. The frequency of a periodic wave is 340 Hz. The period of the vibration motion of the wave is:

    A. 2.56 milliseconds.
    B. 2.94 milliseconds.
    C. 3.55 milliseconds.
    D. 3.94 milliseconds.
    E. 4.25 milliseconds.

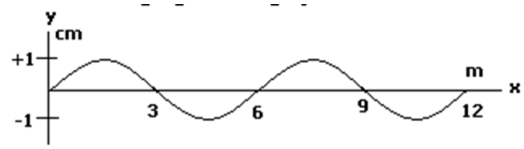
30. A transverse periodic wave is represented by the equation $y(x, t) = 2.50 \text{ cm } \cos(2{,}500 \text{ rad/s } t - 15.0 \text{ m}^{-1} x)$. What is the frequency of the vibration of the wave?

    A. 490 Hz
    B. 467 Hz
    C. 422 Hz
    D. 398 Hz
    E. 302 Hz

31. The following figure is a graph of a wave at a fixed position.



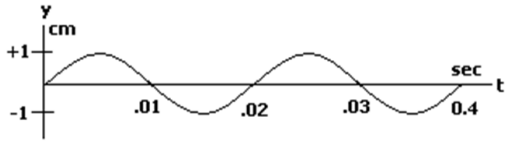
The following figure is a graph of the same wave at a fixed time.



What is the velocity of the wave in the above figure?

A. 150 m/s
B. 200 m/s
C. 250 m/s
D. 300 m/s
E. 450 m/s

32. What is the frequency of the wave?



A. 80 Hz
B. 50 Hz
C. 120 Hz
D. 140 Hz
E. 160 Hz

FinalExam copy Key

1. An object is moving in a circular path with a radius of 4.00 m. If the object moves through an angle of 45.0 degrees, then the angle is:

   A. 0.25 radians.
   B. 0.53 radians.
   C. 0.79 radians.
   D. 1.02 radians.
   E. 1.44 radians.

Giambattista - 005 Circular... #1

2. An object is moving in a circular path with a radius of 5.00 m. If the object moves through an angle of 270 degrees, then the tangential distance traveled by the object is:

   A. 2.04 m.
   B. 2.52 m.
   C. 3.44 m.
   D. 4.02 m.
   E. 4.71 m.

Giambattista - 005 Circular... #2

3. A CD has a diameter of 12.0 cm. If the CD is rotating at a constant angular velocity of 20.0 radians per second, then the period of the rotational motion is:

   A. 0.314 s.
   B. 0.441 s.
   C. 0.582 s.
   D. 0.698 s.
   E. 0.750 s.

Giambattista - 005 Circular... #9

4. The units of momentum are:

   A. ML/T.
   B. M/T.
   C. L/T^2.
   D. ML/T^2.
   E. ML^2/T^2.

Giambattista - 007 Linear... #1

5. A 2.0 kg ball is moving at 4.0 m/s WEST. The momentum of the ball is:

   A. 4.00 kg•m/s WEST.
   B. 6.00 kg•m/s WEST.
   C. 8.0 kg•m/s WEST.
   D. 10 kg•m/s WEST.
   E. 12 kg•m/s WEST.

Giambattista - 007 Linear... #2

6. If the momentum of a ball is doubled, then the kinetic energy is:

A. 0.5 times larger.
B. 2 times larger.
C. 3 times larger.
D. 4 times larger.
E. 5 times larger.

Giambattista - 007 Linear... #6

7. An astronaut in a space suit is motionless in outer space. The propulsion unit strapped to her back ejects some gas with a velocity of 50 m/s. The astronaut recoils with a velocity of 1.0 m/s. If the mass of the astronaut and space suit after the gas is ejected is 120 kg, the mass of the gas ejected is:

A. 1.0 kg.
B. 1.9 kg.
C. 2.4 kg.
D. 3.00 kg.
E. 3.6 kg.

Giambattista - 007 Linear... #17

8. A 120 kg mass is blown apart into an 80 kg piece and a 40 kg piece. After the blast, the two masses are moving apart with a relative velocity of 60 m/s. The total kinetic energy after the explosion is:

A. 21 kJ.
B. 35 kJ.
C. 48 kJ.
D. 56 kJ.
E. 82 kJ.

Giambattista - 007 Linear... #22

9. A 3.00 kg mass is located at x = 2.0 cm and y = 0.0. A 3.00 kg mass is located at x = 0.0 and y = 2.0 cm. A 4.00 kg mass is located at x = 3.0 cm and y = -3.0 cm. Where is the location of the center of mass?

A. (+1.8 cm, -0.60 cm)
B. (+1.8 cm, + 0.60 cm)
C. (+0.60 cm, -1.8 cm)
D. (+3.5 cm, -0.6 cm)
E. (+1.8 cm, + 1.6 cm)

Giambattista - 007 Linear... #28

10. A rifle fires a bullet. Immediately after the bullet is fired, which of the following is not true?

A. The rifle and the bullet have the same magnitude of momentum.
B. The force on the rifle due to the bullet and the force on the bullet due to the rifle have the same magnitude.
C. The impulse on the rifle due to the bullet and the impulse on the bullet due to the rifle have the same magnitude.
D. The rifle and the bullet do not have the same kinetic energy.
E. The rifle and the bullet have the same kinetic energy.

Giambattista - 007 Linear... #56

11. A centrifuge has a rotational inertia of 5.50×10^{-3} kg•m^2. How much energy must be supplied to bring it from rest to 500 rad/s?

A. 627 J
B. 570 J
C. 688 J
D. 743 J
E. 583 J

Giambattista - 008 Torque... #4

12. A 20.0 cm wrench is used to generate a torque at a bolt. A force of 50 N is applied perpendicularly at the end of the wrench. The torque generated at the bolt is:

A. 8.0 N•m.
B. 10 N•m.
C. 14 N•m.
D. 22 N•m.
E. 37 N•m.

Giambattista - 008 Torque... #10

13. A 10 kg object has a moment of inertia of 1.25 kg•m^2. If a torque of 2.5 N•m is applied to the object, the angular acceleration is:

A. 10 rad/s^2.
B. 8.0 rad/s^2.
C. 6.0 rad/s^2.
D. 4.0 rad/s^2.
E. 2.0 rad/s^2.

Giambattista - 008 Torque... #19

14. A 4.00 kg hollow sphere ($I = 2/3\ MR^2$) is spinning with an angular velocity of 10.0 rad/s. The diameter of the sphere is 20.0 cm. The angular kinetic energy of the spinning sphere is:

A. 1.75 J.
B. 1.50 J.
C. 1.33 J.
D. 0.90 J.
E. 0.75 J.

Giambattista - 008 Torque... #56

15. An ice dancer with her arms stretched out starts into a spin with an angular velocity of 1.00 rad/s. Her moment of inertia with her arms stretched out is 2.48 kg•m^2. What is the increase in her rotational kinetic energy when she pulls in her arms to make her moment of inertia 1.40 kg•m^2?

A. 0.957 J
B. 0.902 J
C. 0.870 J
D. 0.750 J
E. 0.690 J

Giambattista - 008 Torque... #71

16. Water has a density of 1000 kg/m^3. The column of water that would produce a pressure of 1.0135 × 10^5 N/m^2 is:

A. 7.3300 m.
B. 9.8200 m.
C. 10.340 m.
D. 15.720 m.
E. 20.010 in.

Giambattista - 009 Fluids... #4

17. A submarine is at a depth of 500 m under the water. The force on a circular hatch of 1.00 m in diameter due to the seawater (density = 1,025 kg/m^3) pressure from outside the submarine is:

A. 2.45 × 10^6 N.
B. 3.95 × 10^6 N.
C. 4.94 × 10^6 N.
D. 5.50 × 10^6 N.
E. 6.34 × 10^6 N.

Giambattista - 009 Fluids... #6

18. The car lift in a gas station operates with an air pressure of 2000 kPa. The piston of the car lift has a diameter of 30.0 cm. What is the mass of the largest car that the lift can raise?

A. 8,750 kg
B. 9,450 kg
C. 10,300 kg
D. 14,400 kg
E. 17,500 kg

Giambattista - 009 Fluids... #8

19. A hydraulic lift has a small piston with a diameter 5.0 cm piston and the large piston with a diameter of 25 cm. What force must be applied on the small piston in order to lift a car on the large piston that weighs 13,000 N?

A. 520 N
B. 5200 N
C. 260 N
D. 2600 N

Giambattista - 009 Fluids... #18

20. Water is flowing through a pipe with a constriction. The area of the narrow section is one-half the area of the wide section. If the velocity of the incompressible fluid is 3.2 m/s in the wide section, then what is the velocity of the fluid in the narrow section?

A. 6.4 m/s
B. 5.9 m/s
C. 5.0 m/s
D. 4.7 m/s
E. 4.2 m/s

Giambattista - 009 Fluids... #24

21. A 10 kg ball weighs 98 N in air and weighs 75 N when submerged in water. The buoyant force of the water on the ball is:

A. 32 N.
B. 30 N.
C. 24 N.
D. 23 N.
E. 19 N.

Giambattista - 009 Fluids... #30

22. A 1.5 kg ball is floating in water. The volume displaced by the ball is:

A. 0.0015 m^3.
B. 0.0027 m^3.
C. 0.0036 m^3.
D. 0.0040 m^3.
E. 0.0051 m^3.

Giambattista - 009 Fluids... #38

23. A small hole is cut in the bottom of a water storage tank. The initial depth of the water is 8.00 m. If the diameter of the small hole in the bottom of the tank is 1.00 cm, then what is the flow rate of the water leaving the tank?

A. 9.83×10^{-4} m^3/s
B. 8.75×10^{-4} m^3/s
C. 8.21×10^{-4} m^3/s
D. 7.45×10^{-4} m^3/s
E. 7.21×10^{-4} m^3/s

Giambattista - 009 Fluids... #61

24. What is the gravitational force between two nuclei, each of mass 3.20×10^{-27} kg and separated by a distance of 10.6×10^{-11} m? ($G = 6.67 \times 10^{-11}$ N m^2/kg^2)

A. 6.08×10^{-47} N
B. 6.08×10^{-46} N
C. 6.08×10^{-45} N
D. 6.08×10^{-44} N

Giambattista - 004 Force... #40

25. The weight of a 1.00 kg on the surface of the moon is, ($G = 6.67 \times 10^{-11}$ N m^2/kg^2, R of the moon is 1.74×10^6 m, mass of the moon is 7.35×10^{22} kg)

A. 9.82 N
B. 7.52 N
C. 1.62 N
D. 0.980 N
E. 0.540 N

Giambattista - 004 Force... #41

26. A 2.0 kg mass is connected to a spring with a spring constant of 9.0 N/m. The displacement is given by the expression x(t) = 12.0 cm sin(ω t). What is the maximum displacement of the simple harmonic motion?

A. 8.0 cm
B. 12 cm
C. 20 cm
D. 24 cm
E. 30 cm

Giambattista - 010 Elasticity... #51

27. An equation that describes the displacement in Simple Harmonic Motion is: x(t) = 1.20 m sin(2.40 rad/s t), What is the maximum velocity of the SHM?

A. 5.32 m/s
B. 4.82 m/s
C. 3.68 m/s
D. 2.88 m/s
E. 2.03 m/s

Giambattista - 010 Elasticity... #48

28. A transverse wave travels at 250 m/s along the z-axis. If the frequency of the periodic vibrations of the wave is 440 Hz, then what is the wavelength of the wave?

A. 21.9 cm
B. 26.7 cm
C. 35.7 cm
D. 56.8 cm
E. 73.7 cm

Giambattista - 011 Waves... #10

29. The frequency of a periodic wave is 340 Hz. The period of the vibration motion of the wave is:

A. 2.56 milliseconds.
B. 2.94 milliseconds.
C. 3.55 milliseconds.
D. 3.94 milliseconds.
E. 4.25 milliseconds.

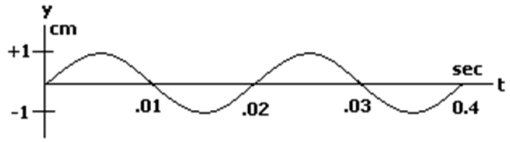
Giambattista - 011 Waves... #14

30. A transverse periodic wave is represented by the equation y(x, t) = 2.50 cm cos(2,500 rad/s t - 15.0 m^{-1} x). What is the frequency of the vibration of the wave?

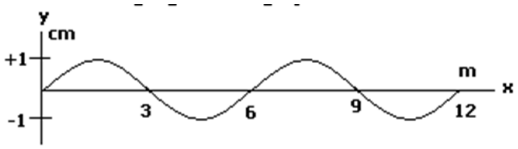
A. 490 Hz
B. 467 Hz
C. 422 Hz
D. 398 Hz
E. 302 Hz

Giambattista - 011 Waves... #26

31. The following figure is a graph of a wave at a fixed position.



The following figure is a graph of the same wave at a fixed time.

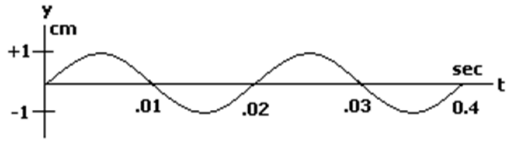


What is the velocity of the wave in the above figure?

A. 150 m/s
B. 200 m/s
C. 250 m/s
D. 300 m/s
E. 450 m/s

Giambattista - 011 Waves... #39

32. What is the frequency of the wave?



A. 80 Hz
B. 50 Hz
C. 120 Hz
D. 140 Hz
E. 160 Hz

Giambattista - 011 Waves... #40

FinalExam copy Summary

Category	*# of Questions*
Giambattista - 004 Force...	2
Giambattista - 005 Circular...	3
Giambattista - 007 Linear...	7
Giambattista - 008 Torque...	5
Giambattista - 009 Fluids...	8
Giambattista - 010 Elasticity...	2
Giambattista - 011 Waves...	5