Universidad de Puerto Rico
Recinto Universitario de Mayagüez
Departamento de Física

Final Exam – Fisi 3161/3171

Name: _____ Thursday, December 11, 2008

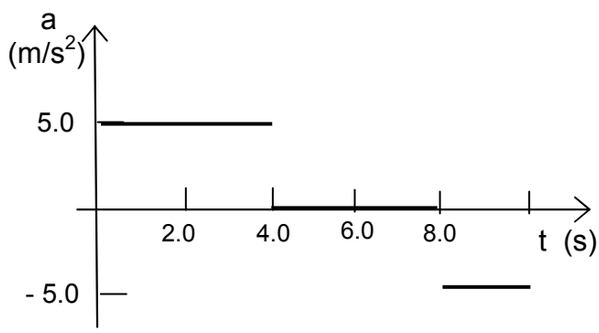
Section: _____ Prof. _____

Read the instructions carefully. Select the best answer. You are required to answer only 20 of the 25 questions. You have to select and identify the 20 questions to be corrected by circulating the question's number. If you choose not to indicate which questions are the chosen ones, the first 20 questions will be the ones selected. All answers most be justified (except 7, 23 and 24). If there is no justification for the answer then it will be considered a wrong answer. In other words, to guess the correct answer is not valid. The % assigned to each question will be: 5 % to a correct answer with a correct justification, 2.5 % to an incorrect answer with a correct justification, and 0 % to a correct or incorrect answer either with no justification or an incorrect one.

1. The position of an object as a function of time is given as $x(t) = (3.00\ \text{m/s})t + (2.00\ \text{m/s}^2)t^2$. What is the displacement of the object between t = 4.00 s and t = 5.00 s?

a) 8.00 m
b) 5.00 m
c) 21.0 m
d) 44.0 m
e) 65.0m

2. The acceleration as a function of time of an object that moves in a straight line is shown in the graph at right. If the object starts from rest, what will its maximum velocity be in the 10 s interval?



a) 5.0 m/s
b) 7.5 m /s
c) 10 m
d) 20 m /s
e) 30 m/s

3. Two objects are dropped from the same height, an interval of 1.00 s apart. What is their separation 1.00 s after the second object is released? Assume there is no air resistance.

a) 4.90 m
b) 7.35 m
c) 9.80 m
d) 14.7 m
e) 19.8

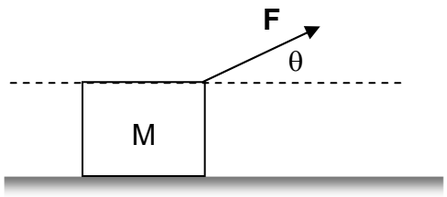
4. A stone is thrown horizontally from the top of a 20 m high hill. It strikes the ground at an angle of 45°. With what speed was it thrown?

a) 14 m/s
b) 20 m/s
c) 28 m/s
d) 32 m/s
e) 40 m/s

5. A 1000 kg elevator is rising and its speed is increasing at 3.00 m/s^2. The tension in the elevator cable is:

a) 1.00×10^3 N
b) 3.00×10^3 N
c) 6.80×10^3 N
d) 9.80×10^3 N
e) 1.28×10^3 N

6. A block of mass M is pulled along a horizontal surface by a force **F** that makes an angle θ with the horizontal. Assuming that the coefficient of kinetic friction is μ_k, The force of friction will be:



a) f = F
b) f = $\mu_k$mg
c) f = μ_k[mg + Fcosθ]
d) f = μ_k[mg - Fcosθ]
e) Otra respuesta: ¿Cuál? _____

7. Kepler's third law states that the square of a planet's (like Earth) period of revolving in its orbit around a center of force (like the Sun) is: $T^2 = 4\pi^2 r^3/Gm$. In this equation r and m represent respectively:

a) Earth's radius and Earth's mass
b) Earth's radius and the Sun's mass
c) the Sun's radius and Earth's mass
d) Earth's Sun distance and Earth's mass
e) Earth's Sun distance and the Sun's mass

8. Suppose the orbit of the Moon is a perfect circle. The gravitational force exerted by the Earth on the Moon does _____.

a) positive work
b) negative work
c) no work

9. Which of the following objects has the largest kinetic energy?

a) Mass 3M and speed V
b) Mass 3M and speed 2V
c) Mass 2M and speed 3V
d) Mass M and speed 4V
e) All four of the above have the same kinetic energy

10. A car with weight of 8000 N is traveling at 12 m/s along a horizontal road when the brakes are applied. The car comes to a stop in 4.0 s. How much kinetic energy does the car loses in this time?

a) 4.8×10^4 J
b) 5.9×10^4 J
c) 1.2×10^5 J
d) 5.8×10^5 J
e) 4.8×10^6 J

11. A force of 10 N holds an ideal spring with a 20 N/m spring constant in compression. The potential energy stored in the spring-mass system is:

a) 0.5 J
b) 2.5 J
c) 5.0 J
d) 10 J
e) 200 J

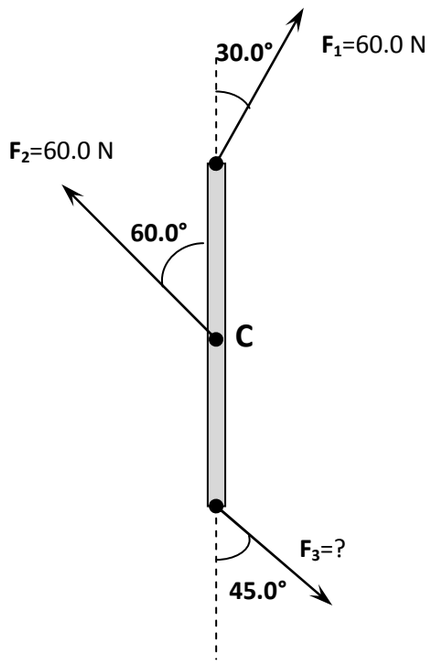
12. A 0.50 kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. The total mechanical energy is 0.12 J. The greatest speed of the block is:

a) 0.15 m/s
b) 0.24 m/s
c) 0.49 m/s
d) 0.69 m/s
e) 1.46 m/s

13. A 0.50 kg ball traveling at 6.0 m/s collides head on with a 1.00 kg ball at rest. After the collision the 0.50 kg ball moves away, traveling opposite to its original direction at 2.0 m/s. The collision is:

a) elastic
b) inelastic
c) There is not enough information to say.

14. The 6.00 m long massless uniform beam can freely rotate about fixed axis C at the center of the beam. Three forces are applied to the beam as shown in the figure. To hold the beam in static equilibrium (no rotation), the force $\mathbf{F_3}$ must be:



a) 116 N
b) 73.5 N
c) 42.4 N
d) 0 N
e) Another answer: Which one? _____

15. A 5.0 m radius playground merry-go-round with a moment of inertia of 2000 kg · m^2 is rotating freely with an angular speed of 1.0 rad/s. Two people, each having a mass of 60 kg are standing right outside the edge of the merry-go-round and step on it with negligible speed. What is the angular speed of the merry-go-round right after the two people have stepped on?

a) 0.20 rad/s
b) 0.40 rad/s
c) 0.60 rad/s
d) 0.80 rad/s
e) 0.67 rad/s

16. Two children are carrying a 2.00 m long uniform level board with a mass 5.00 kg, each supporting one end of the board. A 1.00 kg book is resting on the board a distance of 1.20 m from one end of the board. What is the force applied by the child that is closer to the book to support the board?

a) 29.4 N downward
b) 58.9 N upward
c) 29.4 N upward
d) 30.4 N upward
e) 3.10 N upward

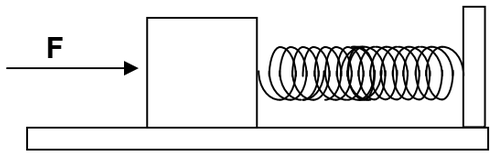
17. An open tank contains a liquid substance. The atmospheric pressure is 1.01×10^5 Pa, the depth of the liquid is 10.0 m and the absolute pressure at the bottom of the tank is 1.50×10^5 Pa. The density of the liquid is:

a) 2.53×10^3 kg / m^3
b) 1.53 X 103 kg / m^3
c) 1.01×10^3 kg / m^3
d) 500 kg / m^3
e) 250 kg / m^3

18. An object floats in a fluid with 30 % of its volume above the level of the fluid. The density of the object relative to the fluid is:

a) 0.30
b) 0.40
c) 0.50
d) 0.60
e) 0.70

19. By pushing on a 1.5 kg mass that is attached to an ideal massless spring with a 30.0 N horizontal force, the mass is displaced 5.0 cm from its equilibrium position (See the figure at right.). In this position the mass is at rest. What will be its period of oscillation if it is released from this position? (Assume there is no friction between the block and the surface.)



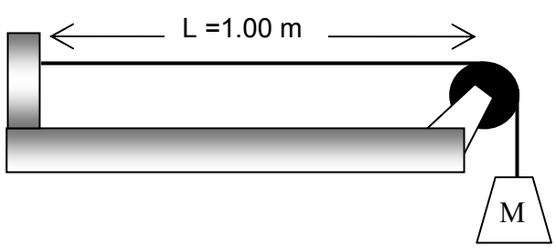
a) 7.1×10^{-2} s
b) $\pi/10$ s
c) 5.0×10^{-1} s
d) $10/\pi$ s
e) 20 s

20. A standing wave established on a string fixed at both ends exhibits a pattern of 6 nodes and 5 antinodes. The length of the string is 1.0 m. The wave's wavelength is approximately:

a) 0.16 m
b) 0.20 m
c) 0.33 m
d) 0.40 m
e) Another. Which one? _____

21. A wave travels along a string with a mass of 5.00×10^{-3} kg. The wave propagates with a speed of 100 m/s. The mass M hanging at the end of the string is:

a) 0.051 kg
b) 0.102 kg
c) 5.10 kg
d) 10.2 kg
e) Another. Which one? _____



22. A long solid metal cylinder with the diameter D of 10 cm and length L, is heated homogeneously. Find the change in volume of the cylinder when its length L increases 1.00 mm.

a) 0.79×10^{-7} m^3
b) 2.4×10^{-7} m^3
c) 0.79×10^{-5} m^3
d) 1.6×10^{-5} m^3
e) 2.4×10^{-5} m^3

23. Since $v_{rms}=(3kT/m)^{1/2}$ is different for different molecular masses, the kinetic energy of each molecule for different ideal gases is

a) different at a given temperature T
b) the same at a given temperature T
c) dependent on m
d) independent on m and T
e) zero

24. The internal energy of an isolated system

a) depends on the volume
b) depends on the temperature
c) depends on the pressure
d) depends on how many moles of substances in the system
e) remains constant

25. Five moles of an ideal gas expands isothermally at 227 °C to four times of its initial volume. The heat energy transferred to the system during the process is:

a) 13.1 kJ
b) 28.8 kJ
c) 0.285 kJ
d) 0.129 kJ
e) 0.258 kJ