

Final Exam – Fisi 3161/3171

Name: \_\_\_\_\_

Wednesday, December 5, 2007

Section: \_\_\_\_\_

Prof. \_\_\_\_\_

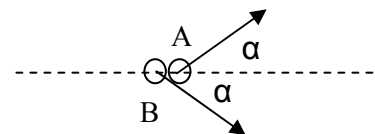
**Read the instructions carefully. Select the best answer. You are required to answer only 20 of the 25 questions. You have to select and identify the 20 questions to be corrected by circulating the question's number. If you choose not to indicate which questions are the chosen ones, the first 20 questions will be the ones selected. All answers must be justified, either by some analytical procedure or by some physics principle. If there is no justification for the answer then it will be considered a wrong answer. In other words 'to guess' the answer is not valid. The points assigned will be: 5 points (100%) to a correct answer with a correct justification, 2.5 points (50%) to an incorrect answer with a correct justification, and 0 points to a correct or incorrect answer either with no justification or an incorrect one.**

1. The law of radioactive decay is given by  $N(t) = N_0 e^{-\lambda t}$  where  $N_0$  is the number of radioactive nuclei a time  $t = 0$  and  $N(t)$  at time  $t$ . The dimensions of the decay constant  $\lambda$  are:
- a) it has no dimensions
  - b) T
  - c) 1/T
  - d) L/T
  - e) Another. Which one? \_\_\_\_\_

2. A baseball is thrown upwards. The acceleration of the ball at the highest point is:
- a)  $9.8 \text{ m/s}^2$  upwards
  - b)  $9.8 \text{ m/s}^2$  downwards
  - c) It changes suddenly from  $9.8 \text{ m/s}^2$  upwards to  $9.8 \text{ m/s}^2$  downwards
  - d)  $0 \text{ m/s}^2$
  - e) It can not be calculated without the value of the initial velocity.

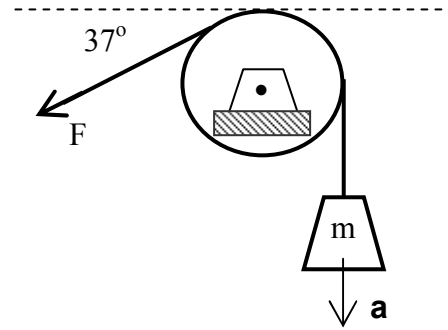
3. Two balls are thrown with the same speed from the top of a building. Ball A is thrown at an angle  $\alpha$  above the horizontal while B is thrown at an angle  $\alpha$  below the horizontal. When they reach the floor their speeds compare in the following way:

- a)  $v_A > v_B$
- b)  $v_A < v_B$
- c)  $v_A = v_B$
- d) it impossible to know without knowing the height



4. A 5.00 kg mass  $m$  that is attached to the end of a cord that goes over a pulley. There is no friction between the pulley and the rope and therefore the pulley does not rotate. The mass accelerates downward at a rate of  $3.00 \text{ m/s}^2$ . The magnitude of the force  $F$  exerted on the other end of the cord is in N:

- a) 20.4
- b) 27.2
- c) 34.0
- d) 64.0
- e) Another. Which one? \_\_\_\_\_



5. An 800N box is pushed along a horizontal surface with a constant velocity by a 200 N force parallel to the surface. The coefficient of kinetic friction between the box and the surface is:

- a) 0.80
- b) 0.20
- c) 0.25
- d) 0.15
- e) Another. Which one? \_\_\_\_\_

6. If the mass of a satellite is doubled, the radius of its orbit stays constant if its speed:

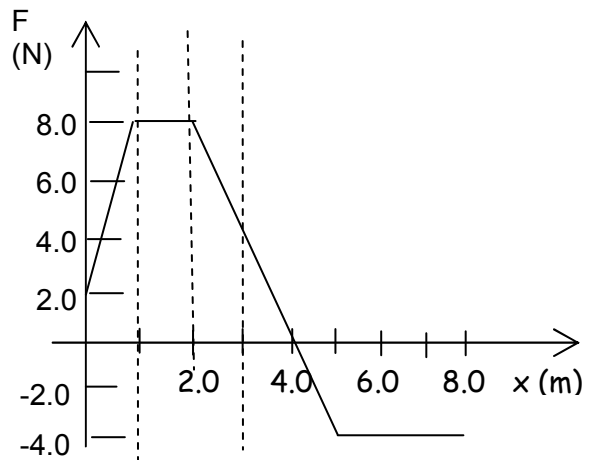
- a) increases by a factor of 4.
- b) increases by a factor of 2
- c) does not change
- d) is reduced by a factor of 4
- e) Another. Which one? \_\_\_\_\_

7. The distance in space ( $r \geq R_{\text{Earth}}$ ) from the center of the earth to a point where the acceleration due to Earth's gravity is  $g/4$  is:

- a)  $R_{\text{Earth}}$
- b)  $2R_{\text{Earth}}$
- c)  $3R_{\text{Earth}}$
- d)  $4R_{\text{Earth}}$
- e) Another. Which one? \_\_\_\_\_

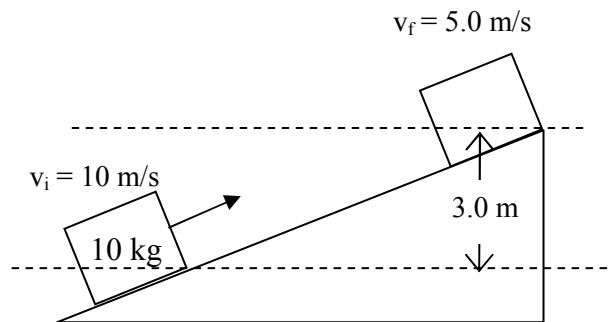
8. The net force acting on a system with a 0.2 kg mass is shown on the graph at right. The net work done on the mass as it is displaced from  $x = 1.0$  m to  $x = 7.0$  m is in J:

- a) 2.0
- b) 6.0
- c) 9.0
- d) 13
- e) Another. Which one? \_\_\_\_\_



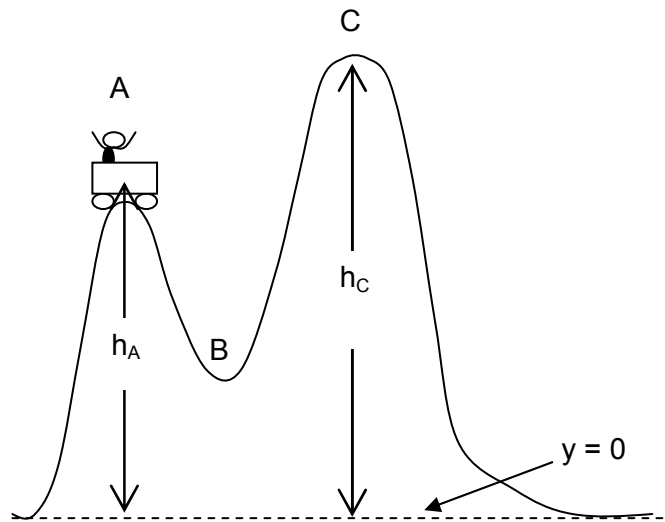
9. A 10.0 kg block starts at the bottom of an incline plane and moves 3.00 m vertically from the initial position. The initial speed of the block at the bottom of the incline is 10.0 m/s and at the highest point its speed is 5.00 m/s. The amount of work done on the block by the non conservative forces in J is:

- a) -125
- b) - 81.0
- c) 0
- d) 419
- e) Another. Which one? \_\_\_\_\_



10. The car and passenger in the figure at right have a combined mass of 400 kg. It starts at point A, which has an altitude of 7.0 m from ground level ( $y = 0$ ) with a speed of 18 m/s and by the time it reaches point C its speed has decreased to 8.3 m/s. Assuming the track is frictionless the height of point C ( $h_C$ ) is in meters:

- a) 13
- b) 17
- c) 20
- d) 22
- e) Another. Which one? \_\_\_\_\_



11. The mechanical energy of the cart and passenger of the previous question at point B relative to  $y = 0$ , in J is:

- a)  $2.7 \times 10^4$
- b)  $3.8 \times 10^4$
- c)  $6.5 \times 10^4$
- d)  $9.2 \times 10^4$
- e) Another. Which one? \_\_\_\_\_

12. A 1.00 kg mass moving to the right at 5.00 m/s makes a head-on collision with a 3.00 kg mass moving to the left at 3.00 m/s. After the collision the 1.00 kg mass moves to the left a 1.00 m/s. After the collision the 3.00 kg mass is moving to the \_\_\_\_\_ at \_\_\_\_\_ m/s:

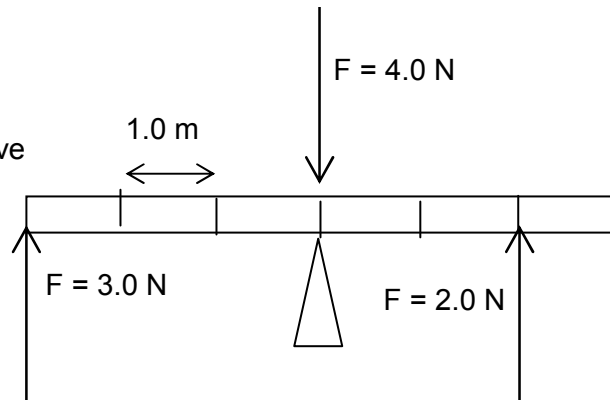
- a) left, 1.00
- b) left, 1.67
- c) right, 4.33
- d) right, 5.00
- e) Another. Which one? \_\_\_\_\_

13. The collision of the previous problem is:

- a) elastic
- b) inelastic
- c) there isn't enough information to be able to tell

14. In the figure at right the arrows represent forces acting on different points of a beam. The triangle is the fulcrum. The net torque acting on the beam with respect to the fulcrum, in  $\text{m}\cdot\text{N}$ , is: (The distance between two consecutive vertical marks on the beam is 1.0 m.)

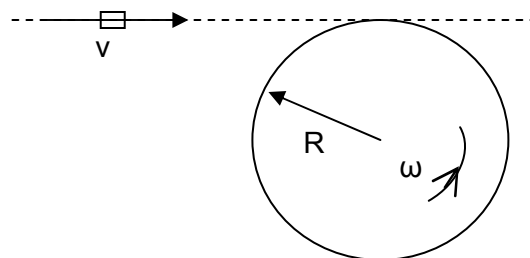
- a) 1.0, out of the page (counterclockwise rotation)
- b) 5.0, into the page (clockwise rotation)
- c) 9.0, into the page (clockwise rotation)
- d) 13, out of the page (counterclockwise rotation)
- e) Another. Which one? \_\_\_\_\_



15. A flywheel rotating at 25 rad/s is acted upon by a tangential frictional force that reduces the angular speed to 10 rad/s after 5.0 s. The moment of inertia of the flywheel is  $0.60 \text{ kgm}^2$ . The magnitude of the torque produced by the frictional force, in  $\text{m}\cdot\text{N}$  is:

- a) 3.0
- b) 1.8
- c) 1.2
- d) 0.20
- e) Another. Which one? \_\_\_\_\_

16. A solid disc of 0.800 kg mass, 0.160 m radius and moment of inertia ( $I_{cm}$ ) of  $1.02 \times 10^{-2} \text{ kg}\cdot\text{m}^2$  is rotating with an angular speed of 19.9 rad/s counterclockwise (ccw). A  $4.00 \times 10^{-3} \text{ kg}$  bullet moving at 317 m/s tangent to the disk but in opposite direction to it hits the disk's border and becomes embedded in it. The angular speed of the disk afterwards is in rad/s:



- a) 0.0
- b) 0.205, clockwise
- c) 0.205, counterclockwise
- d) 0.410, clockwise
- e) Another. Which one? \_\_\_\_\_

17. A body floats with half his volume under water. If its mass is 20 Kg its density, in  $\text{g} / \text{cm}^3$  is:

- a) 0.20
- b) 0.40
- c) 0.50
- d) 1.0
- e) Another. Which one? \_\_\_\_\_

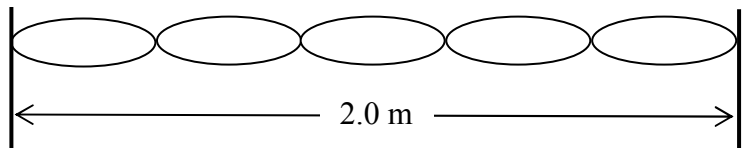
18. A large open water tank has a small hole 0.80 m below the water level. The velocity of the water through the hole, in m/s is:
- a) 4.0
  - b) 10
  - c) 20
  - d) 40
  - e) Another. Which one? \_\_\_\_\_

19. A spring with a constant  $K = 640 \text{ N/m}$  is oscillating at a frequency of  $40/\pi \text{ Hz}$ . The mass attached to the spring, in grams is:
- a) 1.0
  - b) 10
  - c)  $1.0 \times 10^2$
  - d)  $1.0 \times 10^3$
  - e) Another. Which one? \_\_\_\_\_

20. A wave is represented by:  $y(x, t) = (0.050\text{m}) \sin (15\pi x - 750\pi t)$  where  $x$  is in meters and  $t$  is in seconds. The speed of the wave, in m/s is:
- a) 0.75
  - b) 7.5
  - c) 37.5
  - d) 50
  - e) Another. Which one? \_\_\_\_\_

21. A standing wave has been established in a 2.0 meters long string stretched between two poles (see figure). If the wave velocity is 200 m/s then its frequency, in Hz is:

- a) 100
- b) 200
- c) 250
- d) 300
- e) Another. Which one? \_\_\_\_\_



22. The temperature at which both a Celsius and a Fahrenheit thermometers read the same temperature (same number) is:
- a) -50
  - b) -40
  - c) -32
  - d) 0
  - e) Another. Which one? \_\_\_\_\_

23. A 1.00000 meter metallic bar changes its length to 1.00030 m when its temperature rises from 20 °C to 50 °C. Its coefficient of linear expansion  $\alpha$ , in terms of  $10^{-6}/\text{C}^\circ$ , is:
- a) 1.0
  - b) 3.0
  - c) 10
  - d) 30
  - e) Another: which one? \_\_\_\_\_

24. 200 grams of water at a temperature of 10 °C are added to 800 grams of water at 100 °C. If no energy is lost, the final temperature of the 1000 grams of water, in °C, is (the specific heat of water is 1.0 cal / g• °C) :

- a) 9.0
- b) 11
- c) 55
- d) 82
- e) Another. Which one? \_\_\_\_\_

25. At point A the volume is 0.01 m<sup>3</sup> and the pressure is 1 X 10<sup>5</sup> Pa. At point B the volume is 0.02 m<sup>3</sup> and the pressure is 2 x 10<sup>5</sup> Pa. The work done to go from A to B in the figure, in terms of kilo joules, is:

- a) 1
- b) 2
- c) 3
- d) 4
- e) Another. Which one? \_\_\_\_\_

