

**Final Exam – Fisi 3161/3171**

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

Monday December 14, 2009

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. At the end of the exam you should write on this page the 20 questions chosen with their corresponding answers. 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, unless specified to the contrary. 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 % 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.**

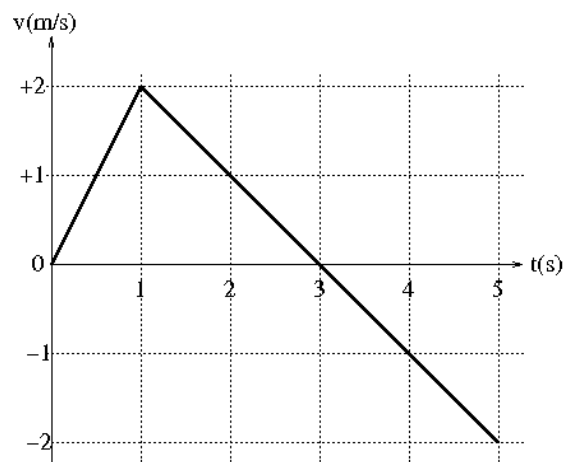
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1. Express the answer to the following sum with the correct number of significant digits:  $2.14 \text{ m} + 135.5 \text{ cm} + 5.38 \times 10^5 \text{ }\mu\text{m}$ .
- a) 4.0 m
  - b) 403.3 cm
  - c) 4.03 m
  - d) 4033000  $\mu\text{m}$
  - e) 403.30 cm

2. An object moves in a straight line with the velocity shown on the graph. Its displacement (in meters) during the first 5 seconds is:

- a) 1 m
- b) 3 m
- c) 5 m
- d) 6 m
- e) Another answer: Which one? \_\_\_\_\_



3. The instantaneous acceleration of the object from the previous question at  $t = 3 \text{ s}$  is in  $\text{m/s}^2$ :

- a)  $-1 \text{ m/s}^2$
- b)  $-0.4 \text{ m/s}^2$
- c)  $0 \text{ m/s}^2$
- d)  $2 \text{ m/s}^2$
- e) Another answer: Which one? \_\_\_\_\_

4. A car moves from position  $(3.0 \text{ m}) \vec{i} + (5.0 \text{ m}) \vec{j}$  to position  $(8.0 \text{ m}) \vec{i} - (7.0 \text{ m}) \vec{j}$  in 2.0 s. The direction of the average velocity vector of the car during that interval is:

- a)  $67^\circ$  measured with respect to the x axis
- b)  $-67^\circ$  measured with respect to the x axis
- c)  $33^\circ$  measured with respect to the x axis
- d)  $-33^\circ$  measured with respect to the x axis
- e)  $52^\circ$  measured with respect to the x axis

5. An object is thrown from the roof of a building with speed of 50 m/s at an angle of  $60^\circ$  above the horizontal. The object falls 300m in front of the building. The height of the building is
- a) 124m
  - b) 173m
  - c) 186m
  - d) 520m
  - e) Another answer: Which one? \_\_\_\_\_

6. Block A of 6.00 kg is in contact with block B of 4.00 kg over a frictionless table as shown in figure 1. Block A is being pushed by a horizontal 20.0 N force to the right. The magnitude of the force exerted on block B by block A is:

- a) 4.00 N
- b) 6.00 N
- c) 8.00 N
- d) 12.0 N
- e) 20.0 N

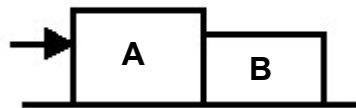


Figure 1

7. A 50.0 kg block is being pulled up a  $13.0^\circ$  slope by a force of 250 N which is parallel to the slope. The coefficient of kinetic friction between the block and the slope is 0.200. The magnitude of the acceleration of the block is:

- a)  $0.886\text{m/s}^2$
- b)  $0.528\text{ m/s}^2$
- c)  $0.260\text{ m/s}^2$
- d)  $0.158\text{ m/s}^3$
- e) Another answer: Which one? \_\_\_\_\_

8. The radius of the Earth is  $R$ . The distance above the earth's surface where the acceleration of gravity will be  $4.9 \text{ m/s}^2$  is:

- a)  $0.41 R$
- b)  $0.50 R$
- c)  $2.0 R$
- d)  $1.0 R$
- e)  $1.4 R$

9. A  $102 \text{ kg}$  man climbs a  $5.00$  meter high staircase at constant speed. The amount of work that he does is:

- a)  $49.0 \text{ J}$
- b)  $510 \text{ J}$
- c)  $2500 \text{ J}$
- d)  $5000 \text{ J}$
- e) Another answer: Which one? \_\_\_\_\_

10. A simple pendulum consists of a mass  $m$  attached to the end of a  $1.5 \text{ m}$  length of string. If the mass is held out horizontally, and then released from rest, its speed at the bottom is

- a)  $4.4 \text{ m/s}$
- b)  $5.4 \text{ m/s}$
- c)  $9.8 \text{ m/s}$
- d)  $17 \text{ m/s}$
- e) Another answer: Which one? \_\_\_\_\_

11. An unstretched spring with spring constant  $37 \text{ N/cm}$  is suspended from the ceiling. A  $4.7 \text{ kg}$  mass is attached to the spring and let fall. The amount the spring is stretched in cm is:

- a)  $2.4 \text{ cm}$
- b)  $24 \text{ cm}$
- c)  $2.5 \text{ cm}$
- d)  $25 \text{ cm}$
- e) Another answer: Which one? \_\_\_\_\_

12. Two small objects are attached each at the ends of a  $2.00 \text{ m}$  long rod of negligible mass. The mass of one object is  $1.00 \text{ kg}$  and the mass of the other is unknown. The center of mass of this system is on the rod a distance  $1.80 \text{ m}$  from the  $1.00 \text{ kg}$  mass object. The mass of the other object is:

- a)  $0.111 \text{ kg}$
- b)  $0.900 \text{ kg}$
- c)  $3.22 \text{ kg}$
- d)  $4.11 \text{ kg}$
- e)  $9.00 \text{ kg}$

13. A  $0.400 \text{ kg}$  ball approaches a very massive wall at  $20.0 \text{ m/s}$  perpendicular to the wall and rebounds with  $70.0\%$  of its initial kinetic energy. The magnitude of the change in momentum of the ball is:

- a)  $14.7 \text{ kg}\cdot\text{m/s}$
- b)  $13.6 \text{ kg}\cdot\text{m/s}$
- c)  $2.40 \text{ kg}\cdot\text{m/s}$
- d)  $1.31 \text{ kg}\cdot\text{m/s}$
- e)  $0.00 \text{ kg}\cdot\text{m/s}$

14. A wheel rotates through an angle of  $320^\circ$  as it slows down from 78.0 rpm to 22.8 rpm. The magnitude of the average angular acceleration of the wheel in  $\text{rad/s}^2$  is:

- a)  $2.34 \text{ rad/s}^2$
- b)  $5.46 \text{ rad/s}^2$
- c)  $6.50 \text{ rad/s}^2$
- d)  $8.35 \text{ rad/s}^2$
- e)  $10.9 \text{ rad/s}^2$

15. A uniform disk of mass  $M$  and radius  $R$  ( $I_{\text{cm}} = 1/2MR^2$ ) is tied to a string which in turn is attached to the ceiling as shown in figure 2. The mass is released from rest and its center of mass moves with constant acceleration of: (Assume there is friction between the disk and the string and therefore the disk doesn't slip.):

- a)  $1/3 g$
- b)  $1/2 g$
- c)  $2/3 g$
- d)  $g$
- e) Another answer: Which one? \_\_\_\_\_

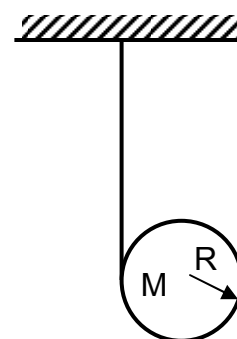


Figura 2

16. A uniform disk rotates at 1200 rpm with respect to a vertical axis that passes through its center. Another disk, located over this one, with half of the inertia and originally at rest falls over the first. After the collision both disks attach to each other and rotate together with the same angular speed. That angular speed is:

- a) 600rpm
- b) 800 rpm
- c) 1600rpm
- d) 2,440 rpm
- e) Another answer: Which one? \_\_\_\_\_

17. A 25 kg boy is seating on one side of a 6.0 m long sea-saw. In order for the sea-saw to be in equilibrium, a 30 kg boy should seat on the other side at a distance of \_\_\_\_\_ m from the center.

- a) 3.0 m
- b) 2.5 m
- c) 2.0 m
- d) 1.0m
- e) Another answer: Which one? \_\_\_\_\_

18. An object floats in a container filled with water with 35% of its volume above the water level. The density of the object relative to that of water is:

- a) 0.35
- b) 0.50
- c) 0.65
- d) 1.35
- e) 1.65

19. A pipeline is arranged as shown in figure 3. The left side of the pipeline has an area  $A$  and the water flowing in it flows from left to right with a speed of 1.00 m/s. The area del on the right side is  $A/5$  and the fluid pressure on the right side is  $2.00 \times 10^5$  Pa. The fluid pressure on the left side is:

- a)  $1.02 \times 10^5$  Pa
- b)  $1.14 \times 10^5$  Pa
- c)  $1.98 \times 10^5$  Pa
- d)  $2.86 \times 10^5$  Pa
- e)  $3.10 \times 10^5$  Pa

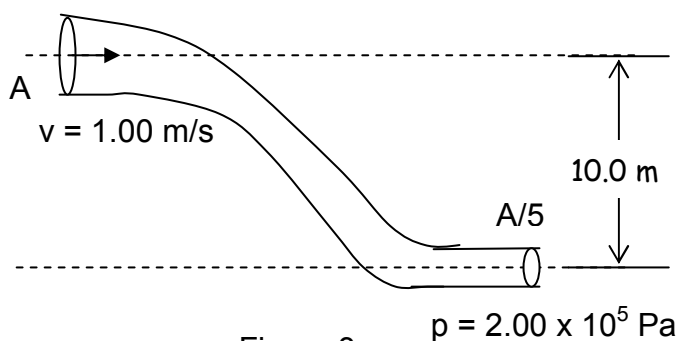


Figure 3

20. A spring-mass system oscillates with simple harmonic motion (SHM). The system has a mechanical energy  $E$  and oscillates with amplitude  $A$ . If the mechanical energy is reduced to one third of its original value, its amplitude reduces to \_\_\_\_\_ of the original:
- a)  $1/3$
  - b)  $(1/3)^{1/2}$
  - c)  $2/3$
  - d)  $(2/3)^{1/2}$
  - e) Another answer: Which one? \_\_\_\_\_

21. The equation which describes a harmonic mechanical wave propagating on a string is given by:

$$y(x, t) = 0.10 \text{ (m)} \sin [\pi/2 \text{ (m)} x - 40\pi \text{ (rad/s)} t]$$

The wave travels with a speed of:

- a) 80 m/s
- b)  $40\pi$  m/s
- c) 160 m/s
- d)  $80\pi$  m/s
- e) Another answer: Which one? \_\_\_\_\_

22. A standing wave is established on a string between two poles separated by a 2.0 m distance. The standing wave pattern exhibits 4 nodes and 3 antinodes. The wave frequency is 60 Hz. The speed of the wave is:

- a) 15 m/s
- b) 30 m/s
- c) 40 m/s
- d) 60 m/s
- e) 80 m/s

23. The length of mercury column in a thermometer is 4.00 cm when it is immersed in ice water. Its length increases to 24.0 cm when immersed in boiling water. Its length at room temperature, 27.0°C will be:
- a) 1.40 cm
  - b) 3.40 cm
  - c) 5.40 cm
  - d) 9.40 cm
  - e) 11.4 cm

24. The mass of the hydrogen molecule is  $3.34 \times 10^{-27}$  kg. The rms speed of a hydrogen molecule at a temperature of 27.0°C is: (Boltzman constant is  $1.38 \times 10^{-23} \text{ m}^2 \cdot \text{kg} \cdot \text{s}^{-2} \cdot \text{K}^{-1}$ .)
- a) 580 m/s
  - b) 2730 m/s
  - c) 61.1 m/s
  - d) 192 m/s
  - e) 1930 m/s

25. Eighty (80) grams of water at 100 °C are added to 20 grams of water at 10 °C. If there is no loss of energy, final temperature, of the water in °C , is:
- a) 9
  - b) 11
  - c) 55
  - d) 82
  - e) Otra respuesta: ¿Cuál?

We wish you success!