Instructor: *Biswas/Ihas/Whiting*

PHYSICS DEPARTMENT

PHY 2053   Exam 1, 120 minutes   October 14, 2009

Name (print, last first): _____   Signature: _____

On my honor, I have neither given nor received unauthorized aid on this examination.

DIRECTIONS

(1) **Code your test number (THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE) on your answer sheet using lines 76–80. Write your test number down and take it with you.** Code your name on your answer sheet. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) You may do scratch work anywhere on this exam. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
(4) **Fill in the circles of your intended answers completely on the answer sheet, using a #2 pencil or <u>blue</u> or <u>black</u> ink**. Do not make any stray marks or some answers may be counted as incorrect.
(5) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing.
(6) **Hand in the answer sheet separately, showing your UFID.**

Useful information:

$g = 9.80$ m/s^2 Neglect air resistance except when stated otherwise.   All ropes, strings, and pulleys are massless.

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1. A rowboat crosses a river with a velocity of 3.21 mi/h at an angle 62.5° north of west relative to the water. The river is 0.675 mi wide and carries an eastward current of 1.25 mi/h. How far upstream from the starting point is the boat when it reaches the opposite shore? (1 mile = 5280 ft.)

   (1) 291 ft   (2) 458 ft   (3) 374 ft   (4) 660 ft   (5) 880 ft

2. A rowboat crosses a river with a velocity of 3.34 mi/h at an angle 62.5° north of west relative to the water. The river is 0.880 mi wide and carries an eastward current of 1.25 mi/h. How far upstream from the starting point is the boat when it reaches the opposite shore? (1 mile = 5280 ft.)

   (1) 458 ft   (2) 374 ft   (3) 660 ft   (4) 880 ft   (5) 291 ft

3. A rowboat crosses a river with a velocity of 3.41 mi/h at an angle 62.5° north of west relative to the water. The river is 0.660 mi wide and carries an eastward current of 1.25 mi/h. How far upstream from the starting point is the boat when it reaches the opposite shore? (1 mile = 5280 ft.)

   (1) 374 ft   (2) 660 ft   (3) 880 ft   (4) 291 ft   (5) 458 ft

4. A rocket is launched at an angle of 53 degrees above the horizontal with an initial speed of 100 m/s. The rocket moves for 3.0 seconds along its initial straight line of motion with an acceleration of 30 m/s^2. What is the horizontal component of the distance covered by the rocket during this time?

   (1) 260 m   (2) 690 m   (3) 69 m   (4) 180 m   (5) 360 m

5. A rocket is launched at an angle of 53 degrees above the horizontal with an initial speed of 100 m/s. The rocket moves for 6.0 seconds along its initial straight line of motion with an acceleration of 30 m/s^2. What is the horizontal component of the distance covered by the rocket during this time?

   (1) 690 m   (2) 69 m   (3) 180 m   (4) 360 m   (5) 260 m

6. A rocket is launched at an angle of 53 degrees above the horizontal with an initial speed of 100 m/s. The rocket moves for 1.0 second along its initial straight line of motion with an acceleration of 30 m/s^2. What is the horizontal component of the distance covered by the rocket during this time?

   (1) 69 m   (2) 690 m   (3) 180 m   (4) 360 m   (5) 260 m

7. A 106 N weight w is supported by three cables as shown in the figure. Find the tension in the right cable.
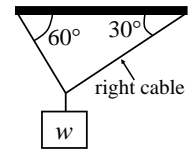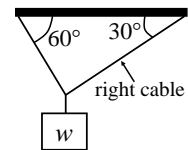

   (1) 53.0 N   (2) 76.0 N   (3) 100 N   (4) 200 N   (5) 152 N

8. A 152 N weight w is supported by three cables as shown in the figure. Find the tension in the right cable.
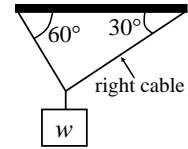
   (1) 76.0 N   (2) 53.0 N   (3) 100 N   (4) 200 N   (5) 152 N

9. A 200 N weight w is supported by three cables as shown in the figure. Find the tension in the right cable.

   (1) 100 N   (2) 200 N   (3) 152 N   (4) 53.0 N   (5) 76.0 N

10. A block of mass 5.0 kg slides down a frictionless inclined plane of length 1.0 m which makes a 30 degree angle with the horizontal. If the block starts from rest, how long does it take for the block to reach the bottom of the inclined plane? Neglect the size of the block itself.

   (1) 0.64 s   (2) 0.90 s   (3) 1.1 s   (4) 0.78 s   (5) 0.45 s

11. A block of mass 5.0 kg slides down a frictionless inclined plane of length 2.0 m which makes a 30 degree angle with the horizontal. If the block starts from rest, how long does it take for the block to reach the bottom of the inclined plane? Neglect the size of the block itself.

   (1) 0.90 s   (2) 0.64 s   (3) 1.1 s   (4) 0.78 s   (5) 0.45 s

12. A block of mass 5.0 kg slides down a frictionless inclined plane of length 3.0 m which makes a 30 degree angle with the horizontal. If the block starts from rest, how long does it take for the block to reach the bottom of the inclined plane? Neglect the size of the block itself.
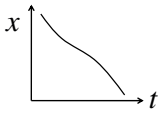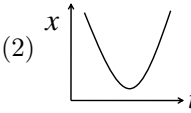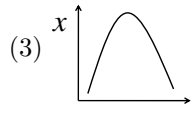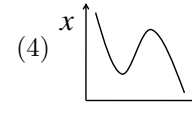
   (1) 1.1 s   (2) 0.64 s   (3) 0.90 s   (4) 0.78 s   (5) 0.45 s

13. Runner A is initially 4.0 mi west of a flagpole and is running with a constant velocity of 4.0 mi/h due east. Runner B is initially 10.0 mi east of the flagpole and is running with a constant velocity of 3.0 mi/h due west. How far are the runners from the flagpole when they meet?

   (1) 4.0 miles   (2) 2.0 miles   (3) 0.50 miles   (4) 1.0 mile   (5) 0.0 miles

14. Runner A is initially 8.0 mi west of a flagpole and is running with a constant velocity of 2.0 mi/h due east. Runner B is initially 7.0 mi east of the flagpole and is running with a constant velocity of 3.0 mi/h due west. How far are the runners from the flagpole when they meet?

   (1) 2.0 miles   (2) 4.0 miles   (3) 0.50 miles   (4) 1.0 mile   (5) 0.0 miles

15. Runner A is initially 10.0 mi west of a flagpole and is running with a constant velocity of 8.0 mi/h due east. Runner B is initially 9.0 mi east of the flagpole and is running with a constant velocity of 8.0 mi/h due west. How far are the runners from the flagpole when they meet?

(1) 0.50 miles   (2) 2.0 miles   (3) 4.0 miles   (4) 1.0 mile   (5) 0.0 miles

16. A ball thrown vertically upward is caught by the thrower after 2.80 s at the same height as the initial point of release. Find the maximum height the ball reaches from the point of release.

(1) 9.60 m   (2) 7.06 m   (3) 5.40 m   (4) 2.80 m   (5) 2.10 m

17. A ball thrown vertically upward is caught by the thrower after 2.40 s at the same height as the initial point of release. Find the maximum height the ball reaches from the point of release.

(1) 7.06 m   (2) 9.60 m   (3) 5.40 m   (4) 2.80 m   (5) 2.10 m

18. A ball thrown vertically upward is caught by the thrower after 2.10 s at the same height as the initial point of release. Find the maximum height the ball reaches from the point of release.

(1) 5.40 m   (2) 7.06 m   (3) 9.60 m   (4) 2.80 m   (5) 2.10 m

19. A ball is thrown upward from the ground with an initial speed of 35 m/s; at the same instant, another ball is dropped from a building 5.0 m high. After how long will the balls be at the same height?

(1) 0.143 s   (2) 0.571 s   (3) 0.333 s   (4) 9.80 s   (5) 4.90 s

20. A ball is thrown upward from the ground with an initial speed of 35 m/s; at the same instant, another ball is dropped from a building 20 m high. After how long will the balls be at the same height?

(1) 0.571 s   (2) 0.143 s   (3) 0.333 s   (4) 9.80 s   (5) 4.90 s

21. A ball is thrown upward from the ground with an initial speed of 30 m/s; at the same instant, another ball is dropped from a building 10 m high. After how long will the balls be at the same height?

(1) 0.333 s   (2) 0.571 s   (3) 0.143 s   (4) 9.80 s   (5) 4.90 s

22. A car is moving along a straight road with non-constant speed but always in the same direction. Which one of the following graphs is a valid position vs. time curve for the motion of the car?

(1)   (2)   (3)   (4)   (5) None of the graphs shown is valid

23. John throws a rock down with speed 14 m/s from the top of a 30.0-m tower. What is the rock's speed just as it hits the ground?

(1) 28 m/s   (2) 37 m/s   (3) 44 m/s   (4) 12 m/s   (5) 6.0 m/s

24. John throws a rock down with speed 14 m/s from the top of a 60.0-m tower. What is the rock's speed just as it hits the ground?

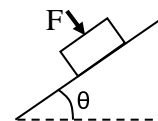(1) 37 m/s   (2) 28 m/s   (3) 44 m/s   (4) 12 m/s   (5) 6.0 m/s

25. John throws a rock down with speed 14 m/s from the top of a 90.0-m tower. What is the rock's speed just as it hits the ground?

   (1) 44 m/s   (2) 28 m/s   (3) 37 m/s   (4) 12 m/s   (5) 6.0 m/s

26. The following force vectors act on an object: i) 50.0 newtons at 45.0° north of east and ii) 25.0 newtons at 30.0° south of east. Which of the following represents the magnitude of the resultant and its angle relative to the easterly direction?

   (1) 61.4 newtons 21.8° (2) 75.0 newtons 7.50° (3) 23.4 newtons 18.3° (4) 12.8 newtons 37.5° (5) 12.8 newtons -37.5°

27. A 60.0-kilogram physics student would weigh 1560 newtons on the surface of planet X. What is the magnitude of the acceleration due to gravity on the surface of planet X?

   (1) 26.0 m/s^2 (2) 6.10 m/s^2 (3) 0.038 m/s^2 (4) 9.80 m/s^2 (5) 4.90 m/s^2

28. Two spheres, A and B, are simultaneously projected horizontally from the top of a tower. Sphere A has a horizontal speed of 40.0 meters per second and sphere B has a horizontal speed of 20.0 meters per second. Which statement best describes the time required for the spheres to reach the ground and the horizontal distance they travel? [Assume the ground is level.]

   (1) Both spheres hit the ground at the same time, but sphere A lands twice as far as sphere B from the base of the tower.
   (2) Both spheres hit the ground at the same time, but sphere B lands twice as far as sphere A from the base of the tower.
   (3) Sphere A hits the ground before sphere B, and sphere A lands twice as far as sphere B from the base of the tower.
   (4) Both spheres hit the ground at the same time and at the same distance from the base of the tower.
   (5) None of the other statements is correct.

29. A block weighing 40.0 newtons is released from rest on an incline 8.0 meters above the horizontal, as shown in the diagram. If 50.0 joules of work is done by non-conservative forces as the block slides down the incline, what is the kinetic energy of the block at the bottom of the incline?
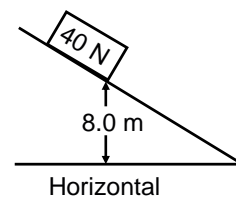
   (1) 270 J
   (2) 320 J
   (3) 55 J
   (4) 3100 J
   (5) 85 J

30. A force F is used to hold a block of mass $m = 4.00$ kg on an incline as shown in the diagram. The plane makes an angle of $\theta = 30.0°$ with the horizontal and F is perpendicular to the incline. The coefficient of static friction between the plane and the block is 0.300. What is the minimum force, F, necessary to keep the block at rest?

   (1) 31.4 N   (2) 47.1 N   (3) 62.8 N   (4) 19.6 N   (5) 9.80 N

31. A force F is used to hold a block of mass $m = 6.00$ kg on an incline as shown in the diagram. The plane makes an angle of $\theta = 30.0°$ with the horizontal and F is perpendicular to the incline. The coefficient of static friction between the plane and the block is 0.300. What is the minimum force, F, necessary to keep the block at rest?

(1) 47.1 N   (2) 31.4 N   (3) 62.8 N   (4) 19.6 N   (5) 9.80 N

32. A force F is used to hold a block of mass $m = 8.00$ kg on an incline as shown in the diagram. The plane makes an angle of $\theta = 30.0°$ with the horizontal and F is perpendicular to the incline. The coefficient of static friction between the plane and the block is 0.300. What is the minimum force, F, necessary to keep the block at rest?

(1) 62.8 N   (2) 47.1 N   (3) 31.4 N   (4) 19.6 N   (5) 9.80 N

33. Given the three masses as shown in the diagram, if the coefficient of kinetic friction between the mass $m_2 = 10.0$ kg and the table is $\mu = 0.200$, what would be the magnitude of the upward acceleration of the mass $m_3 = 2.00$ kg? Mass $m_1 = 6.00$ kg. The mass and friction of the cords and pulleys are small enough to produce a negligible effect on the system.

(1) 1.09 m/s^2 (2) 2.29 m/s^2 (3) 0.151 m/s^2 (4) 0.400 m/s^2 (5) 9.80 m/s^2

34. Given the three masses as shown in the diagram, if the coefficient of kinetic friction between the mass $m_2 = 6.00$ kg and the table is $\mu = 0.200$, what would be the magnitude of the upward acceleration of the mass $m_3 = 1.00$ kg? Mass $m_1 = 5.00$ kg. The mass and friction of the cords and pulleys are small enough to produce a negligible effect on the system.

(1) 2.29 m/s^2 (2) 1.09 m/s^2 (3) 0.151 m/s^2 (4) 0.400 m/s^2 (5) 9.80 m/s^2

35. Given the three masses as shown in the diagram, if the coefficient of kinetic friction between the mass $m_2 = 9.00$ kg and the table is $\mu = 0.200$, what would be the magnitude of the upward acceleration of the mass $m_3 = 1.00$ kg? Mass $m_1 = 3.00$ kg. The mass and friction of the cords and pulleys are small enough to produce a negligible effect on the system.

(1) 0.151 m/s^2 (2) 1.09 m/s^2 (3) 2.29 m/s^2 (4) 0.400 m/s^2 (5) 9.80 m/s^2

36. A large beach ball with mass 2.0 kg is thrown upwards with velocity 9.0 m/s. The ball travels upwards a distance of 1.0 m before falling back to Earth. How much energy was lost to air resistance while the ball traveled upward?

(1) 61 J   (2) 12 J   (3) 32 J   (4) 81 J   (5) 22 J

37. A large beach ball with mass 1.0 kg is thrown upwards with velocity 8.0 m/s. The ball travels upwards a distance of 2.0 m before falling back to Earth. How much energy was lost to air resistance while the ball traveled upward?

(1) 12 J   (2) 61 J   (3) 32 J   (4) 81 J   (5) 22 J

38. A large beach ball with mass 3.0 kg is thrown upwards with velocity 10 m/s. The ball travels upwards a distance of 4.0 m before falling back to Earth. How much energy was lost to air resistance while the ball traveled upward?

    (1) 32 J   (2) 12 J   (3) 61 J   (4) 81 J   (5) 22 J

39. A 66 kg diver steps off a tower 15 m above water and drops from rest straight down into the water. If he comes to rest 5.0 m beneath the surface, determine the average resistance force exerted on him by the water. Ignore air resistance.

    (1) 2600 N   (2) 1900 N   (3) 1200 N   (4) 1300 N   (5) 650 N

40. A 2.7 m long pendulum is released from rest when the support string is at an angle of 29° with the vertical. What is the speed of the bob at the bottom of the swing?

    (1) 2.6 m/s   (2) 10. m/s   (3) 1.0 m/s   (4) 3.2 m/s   (5) 0.27 m/s

41. By throwing a ball at an angle of 50°, a girl can throw it a maximum horizontal distance of $R = 35$ m on a level field. How far can she throw the same ball vertically upward? Assume that her muscles give the ball the same speed in each case.

    (1) 18 m   (2) 48 m   (3) 23 m   (4) 5.0 m   (5) 35 m

42. Have you entered your identifying information correctly on the answer form (bubble sheet)? The information, your name, UFID (8 digits, no space or hyphen), and exam code (5 digits), must be bubbled in the appropriate rows.

    (1) yes   (2) no   (3) no   (4) no   (5) no

FOLLOWING GROUPS OF QUESTIONS WILL BE SELECTED AS ONE GROUP FROM EACH TYPE
TYPE 1
Q# S 1
Q# S 2
Q# S 3
TYPE 2
Q# S 4
Q# S 5
Q# S 6
TYPE 3
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Q# S 8
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TYPE 4
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