Instructor(s): *Acosta/Rinzler*

PHYSICS DEPARTMENT

PHY 2048 Exam 1 February 5, 2014

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

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

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.

(1) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number)**. Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY**. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work anywhere on this exam that you like. **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) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black 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. If you believe that no listed answer is correct, leave the form blank.**
(6) Hand in the answer sheet separately.

Take g = 9.8 m/s^2 as the acceleration due to gravity.

---

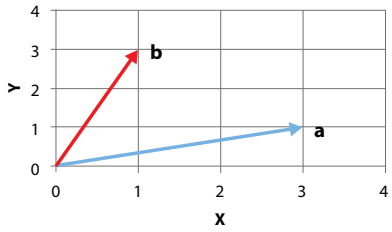
1. Let vector $\vec{a} = 4\,\hat{i} + 3\,\hat{j}$ and vector $\vec{b} = -\hat{i} + 2\,\hat{j}$. What is the opening angle between vectors $\vec{a}$ and $\vec{b}$?

   (1) 80° (2) 0.2° (3) 67° (4) 10° (5) 0°

2. Let vector $\vec{a} = 4\,\hat{i} + 3\,\hat{j}$ and vector $\vec{b} = -\hat{i} + 4\,\hat{j}$. What is the opening angle between vectors $\vec{a}$ and $\vec{b}$?

   (1) 67° (2) 0.2° (3) 80° (4) 10° (5) 0°

3. Vectors $\vec{a}$ and $\vec{b}$ are shown in graphical form in the figure. What is the magnitude $|\vec{a} - \vec{b}|$ in the same units as used in the graph?



   (1) $2\sqrt{2}$
   (2) 2
   (3) $\sqrt{2}$
   (4) $4\sqrt{2}$
   (5) $2\sqrt{10}$

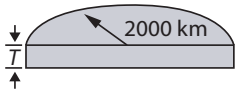
4. Four vectors are expressed in terms of a magnitude and an angle measured counter-clockwise from the x-axis:
   $\vec{A}$: 6.0 m at 0° $\vec{B}$: 3.0 m at 60° $\vec{C}$: 9.0 m at 135° $\vec{D}$: 6.0 m at 240°
   What is the x-component of the sum of these four vectors?

   (1) −1.9 m (2) 3.8 m (3) 16.9 m (4) 6.2 m (5) −9.0 m

5. Four vectors are expressed in terms of a magnitude and an angle measured counter-clockwise from the x-axis:
   $\vec{A}$: 6.0 m at 0° $\vec{B}$: 3.0 m at 60° $\vec{C}$: 9.0 m at 135° $\vec{D}$: 6.0 m at 240°
   What is the y-component of the sum of these four vectors?

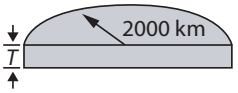
   (1) 3.8 m (2) −1.9 m (3) 16.9 m (4) 6.2 m (5) −9.0 m

6. Antarctica is roughly semicircular, with a radius of 2000 km. In a particular year the new snow that falls on the continent has an average thickness of $T = 5.0$ cm (see figure). How many cubic meters of snow fell in that year?



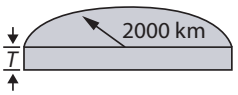
   (1) 3.1×10^{11} (2) 6.3×10^{11} (3) 9.4×10^{11} (4) 3.1×10^{12} (5) 6.3×10^{12}

7. Antarctica is roughly semicircular, with a radius of 2000 km. In a particular year the new snow that falls on the continent has an average thickness of $T = 10.0$ cm (see Figure). How many cubic meters of snow fell in that year?



(1) 6.3×10^{11} (2) 3.1×10^{11} (3) 9.4×10^{11} (4) 3.1×10^{12} (5) 6.3×10^{12}

8. Antarctica is roughly semicircular, with a radius of 2000 km. In a particular year the new snow that falls on the continent has an average thickness of $T = 15.0$ cm (see Figure). How many cubic meters of snow fell in that year?



(1) 9.4×10^{11} (2) 3.1×10^{11} (3) 6.3×10^{11} (4) 3.1×10^{12} (5) 6.3×10^{12}

9. A car, initially at rest, travels 40 m in time $t = 4$ s along a straight line with constant acceleration. The acceleration of the car is:

(1) 5.0 m/s^2 (2) 3.2 m/s^2 (3) 2.2 m/s^2 (4) 1.1 m/s^2 (5) 6.1 m/s^2

10. A car, initially at rest, travels 40 m in time $t = 5$ s along a straight line with constant acceleration. The acceleration of the car is:

(1) 3.2 m/s^2 (2) 5.0 m/s^2 (3) 2.2 m/s^2 (4) 1.1 m/s^2 (5) 6.1 m/s^2

11. A car, initially at rest, travels 40 m in time $t = 6$ s along a straight line with constant acceleration. The acceleration of the car is:

(1) 2.2 m/s^2 (2) 5.0 m/s^2 (3) 3.2 m/s^2 (4) 1.1 m/s^2 (5) 6.1 m/s^2

12. Two automobiles are a distance $d = 200$ km apart and traveling toward each other with one going at 60 km/h and the other at 40 km/h. In how much time (in h) do they meet?

(1) 2.0 (2) 2.5 (3) 3.0 (4) 3.3 (5) 4.0

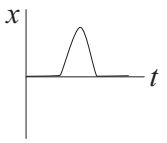
13. Two automobiles are a distance $d = 250$ km apart and traveling toward each other with one going at 60 km/h and the other at 40 km/h. In how much time (in h) do they meet?

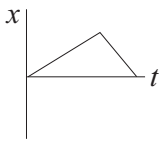
(1) 2.5 (2) 2.0 (3) 3.0 (4) 3.3 (5) 4.0

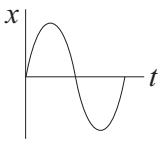
14. Two automobiles are a distance $d = 300$ km apart and traveling toward each other with one going at 60 km/h and the other at 40 km/h. In how much time (in h) do they meet?

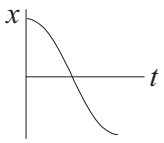
(1) 3.0 (2) 2.0 (3) 2.5 (4) 3.3 (5) 4.0

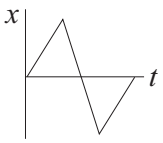
15. A car accelerates from rest on a straight road. A short time later, the car decelerates to a stop and then returns to its original position in a similar manner, by speeding up and then slowing to a stop. Which of the following five coordinate versus time graphs best describes the motion?

(1) 

(2) 

(3) 

(4) 

(5) 

16. One object is shot vertically upwards with an initial velocity of 100 m/s. Another object is shot vertically upwards with a velocity of 10 m/s. The first object climbs to a maximum height that is Q times the maximum height of the second object. Q is:

(1) 100 (2) 10 (3) 33.3 (4) 3.3 (5) 1000

17. A ball is thrown horizontally from the top of a cliff from a height $h = 23.0$ m above the level plain below. It strikes the plain at an angle of 60° with respect to the horizontal. With what speed (in m/s) was the ball thrown?

(1) 12.3 (2) 14.5 (3) 16.4 (4) 10.1 (5) 7.9

18. A ball is thrown horizontally from the top of a cliff from a height $h = 32.0$ m above the level plain below. It strikes the plain at an angle of 60° with respect to the horizontal. With what speed (in m/s) was the ball thrown?

(1) 14.5 (2) 12.3 (3) 16.4 (4) 10.1 (5) 7.9

19. A ball is thrown horizontally from the top of a cliff from a height $h = 41.0$ m above the level plain below. It strikes the plain at an angle of 60° with respect to the horizontal. With what speed (in m/s) was the ball thrown?

(1) 16.4 (2) 12.3 (3) 14.5 (4) 10.1 (5) 7.9

20. A plane traveling north at 200 m/s turns and then travels south at 300 m/s. The change in its velocity is:

(1) 500 m/s south (2) 600 m/s south (3) 700 m/s south (4) 100 m/s south (5) 500 m/s north

21. A plane traveling north at 200 m/s turns and then travels south at 400 m/s. The change in its velocity is:

(1) 600 m/s south (2) 500 m/s south (3) 700 m/s south (4) 100 m/s south (5) 500 m/s north

22. A plane traveling north at 200 m/s turns and then travels south at 500 m/s. The change in its velocity is:

(1) 700 m/s south (2) 500 m/s south (3) 600 m/s south (4) 100 m/s south (5) 500 m/s north

23. Two objects are traveling around different circular orbits, each with a constant speed. They both have the same acceleration but object A is traveling twice as fast as object B. The radius for object A's orbit is how many times that of the radius for object B's?

(1) 4 (2) 2 (3) 1 (4) $\frac{1}{2}$ (5) $\frac{1}{4}$

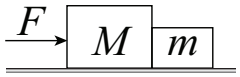
24. A ferry boat is sailing at 12 km/h 30°W of N with respect to a wide river that is flowing at 6.0 km/h E. As observed from the shore, the ferry boat is sailing:

(1) due N (2) 30°W of N (3) 45°E of N (4) 30°E of N (5) none of these

25. For a garden installation a series of flat stones are being stacked one atop the other. The first in contact with the ground weighs 50 N, the second 100 N, the third 150 N, and the fourth 200 N. The net force acting on the second stone (in N) is

(1) zero (2) 100 (3) 150 (4) 350 (5) 450

26. Two blocks of different masses M and m, labeled as such in the figure, lie on a frictionless surface and are accelerated by the force labeled F which pushes on block M. The force acting on mass m is:



(1) $mF/(m+M)$ (2) mF/M (3) $mF/(m-M)$ (4) $MF/(M+m)$ (5) MF/m

27. A 1200 kg elevator accelerates upwards at 3.00 m/s^2. The tension in the cable lifting the elevator (in N) has value closest to:

(1) 15,400 (2) 14,800 (3) 14,200 (4) 13,800 (5) 13,200

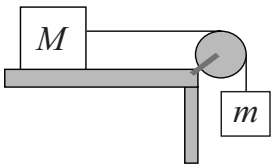
28. A 1200 kg elevator accelerates upwards at 2.50 m/s^2. The tension in the cable lifting the elevator (in N) has value closest to:

(1) 14,800 (2) 15,400 (3) 14,200 (4) 13,800 (5) 13,200

29. A 1200 kg elevator accelerates upwards at 2.00 m/s^2. The tension in the cable lifting the elevator (in N) has value closest to:

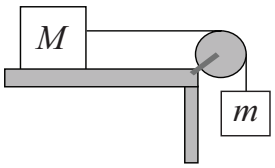
(1) 14,200 (2) 15,400 (3) 14,800 (4) 13,800 (5) 13,200

30. A block of mass $M = 5.0$ kg resting on a frictionless table is connected via a massless string, across a massless, frictionless pulley, to a hanging block of mass $m = 3.2$ kg. The system is let go to accelerate under Earth's gravity. The magnitude of that acceleration (in m/s^2) is



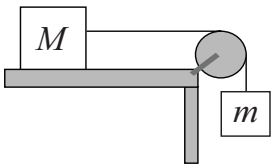
(1) 3.8 (2) 4.5 (3) 5.0 (4) 3.2 (5) 6.1

31. A block of mass $M = 5.0$ kg resting on a frictionless table is connected via a massless string, across a massless, frictionless pulley, to a hanging block of mass $m = 4.2$ kg. The system is let go to accelerate under Earth's gravity. The magnitude of that acceleration (in m/s^2) is



(1) 4.5 (2) 3.8 (3) 5.0 (4) 3.2 (5) 6.1

32. A block of mass $M = 5.0$ kg resting on a frictionless table is connected via a massless string, across a massless, frictionless pulley, to a hanging block of mass $m = 5.2$ kg. The system is let go to accelerate under Earth's gravity. The magnitude of that acceleration (in m/s^2) is



(1) 5.0 (2) 3.8 (3) 4.5 (4) 3.2 (5) 6.1

33. The speed of a 0.42-kg hockey puck, sliding across a level ice surface, decreases at the rate of 0.61 m/s^2. The coefficient of kinetic friction between the puck and ice is:

(1) 0.062 (2) 0.074 (3) 0.085 (4) 0.091 (5) 0.051

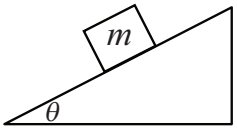
34. The speed of a 0.42-kg hockey puck, sliding across a level ice surface, decreases at the rate of 0.72 m/s^2. The coefficient of kinetic friction between the puck and ice is:

(1) 0.074 (2) 0.062 (3) 0.085 (4) 0.091 (5) 0.051

35. The speed of a 0.42-kg hockey puck, sliding across a level ice surface, decreases at the rate of 0.83 m/s^2. The coefficient of kinetic friction between the puck and ice is:

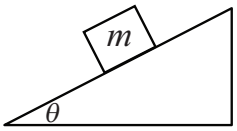
(1) 0.085 (2) 0.062 (3) 0.074 (4) 0.091 (5) 0.051

36. A block of unknown mass m is held on an incline for which $\theta = 40°$. The coefficient of kinetic friction $\mu_k = 0.10$ between the block and the incline. When the block is let go its acceleration down the incline (in m/s^2) is:



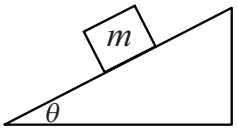
(1) 5.5 (2) 4.8 (3) 4.0 (4) 3.3 (5) mass of block needed to answer

37. A block of unknown mass m is held on an incline for which $\theta = 40°$. The coefficient of kinetic friction $\mu_k = 0.20$ between the block and the incline. When the block is let go its acceleration down the incline (in m/s^2) is:



(1) 4.8 (2) 5.5 (3) 4.0 (4) 3.3 (5) mass of block needed to answer

38. A block of unknown mass m is held on an incline for which $\theta = 40°$. The coefficient of kinetic friction $\mu_k = 0.30$ between the block and the incline. When the block is let go its acceleration down the incline (in m/s^2) is:



(1) 4.0 (2) 5.5 (3) 4.8 (4) 3.3 (5) mass of block needed to answer

39. While driving at constant speed around a traffic circle with a radius of 40 m you notice that the air freshener dangling from the rear view mirror is hanging at a steady angle of 20° with respect to the vertical. The speed of the car in m/s is:

(1) 11.9 (2) 10.2 (3) 8.3 (4) 6.8 (5) 5.1

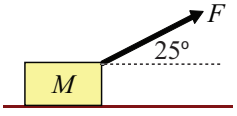
40. While driving at constant speed around a traffic circle with a radius of 40 m you notice that the air freshener dangling from the rear view mirror is hanging at a steady angle of 15° with respect to the vertical. The speed of the car in m/s is:

(1) 10.2 (2) 11.9 (3) 8.3 (4) 6.8 (5) 5.1

41. While driving at constant speed around a traffic circle with a radius of 40 m you notice that the air freshener dangling from the rear view mirror is hanging at a steady angle of 10° with respect to the vertical. The speed of the car in m/s is:

(1) 8.3 (2) 11.9 (3) 10.2 (4) 6.8 (5) 5.1

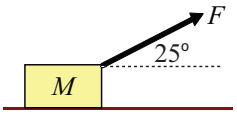
42. A crate of mass $M = 40$ kg is to be dragged across a floor by a rope pulled by a force $F = 120$ N acting at an angle of 25° from the horizontal. The coefficient of kinetic friction $\mu_k = 0.23$ between the crate and floor. The crate's acceleration (in m/s^2) is:



(1) 0.76 (2) 1.5 (3) 2.3 (4) 3.0 (5) 3.7

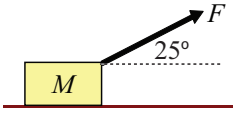
77777

43. A crate of mass $M = 40$ kg is to be dragged across a floor by a rope pulled by a force $F = 150$ N acting at an angle of 25° from the horizontal. The coefficient of kinetic friction $\mu_k = 0.23$ between the crate and floor. The crate's acceleration (in m/s^2) is:



(1) 1.5 (2) 0.76 (3) 2.3 (4) 3.0 (5) 3.7

44. A crate of mass $M = 40$ kg is to be dragged across a floor by a rope pulled by a force $F = 180$ N acting at an angle of 25° from the horizontal. The coefficient of kinetic friction $\mu_k = 0.23$ between the crate and floor. The crate's acceleration (in m/s^2) is:



(1) 2.3 (2) 0.76 (3) 1.5 (4) 3.0 (5) 3.7

FOLLOWING GROUPS OF QUESTIONS WILL BE SELECTED AS ONE GROUP FROM EACH TYPE
TYPE 1
Q# S 1
Q# S 2
TYPE 2
Q# S 4
Q# S 5
TYPE 3
Q# S 6
Q# S 7
Q# S 8
TYPE 4
Q# S 9
Q# S 10
Q# S 11
TYPE 5
Q# S 12
Q# S 13
Q# S 14
TYPE 6
Q# S 17
Q# S 18
Q# S 19
TYPE 7
Q# S 20
Q# S 21
Q# S 22
TYPE 8
Q# S 27
Q# S 28
Q# S 29
TYPE 9
Q# S 30
Q# S 31
Q# S 32
TYPE 10
Q# S 33
Q# S 34
Q# S 35
TYPE 11
Q# S 36
Q# S 37
Q# S 38
TYPE 12
Q# S 39
Q# S 40
Q# S 41
TYPE 13
Q# S 42
Q# S 43
Q# S 44