Instructor(s): *C. Parks*

PHYSICS DEPARTMENT

PHY2053, Summer 2015 EXAM 1 June 9, 2015

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.

Given Information:

$g = 9.80$ m/s^2 $G = 6.67 \times 10^{-11}$ Nm^2/kg^2 1 kg = 1000 g 1 m = 100 cm
1 hour = 60 minutes 1 minute = 60 seconds 1 rev = 2π radians π radians = 180°

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1. Driving along the interstate, you travel 105 miles in 1.5 hours. Next you enter a construction zone where you drive at 40 mph for 30 minutes. Leaving the construction zone you enter a city and drive another 30 minutes and travel 25 miles. What is the average velocity of the entire trip?

   (1) 60 mph (2) 53 mph (3) 59 mph (4) 63 mph (5) None of these.

2. Driving along the interstate, you travel 100 miles in 1.5 hours. Next you enter a construction zone where you drive at 35 mph for 30 minutes. Leaving the construction zone you enter a city and drive another 30 minutes and travel 30 miles. What is the average velocity of the entire trip?

   (1) 59 mph (2) 54 mph (3) 60 mph (4) 53 mph (5) None of these.

3. Driving at 27 m/s (about 60 mph), you suddenly see a Krispy Kreme store 120 m ahead with the HOT DOUGHNUTS NOW sign illuminated. As any sane person would do, you slam on the brakes. The magnitude of your acceleration is 3.0 m/s^2. What is your speed as you pass the store?

   (1) 3.0 m/s (2) 38 m/s (3) 33 m/s (4) 2.0 m/s (5) None of these.

4. Driving at 22 m/s (about 50 mph), you suddenly see a Krispy Kreme store 120 m ahead with the HOT DOUGHNUTS NOW sign illuminated. As any sane person would do, you slam on the brakes. The magnitude of your acceleration is 4.0 m/s^2. What is your speed as you pass the store?

   (1) None of these. (2) 38 m/s (3) 31 m/s (4) 2.0 m/s (5) 3.0 m/s

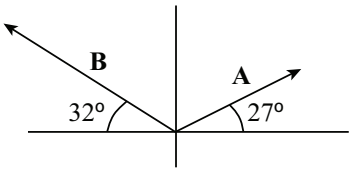
5. Walking past a construction site, you see a roofing tile dropped from the top of a building fall into a dumpster. It takes 2.0 s for the tile to fall. How long after the tile is dropped will the roofer hear the thud of the tile as it hits the dumpster? The speed of sound is 340 m/s.

   (1) 0.058 s (2) 0.12 s (3) 0.073 s (4) 0.070 s (5) None of these.

6. Walking past a construction site, you see a roofing tile dropped from the top of a building fall into a dumpster. It takes 2.2 s for the tile to fall. How long after the tile is dropped will the roofer hear the thud of the tile as it hits the dumpster? The speed of sound is 340 m/s.

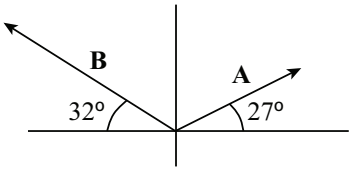
   (1) 0.070 s (2) 0.058 s (3) 0.073 s (4) 0.14 s (5) None of these.

7. Find the direction of $\vec{A} + \vec{B}$. The magnitude of A is 9.0 N and the magnitude of B is 13.0 N. The direction is measured counterclockwise from the $+x$-axis.



   (1) 105°
   (2) 285°
   (3) 344°
   (4) 164°
   (5) None of these.

8. Find the direction of $\vec{A} + \vec{B}$. The magnitude of A is 6.0 N and the magnitude of B is 9.0 N. The direction is measured counterclockwise from the $+x$-axis.



   (1) 107°
   (2) 287°
   (3) 343°
   (4) 163°
   (5) None of these.

9. It was a dark and foggy night and you could barely see your hand in front of your face. Nevertheless, you had to take the boat to the other side of the river. The boat heads at 24° north of east relative to the water and its speed is 10 mph through still water. The current is 5 mph due north. What is your speed (relative to the ground) as you cross the river?

   (1) 13 m/s (2) 15 m/s (3) 11 m/s (4) 9.0 m/s (5) None of these.

10. It was a dark and foggy night and you could barely see your hand in front of your face. Nevertheless, you had to take the boat to the other side of the river. The boat heads at 24° north of east relative to the water and its speed is 10 mph through still water. The current is 5 mph due north. What is your direction as you cross the river?

    (1) 45° N of E (2) 47° N of E (3) 63° N of E (4) 60° N of E (5) None of these.

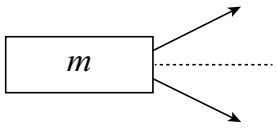
11. From the top of a 14.4 m tall tower, you throw a rock with an unknown velocity directed 40° above the horizontal. The rock hits the ground 45 m from the base of the tower. What is the maximum height of the rock above the ground (not just above the tower)?

    (1) 21 m (2) 23 m (3) 25 m (4) 27 m (5) None of these.

12. From the top of a 10.2 m tall tower, you throw a rock with an unknown velocity directed 40° above the horizontal. The rock hits the ground 50 m from the base of the tower. What is the maximum height of the rock above the ground (not just above the tower)?

    (1) 19 m (2) 21 m (3) 23 m (4) 25 m (5) None of these.

13. The forces in the diagram are both 25 N and they make 30° angles above and below the horizontal respectively. The acceleration of m is 1.2 m/s^2. What is the value of m? No other forces are acting.



    (1) 36 kg (2) 42 kg (3) 29 kg (4) 25 kg (5) None of these.

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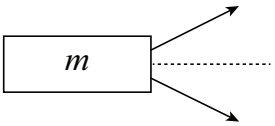
14. The forces in the diagram are both 15 N and they make 30° angles above and below the horizontal respectively. The acceleration of m is 1.3 m/s^2. What is the value of m? No other forces are acting.



(1) 20 kg (2) 23 kg (3) 16 kg (4) 25 kg (5) None of these.

15. While running 4.2 m/s, a 30-kg Raichu slips, falls, and slides to a stop. The coefficient of kinetic friction between Raichu and the level floor is 0.3. How far did he slide?

(1) 3.0 m
(2) 6.0 m
(3) 0.51 m
(4) 3.8 m
(5) None of these.

16. While running 4.8 m/s, a 30-kg Raichu slips, falls, and slides to a stop. The coefficient of kinetic friction between Raichu and the level floor is 0.3. How far did he slide?

(1) 3.9 m
(2) 7.8 m
(3) 1.1 m
(4) 2.7 m
(5) None of these.

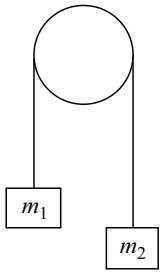
17. Sliding with constant velocity, a block of mass m descends a plane inclined at θ with respect to the horizontal. If m is replaced with a mass $2m$, what angle is needed for $2m$ to descend also at constant velocity? The coefficients of kinetic friction are the same for both blocks.

(1) θ (2) 2θ (3) $\theta/2$ (4) Cannot be determined without knowing the value of m (5) None of these.

18. Sliding with constant velocity, a block of mass m descends a plane inclined at θ with respect to the horizontal. If m is replaced with a mass $m/2$, what angle is needed for $m/2$ to descend also at constant velocity? The coefficients of kinetic friction are the same for both blocks.

(1) θ (2) 2θ (3) $\theta/2$ (4) Cannot be determined without knowing the value of m (5) None of these.

19. Find the y-component of the acceleration of m_1. The masses are $m_1 = 6$ kg and $m_2 = 2$ kg. Use our normal convention where up is positive.



(1) -4.9 m/s^2
(2) 4.9 m/s^2
(3) -6.5 m/s^2
(4) 6.5 m/s^2
(5) None of these.

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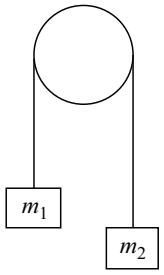
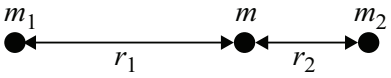
20. Find the y-component of the acceleration of m_1. The masses are $m_1 = 8$ kg and $m_2 = 2$ kg. Use our normal conventions where up is positive.



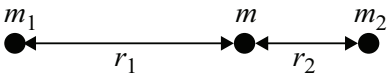
(1) -5.9 m/s^2
(2) 5.9 m/s^2
(3) -7.4 m/s^2
(4) 7.4 m/s^2
(5) None of these.

21. Find the magnitude of the net gravitational force acting on m. The masses are $m = 1.0 \times 10^4$ kg, $m_1 = 5.0 \times 10^{18}$ kg, $m_2 = 6.0 \times 10^{18}$ kg. The distances are $r_1 = 1.0 \times 10^6$ m and $r_2 = 5.0 \times 10^5$ m.



(1) 13 N (2) 19 N (3) 16 N (4) 3.3 N (5) None of these.

22. Find the magnitude of the net gravitational force acting on m. The masses are $m = 1.0 \times 10^4$ kg, $m_1 = 6.0 \times 10^{18}$ kg, $m_2 = 7.0 \times 10^{18}$ kg. The distances are $r_1 = 1.0 \times 10^6$ m and $r_2 = 5.0 \times 10^5$ m.



(1) 15 N (2) 23 N (3) 4.0 N (4) 19 N (5) None of these.

23. A spinning wheel rotates 18 times in 30 seconds. What is the speed of a point on the wheel, 0.30 m from the axis?

(1) 1.1 m/s (2) 0.18 m/s (3) 0.50 m/s (4) 0.77 m/s (5) None of these.

24. A spinning wheel rotates 25 times in 30 seconds. What is the speed of a point on the wheel, 0.30 m from the axis?

(1) 1.6 m/s (2) 0.25 m/s (3) 0.36 m/s (4) 1.3 m/s (5) None of these.

25. A car approaches the top of a hill that is shaped like a vertical circle with a radius of 55.0 m. What is the fastest speed that the car can go over the hill without losing contact with the ground?

(1) 23 m/s (2) 33 m/s (3) 16 m/s (4) 21 m/s (5) None of these.

26. A 0.70-m diameter flywheel starts from rest and accelerates to an angular speed of 34 rad/s in 10 seconds. What is the tangential acceleration of a point on the rim of the flywheel?

(1) 1.2 m/s^2 (2) 2.4 m/s^2 (3) 3.4 m/s^2 (4) 4.2 m/s^2 (5) None of these

27. A 0.60-m diameter flywheel starts from rest and accelerates to an angular speed of 40 rad/s in 15 seconds. What is the tangential acceleration of a point on the rim of the flywheel?

(1) 0.80 m/s^2 (2) 1.6 m/s^2 (3) 2.7 m/s^2 (4) 0.45 m/s^2 (5) None of these

28. A wheel's angular acceleration is constant. Initially its angular velocity is zero. In the first second, the wheel rotates 90°. What is the total rotation of the wheel two seconds later (a total of three seconds after it starts moving)? The wheel's radius is 0.20 m.

(1) 810° (2) 360° (3) 270° (4) 720° (5) None of these.

29. A wheel's angular acceleration is constant. Initially its angular velocity is zero. In the first second, the wheel rotates 60°. What is the total rotation of the wheel two seconds later (a total of three seconds after it starts moving)? The wheel's radius is 0.20 m.

(1) 540° (2) 240° (3) 480° (4) 180° (5) None of these.

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 3
Q# S 4
TYPE 3
Q# S 5
Q# S 6
TYPE 4
Q# S 7
Q# S 8
TYPE 5
Q# S 9
Q# S 10
TYPE 6
Q# S 11
Q# S 12
TYPE 7
Q# S 13
Q# S 14
TYPE 8
Q# S 15
Q# S 16
TYPE 9
Q# S 17
Q# S 18
TYPE 10
Q# S 19
Q# S 20
TYPE 11
Q# S 21
Q# S 22
TYPE 12
Q# S 23
Q# S 24
TYPE 13
Q# S 26
Q# S 27
TYPE 14
Q# S 28
Q# S 29