

Instructor(s): *C. Parks*PHYSICS DEPARTMENT
EXAM 1

June 5, 2013

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:

$$g = 9.80 \text{ m/s}^2 \quad G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2 \quad 8 \text{ furlongs} = 1 \text{ mile} \quad 1 \text{ week} = 7 \text{ days}$$

$$1 \text{ day} = 24 \text{ hours} \quad 1 \text{ hour} = 60 \text{ minutes} \quad 1 \text{ minute} = 60 \text{ seconds} \quad 1 \text{ rev} = 2\pi \text{ radians}$$

1. Newton's law of universal gravitation can be used to find the attractive force between any two mass m_1 and m_2 separated by a distance r . For a particular choice of m_1 , m_2 , and r , the force is F . What must happen to double F ?
 - (1) Double m_1
 - (2) Double m_1 and m_2
 - (3) Double r
 - (4) Halve r
 - (5) Double m_1 , m_2 , and r

2. The speed of light is 186,282 miles/s. What is the speed of light in furlongs/fortnight? A fortnight is 2 weeks.
 - (1) 1.8×10^{12} furlongs/fortnight
 - (2) 3.0×10^{10} furlongs/fortnight
 - (3) 2.3×10^{11} furlongs/fortnight
 - (4) 1.4×10^{13} furlongs/fortnight
 - (5) 9.0×10^{11} furlongs/fortnight

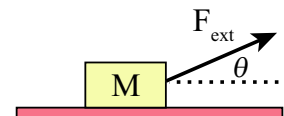
3. Your average speed for a 1 hour 15 minute trip is 36 mph. For the first 30 minutes, your average speed is 30 mph. What is your average speed for the other portion of the trip?
 - (1) 40 mph
 - (2) 45 mph
 - (3) 35 mph
 - (4) 50 mph
 - (5) 55 mph

4. A car has a constant acceleration. After 10 s, the car has traveled 120 m. In another 2 s, the car travels 48 m further. What is the initial speed of the car?
 - (1) 2.0 m/s
 - (2) 0 m/s
 - (3) 1.0 m/s
 - (4) 3.0 m/s
 - (5) None of these.

5. Starting from rest, it takes 10 s to travel 100 m. What is the final velocity after another 300 m? The acceleration is constant throughout the motion.
 - (1) 40 m/s
 - (2) 110 m/s
 - (3) 130 m/s
 - (4) 28 m/s
 - (5) None of these.

6. A bridge is 19.6 m above a river. You stand on the bridge with two stones in your hand. You drop the first stone and one second later you throw the second stone. What is the magnitude of the velocity of the second stone needed so both stones hit the water at the same time?
 - (1) 15 m/s
 - (2) 45 m/s
 - (3) 9.8 m/s
 - (4) 3.9 m/s
 - (5) None of these.

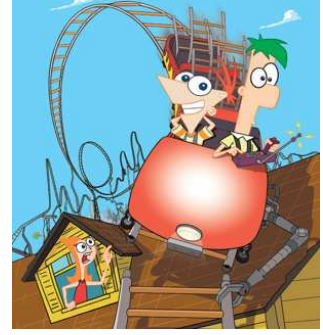
7. The running back breaks free. He runs for 20 yards due N, then runs 45° W of N for another 30 yards before being tackled. What is the magnitude of his displacement?
- (1) 46 yards (2) 50 yards (3) 36 yards (4) 63 yards (5) None of these.
8. A 30-N force acts at 35° above the $+x$ -axis. What additional force is needed to make the resultant force act along the $+x$ -axis with a magnitude of 75 N?
- (1) 53 N at 19° below the $+x$ -axis
 (2) 53 N at 19° above the $+x$ -axis
 (3) 40 N at 35° below the $+x$ -axis
 (4) 40 N at 35° below the $+x$ -axis
 (5) 66 N at 19° below the $+x$ -axis
9. Jack wants to row directly across river from the east shore to a point on the west shore. The width of the river is 250 m and the current flows from north to south at 0.61 m/s. The trip takes Jack 4.2 minutes. In what direction did he head his rowboat to follow a course due west across the river?
- (1) 32° N of W (2) due W (3) 38° N of W (4) 32° S of W (5) 38° S of W
10. A ball is thrown horizontally from the top of a 78.4-m tall building. The ball hits the ground a distance of 80 m from the base of the building. What velocity is needed to double the range of the throw? The ball is thrown horizontally again.
- (1) 40 m/s (2) 20 m/s (3) 28 m/s (4) 9.8 m/s (5) None of these.
11. A machine hits a golf ball from the ground over a horizontal field. The ball is in the air for 5.85 s and it travels 240 m downrange. What is the velocity of the ball when it hits the ground? Ignore air resistance. The trig identity $\sin 2\theta = 2 \sin \theta \cos \theta$ will prove useful.
- (1) 50 m/s (2) 35 m/s (3) 41 m/s (4) 21 m/s (5) None of these.
12. A block of wood sits motionless on a horizontal table. Use Newton's third law to determine the interaction partner for the weight of the block.
- (1) The block pulls up on the earth.
 (2) The normal force of the table pushing up on the block.
 (3) The static friction force of the table on the block.
 (4) No interaction partner exists.
 (5) None of these.
13. A 1000 kg rocket sits on the launching pad. When the rocket ignites, the engine provides 49000 N of force. What is the acceleration of the rocket?
- (1) 39 m/s^2 (2) 49 m/s^2 (3) 9.8 m/s^2 (4) 20 m/s^2 (5) None of these.
14. A 4-kg mass slides along the floor while an external force F_{ext} is applied at an upward angle $\theta = 25^\circ$. If the coefficient of kinetic friction between the block and the floor is 0.3, and the block slides at constant velocity, what is the magnitude of the external force?



- (1) 11 N (2) 12 N (3) 28 N (4) 13 N (5) None of these.

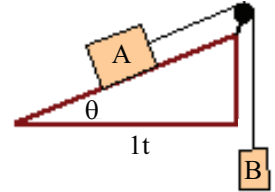
15. Phineas says to Ferb, "I know what we are going to do today." They build a roller coaster which is made of a straight piece of track inclined at an angle of 30° . When Phineas rides in the roller coaster, his speed at the bottom is 10 m/s . When Ferb, Buford, and Isabella ride with Phineas, the mass of the roller coaster doubles. What is their speed at the bottom of the track? Assume friction can be ignored.

- (1) 10 m/s
- (2) 20 m/s
- (3) 5 m/s
- (4) 7.1 m/s
- (5) None of these.



16. In the figure $M_A = 10 \text{ kg}$ and $M_B = 5 \text{ kg}$. The angle is 37° . What is the acceleration of M_B ? The surface is frictionless.

- (1) 0.67 m/s^2 up
- (2) 2.0 m/s^2 up
- (3) 0
- (4) 3.3 m/s^2 up
- (5) None of these.



17. A wheel rotates at 36 rev/min . What is its angular displacement after 45 seconds?

- (1) 170 rad
- (2) 1600 rad
- (3) 27 rad
- (4) 10000 rad
- (5) None of these.

18. In class, I swung a bucket with 2 kg of water in a circle without spilling (too much). Assuming that my arm is 1 m long, what is the minimum speed at the top of the circle so that the water does not spill out of the bucket?

- (1) 3.1 m/s
- (2) 20 m/s
- (3) 9.8 m/s
- (4) 4.4 m/s
- (5) None of these.

19. The London Eye has a radius of 67.5 m . While rotating at its operating speed, it takes 30 minutes to complete one revolution. Suppose it takes 20 s to bring it from rest to its operating speed. What is the angular displacement while it accelerates?

- (1) $3.5 \times 10^{-2} \text{ rad}$
- (2) 2.3 rad
- (3) 3.4 rad
- (4) $3.5 \times 10^{-3} \text{ rad}$
- (5) None of these.



20. A spinning wheel is accelerating. A point 0.25 m from the axle of the wheel has a net acceleration of 1.6 m/s^2 . If the angular speed of the wheel is 2 rad/s , what is the angular acceleration of the wheel?

- (1) 5.0 rad/s^2
- (2) 2.4 rad/s^2
- (3) 10 rad/s^2
- (4) 7.5 rad/s^2
- (5) None of these.