Instructor(s): *Matcheva/Rinzler/Acosta*

PHYSICS DEPARTMENT

PHY 2048, Spring 2016 Exam 1 February 4, 2016

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.

Use $g = 9.81$ m/s^2 unless the problem states otherwise. Air drag is neglected.

1. A 1-meter wide nature path is to be covered with an asphalt layer, which is 1 inch thick. What is the length of the finished path in meters if the workers used 10 yd^3 of asphalt? Use 1in = 2.54 cm, 12in = 1ft, 3ft = 1yd.

   (1) 300 m (2) 390 m (3) 250 m (4) 180 m (5) 150 m

2. How many milliseconds (ms) are there in one day?

   (1) 86.4×10^6 (2) 51.84×10^5 (3) 311.04×10^6 (4) 1.44×10^3 (5) 1.44×10^6

3. A UF student bikes from home to the physics department with a constant speed of 6 m/s and then immediately bikes back home with a constant speed of 3 m/s. What is the average speed and what is the average velocity (in m/s) of the student for the entire trip (in that order)?

   (1) 4 and 0 (2) 4.5 and 0 (3) 4.5 and 4.5 (4) 5 and 0 (5) 5 and 5

4. The position of a particle moving along the x axis is given by $x(t) = 2 + 12t^2 - 2t^3$. Find the acceleration (in m/s^2) of the particle for $t > 0$ when it momentarily stops. All variables are given in basic SI units.

   (1) -24 (2) 0 (3) 12 (4) 6 (5) -12

5. A drag race car is driving on a straight road track with a constant speed of 64 m/s when the driver hits the brakes. How many seconds does it take for the car to stop if the non-constant deceleration is $a = -2t$ m/s^2, where t is the time in seconds?

   (1) 8 s (2) 4 s (3) 6 s (4) 2 s (5) 10 s

6. If the maximum constant acceleration that is tolerable for passengers in a subway train is 1.34 m/s^2 and the subway stations are located 800 m apart, what is the maximum speed the train can attain between stations if it stops at each station?

   (1) 33 m/s (2) 46 m/s (3) 52 m/s (4) 26 m/s (5) 40 m/s

7. A hot air balloon is ascending at a rate of 10 m/s and is 75 m above the ground when a package is dropped over the side. How long does it take for the package to reach the ground?

(1) 5 s (2) 3 s (3) 4 s (4) 6 s (5) 7 s

8. The result of the expression $(\hat{\imath} \times \hat{\jmath}) \times \hat{k}$ is

(1) 0 (2) 1 (3) $\hat{\imath}$ (4) $-\hat{\imath}$ (5) $\hat{\jmath}$

9. The position vector of a moving particle at some time t is $\vec{r}_1 = 2\hat{\imath} - 3\hat{\jmath}$. Some time later the particle is at position $\vec{r}_2 = -3\hat{\imath} + 6\hat{\jmath}$. Find the magnitude of the displacement. All vectors are given in meters.

(1) 10.3 (2) 14 (3) 4 (4) 5.8 (5) 3.2

10. Find the interior angle between the vectors $\vec{a}$ and $\vec{b}$ if $\vec{a} = 5\hat{\imath} + 3\hat{\jmath}$ and $\vec{b} = -2\hat{\imath} - 4\hat{\jmath}$.

(1) 148 degrees (2) 32 degrees (3) 58 degrees (4) 122 degrees (5) 63 degrees

11. The position of an aircraft is tracked by radar and it is given by vector $\vec{r}(t) = 3\hat{\imath} + 2t^2\hat{\jmath} + (1 - 2t^2)\hat{k}$, where $\vec{r}$ is in meters and t is the time in seconds. What is the magnitude of the acceleration (in m/s^2) of the plane at $t = 4$s?

(1) 5.7 (2) 0 (3) 4 (4) 3.5 (5) 2.8

12. The position of a football player on the field is described by the vector $\vec{r}(t) = (2t^2 - 8t)\hat{\imath} + (3t - 12)\hat{\jmath}$, where t is the time in seconds and r is in meters. What is the x coordinate of the player when his y coordinate is 12 m?

(1) 64 m (2) 32 m (3) 75 m (4) 54 m (5) 48 m

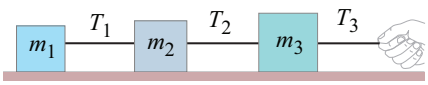
13. During a tennis match a tennis player serves the ball at 23.6 m/s with the center of the ball leaving the racquet horizontally 2.37 m above the court surface. The net is 12 m away and 0.9 m high. What is the distance between the center of the ball and the top of the net when the ball flies over the net?

(1) 0.20 m (2) 0.15 m (3) 0.55 m (4) 0.36 m (5) 0.44 m

14. A coin is dropped from a 20 m high bridge. Simultaneously a second coin is tossed from the same bridge horizontally with an initial speed of 10 m/s. Find the difference between the arrival times of the two coins when they hit the ground. Neglect air resistance.

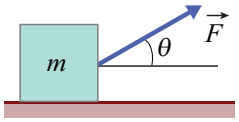
(1) 0 s (2) 3 s (3) 4 s (4) 5 s (5) 2 s

15. Three connected blocks are pulled to the right on a horizontal frictionless table by a force $T_3 = 65$ N as shown in the sketch. If $m_1 = 12$ kg, $m_2 = 24$ kg, and $m_3 = 31$ kg, calculate the magnitude of the tension T_1.



(1) 11.6 N (2) 65 N (3) 35.2 N (4) 20.5 N (5) 5 N

16. A box of mass $m = 5.0$ kg is being pulled by a force F at 30 degree angle to the horizontal along a frictionless horizontal surface. The block's acceleration is 3 m/s^2. Find the magnitude of the force with which the box presses on the table.

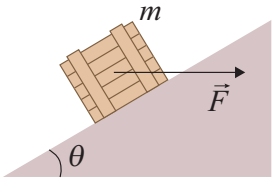


(1) 40.4 N (2) 36.0 N (3) 49.0 N (4) 7.5 N (5) 26.0 N

17. A delusional dieter stands on a weight scale in a stationary elevator. The scale shows 700 N. The dieter then pushes a button for a lower floor, and as the elevator accelerates the scale shows a reading of 600 N. What is the magnitude of the acceleration of the elevator?

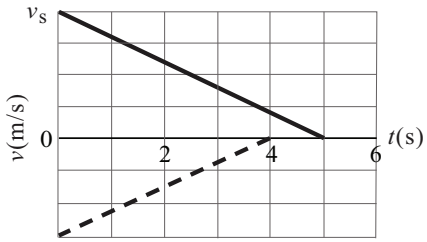
(1) 1.4 m/s^2 (2) 1.6 m/s^2 (3) 1.8 m/s^2 (4) 9.8 m/s^2 (5) 0 m/s^2

18. A 100 N crate is pushed up a frictionless incline with a constant speed by a constant horizontal force F as shown in the figure. The angle of the slope is $\theta = 60°$. What is the force with which the crate acts on the hill?



(1) 200 N (2) 400 N (3) 273 N (4) 100 N (5) 129 N

19. As two trains move along a track, their conductors suddenly notice that they are headed toward each other. The plot gives their velocities v as functions of time t as the conductors slow the trains. The plot's vertical scaling is set by $v_s = 40$ m/s. The slowing processes begin when the trains are 200 m apart. What is their separation when both trains have stopped?



(1) 40 m (2) 10 m (3) 20 m (4) 30 m (5) 50 m

20. A particle is performing a uniform circular motion. How many of the following statements about this particle are correct:
(i) A non zero net force is acting on the particle.
(ii) The speed of the particle is constant.
(iii) The linear velocity of the particle is constant.
(iv) The particle has an acceleration.

(1) 3 (2) 1 (3) 2 (4) 4 (5) 0