Instructor(s): *Matcheva/Sabin*

PHYSICS DEPARTMENT

PHY 2048 Exam 1 February 1, 2011

Name (print, last first): KEY 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 = 10 m/s^2 as the acceleration due to gravity.

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1. A car starts from Hither, goes 50 km in a straight line to Yon, immediately turns around, and returns to Hither. The time for this round trip is 2 hours. The magnitude of the average velocity of the car for this round trip is:

(1) 0 (2) 50 km/hr (3) 100 km/hr (4) 200 km/hr (5) cannot be calculated without knowing the acceleration

$\frac{v_0 + (-v_0)}{2} = 0$

2. Which of the following statements is correct for an object dropped from rest?

$v = v_0 + at = 0 + 10 \cdot 1$ $g = 10$

$\bar{v} = \frac{v + v_0}{2} = 5$

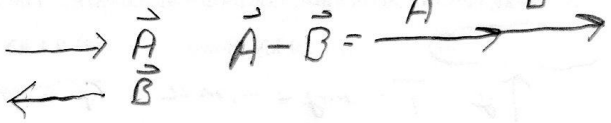
(1) The average velocity during the first second of time is 5 m/s.
(2) During each second the object falls 10 m.
(3) The acceleration changes by 10 m/s every second.
(4) The object falls 10 m during the first second of time.
(5) The acceleration of the object is proportional to its weight.

3. A baseball is hit straight up and is caught by the catcher 2.0 s later. The maximum height of the ball during the interval is:

(1) 5 m (2) 7.5 m (3) 10 m (4) 12.8 m (5) 20 m

$\Delta y_{down} = v_0 t - \frac{1}{2} g t^2 = 0 = 0 - \frac{1}{2} \cdot 10 \cdot 1^2 = 5$

4. If $|\vec{A} - \vec{B}| = A + B$ and neither $\vec{A}$ nor $\vec{B}$ vanish, then



(1) $\vec{A}$ and $\vec{B}$ are parallel and in opposite directions.
(2) $\vec{A}$ and $\vec{B}$ are parallel and in the same direction.
(3) the angle between $\vec{A}$ and $\vec{B}$ is 45°.
(4) the angle between $\vec{A}$ and $\vec{B}$ is 60°.
(5) $\vec{A}$ is perpendicular to $\vec{B}$.

5. Let $\vec{V} = 2.00\hat{i} + 6.00\hat{j} - 3.00\hat{k}$. The magnitude of $\vec{V}$ is:

(1) 7.00 (2) 5.00 (3) 5.57 (4) 7.42 (5) 8.54

$(2^2 + 6^2 + (-3)^2)^{1/2} = \sqrt{49} = 7$

6. Vectors $\vec{A}$ and $\vec{B}$ each have magnitude L. When drawn with their tails at the same point, the angle between them is 30°. The magnitude of $\vec{A} \times \vec{B}$ is:

(1) $L^2/2$ (2) L^2 (3) $\sqrt{3}L^2/2$ (4) $2L^2$ (5) none of these

$\sin\theta = \frac{|\vec{A} \times \vec{B}|}{AB}$ $|\vec{A} \times \vec{B}| = L \cdot L \cdot \sin 30 = \frac{1}{2} L^2$

7. The value of $\hat{i} \cdot (\hat{j} \times \hat{k})$ is $\hat{j} \times \hat{k} = \hat{i}$ $\hat{i} \times \hat{i} = 1$

(1) +1 (2) −1 (3) 3 (4) $\sqrt{3}$ (5) zero

8. A projectile is fired over level ground with an initial velocity that has a vertical component of 20 m/s and a horizontal component of 30 m/s. The distance from launching to landing points is:

(1) 120 m (2) 40 m (3) 60 m (4) 80 m (5) 180 m

$y = y_0 + v_0 t - \frac{1}{2} g t^2$ $0 = v_0 - \frac{1}{2} g t^2$ $t = 4$ $4 v_x = 120$

9. A girl on a merry-go-round moves horizontally in a circle at constant speed. She travels one fourth of a revolution, a distance of 20 m along the circumference of the circle, in 2.5 s. The magnitude of her acceleration is:

(1) 5.0 m/s² (2) 1.25 m/s² (3) 2.5 m/s² (4) 0.62 m/s² (5) 4.0 m/s²

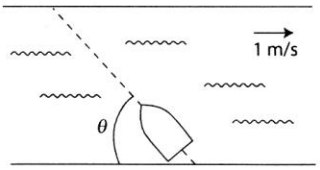
$C = 80 = 2\pi R$ $R = 12.7$ $a = \frac{v^2}{R} = \frac{8^2}{12.7} = 5.03$

$1 rev = 100$ $v = \frac{80}{10} = 8$

10. A boy wishes to row from one bank of the river to the other in the shortest possible time. He can row at 2 m/s in still water and the river is flowing at 1 m/s. At what angle θ should he point the bow (front) of his boat?

(1) 90°
(2) 30°
(3) 45°
(4) 60°
(5) 63°

to minimize time without regard to how far down the river he lands



11. We send a beam of light, traveling at the speed of light c, toward a distant galaxy, which is receding from us with a speed of $0.90c$. Observers in the galaxy see the light coming toward them with a speed of:

(1) c (2) 0 (3) $0.10c$ (4) $1.9c$ (5) $2.0c$

12. An object placed on an equal-arm balance requires 12 kg to balance it. When placed on a spring scale, the scale reads 12 kg. Everything (balance, scale, set of masses and object) is now transported to the moon where the force of gravity is one-sixth that on earth. The new reading so the balance and spring scale (respectively) are:

(1) 12 kg, 2 kg (2) 12 kg, 12 kg (3) 2 kg, 2 kg (4) 2 kg 12 kg (5) 12 kg, 72 kg

mass = Const = 12 $w = mg = 12 \cdot \frac{1}{6} 2$

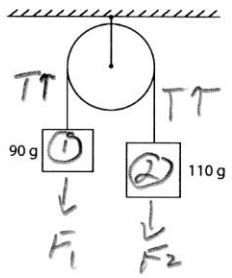
13. A 700-kg elevator accelerates downward at 3.0 m/s². The force exerted by the cable on the elevator is:

(1) 4.9 kN, up (2) 4.9 kN, down (3) 2.1 kN, up (4) 2.1 kN, down (5) 7.0 kN, up

$\uparrow y$ $T - mg = -ma$ $T = m(g - a) = 700 \cdot 7 = 4900$

14. Two blocks aree connected by a string and pulley as shown. Assuming that the string and pulley are massless, the magnitude of the acceleration of each block is:

(1) 1.0 m/s²
(2) 0.05 m/s²
(3) 0.02 m/s²
(4) 0.1 m/s²
(5) 10 m/s²



① $T - m_1 g = m_1 a$

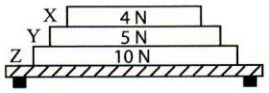
② $T - m_2 g = -m_2 a$

$m_1(a + g) = m_2(-a + g)$

$(m_1 + m_2) a = -(m_1 + m_2) g$

$a = \frac{m_2 - m_1}{m_1 + m_2} g = \frac{.02 \text{ kg}}{.2 \text{ kg}} \cdot g = 0.1 g$

15. Three books (X, Y, and Z) rest on a table. The weight of each book is indicated. The net force acting on book Y is:



at rest, so $F_{net} = 0$

(1) zero (2) 4 N down (3) 5 N up (4) 9 N down (5) none of these

16. You throw a ball straight up with $v = 10$ m/s. One second later, you throw a second ball up with $v = 10$ m/s. How long after you throw the FIRST ball do they collide?

(1) 1.5 s (2) 1.0 s (3) 2.5 s (4) 2.0 s (5) 1.8 s

$y_1 = v_0 t - \frac{1}{2} g t^2$ $y_2 = v_0 (t-1) - \frac{1}{2} g (t-1)^2 \Rightarrow y_1 = y_2$ $t = \frac{\frac{1}{2}g + v_0}{g} = \frac{15}{10}$

17. You are standing 34 m away from a school building. You throw a snowball with a speed of 20 m/s at an angle of 45° above the horizontal. The snowball barely goes inside an open window of the building. What is the vertical height of the window above the point where you released the snowball?

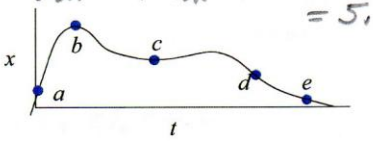
$v_{0x} = v_{0y}$ @ $\theta = 45$

(1) 5 m (2) 10 m (3) 3 m (4) 1 m (5) 20 m

$\Delta x = v_{0x} t$ $t = \frac{\Delta x}{v_{0x}}$ $y = y_0 + v_{0y} t - \frac{1}{2} g t^2 = 0 + v_{0y} \frac{\Delta x}{v_{0x}} - \frac{1}{2} g \frac{\Delta x^2}{v_{0x}^2} = 34 - 5 \frac{34^2}{(20 \cos 45)^2}$

$= 5.10$

18. The position x, as a function of time t, of a person walking along the lecture desk is described by the figure. At which of the labeled points is the magnitude of the velocity of the person greatest?



$v = dx/dt$, so where slope is greatest

(1) a (2) b (3) c (4) d (5) e

19. At which of the labeled points in the previous figure is the magnitude of the acceleration of the person greatest?

(1) b (2) a (3) c (4) d (5) e

$a = d^2x/dt^2$, so where curvature is greatest

20. The motion of a particle moving along the x-axis is given by $x(t) = t^3 - 48t + 10$. What is the acceleration at the instant the particle changes direction?

(1) 24 (2) 0 (3) It never changes direction (4) 12 (5) 96

$x = t^3 - 48t + 10$ $v = 3t^2 - 48$ $a = 6t$

for $v = 0$ $3t^2 = 48$ $t = 4$ $a(4) = 24$

THE FOLLOWING QUESTIONS, NUMBERED IN THE ORDER OF THEIR APPEARANCE ON THE ABOVE LIST, HAVE BEEN FLAGGED AS CONTINUATION QUESTIONS: 19