

Practice Physics 111 Common Exam 1

Name (Print): _____ UCID: _____ Section: _____

Honors Code Pledge: For ethical and fairness reasons all students are pledged to comply with the provisions of the NJIT Academic Honor Code. You must answer the exam questions entirely by yourself. **Turn off all cell phones, pagers, or other communication devices.** Use only your own calculator.

Instructions:

- First, write your name and section number on **both** the Scantron card and this exam booklet.
- Use the formula sheet (last page of exam booklet) and no other materials.
- All questions are worth 1 point each. You need to answer a total of 16 questions correctly for a 100% score on the exam. No partial credit.
- **Briefly show work on this set of exam sheets for problems which require calculations.** Use the backs of pages if necessary.
- **Answers are approximate.** Select the closest one.
- Answer each question on the Scantron card using #2 pencil. Also circle your answers on question papers.
- Do not hesitate to ask for clarification of any exam question, if needed, from your proctor or Professor.

1. 2 mm^3 is equivalent to:

- A) $2 \cdot 10^{-3} \text{ m}^3$
- B) $2 \cdot 10^{-6} \text{ m}^3$
- C) **$2 \cdot 10^{-9} \text{ m}^3$**
- D) $2 \cdot 10^{-12} \text{ m}^3$
- E) $2 \cdot 10^{-15} \text{ m}^3$

For the following 3 problems use the vectors:

$$\vec{A} = 1\hat{i} + 2\hat{j} + 0\hat{k} \quad \text{and} \quad \vec{B} = 2\hat{i} + 2\hat{j} + 0\hat{k}$$

2. Find the magnitude of $\vec{A} + \vec{B}$. Select the closest answer.

- A) 1
- B) 2
- C) 3
- D) 4
- E) **5**

3. Find the dot product $\vec{A} \cdot \vec{B}$ and the angle between vectors:

- A) 4, 33°
- B) 12, 38°
- C) **6, 48°**
- D) 3, 48°
- E) 9, 23°

4. At $t = 0$, a particle leaves the origin with a velocity of 8 m/s in the positive y direction and moves in the xy plane with a constant acceleration of $(-2.0\hat{i} + 4.0\hat{j}) \text{ m/s}^2$. How far from the origin is the particle 10 sec later?

- A) 100 m
- B) 210 m
- C) 297 m**
- D) 424 m
- E) 345 m

5. A body is projected vertically upward from the surface of the earth with a speed of 10.0 m/s. What is its speed (in m/s) when it is at $\frac{1}{2}$ of its maximum height?

- A) 0
- B) 2.5
- C) 5.0
- D) 7.0**
- E) 10.0

6. A body moves from A to B along a straight line a distance of 100 m in 10 sec. Stops at B for 20 sec. and then returns to A at an average speed of 5 m/s. The average speed (in m/s) from A to B is:

- A) 0
- B) -2
- C) 3**
- D) 4
- E) 5

7. An Apache helicopter during vertical takeoff releases a package when it is at 39.2 m high and its speed is 9.80 m/s. How long (in seconds) does it take the package to reach the ground?

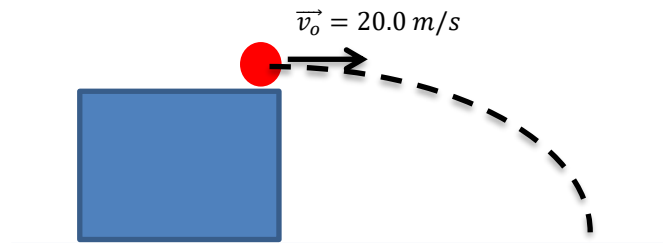
- A) 1
- B) 2.8
- C) 3
- D) 4**
- E) 5.2

8. The displacement of a body $x(t) = 10 \text{ (m)} + 20 \left(\frac{\text{m}}{\text{s}}\right)t - 5 \left(\frac{\text{m}}{\text{s}^2}\right)t^2$. Find the average velocity for the period between $t=0$ and $t=5\text{s}$.

- A) 0
- B) -1**
- C) 1
- D) -2
- E) -5

9. A ball is thrown off a 100 meters high cliff with an initial horizontal velocity of 20 m/s. How long does it take for it to hit the ground?

- A) 4.5 s**
- B) 20.0
- C) 2.0 s
- D) 3.2 s
- E) 12 s



10. A particle starts from the origin with velocity $5\hat{i} \text{ m/s}$ and $t=0$ and moves in the xy plane with a constant acceleration of $6\hat{j}$. Determine the position of the particle after 5 s:

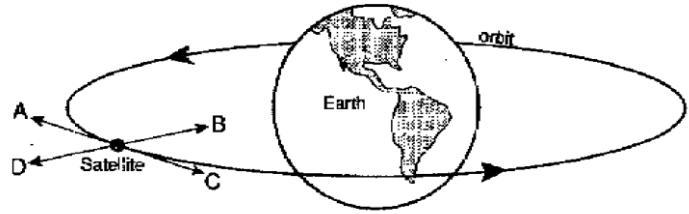
- A) $\vec{r} = 25\hat{i} + 75\hat{j}$**
- B) $\vec{r} = 5\hat{i} + 25\hat{j}$
- C) $\vec{r} = 30\hat{i} + 15\hat{j}$
- D) $\vec{r} = 20\hat{i} + 30\hat{j}$
- E) $\vec{r} = 5\hat{i} + 25\hat{j}$

11. A projectile is fired from the ground with a velocity of 110.0 m/s at an angle of 40.0 degrees above the horizontal. What will be the range (the horizontal displacement) of this projectile?

- A) 125 m
- B) 2350 m
- C) 532 m
- D) 1215 m**
- E) 752 m

12. The diagram shows a satellite orbiting the earth. The centripetal acceleration and velocity of the satellite, respectively, point to the following letters:

- A) A and B
- B) B and D
- C) A and C
- D) B and D
- E) **B and C**



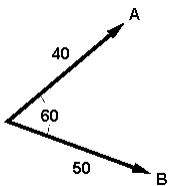
13. A firefighter, a distance $d=5$ meters from a burning building directs a stream of water from a fire hose at angle $\theta = 40^\circ$ above the horizontal. If the initial speed of the stream is $v_i = 10$ m/s, at what height h does the water strike the building?

- A) **2.1 m**
- B) 5.1 m
- C) 1.2 m
- D) 1.7 m
- E) 3.4 m

14. A race car moving with a constant speed of 60 m/s completes one lap around a circular track in 50 s. What is the magnitude of the acceleration of the race car?

- a. 8.8 m/s²
- b. 7.5 m/s²**
- c. 9.4 m/s²
- d. 6.3 m/s²
- e. 5.3 m/s²

15. Vectors \vec{A} and \vec{B} are shown. What is the magnitude of a vector $\vec{C} = \vec{A} - \vec{B}$?



- a. 46**
- b. 10
- c. 30
- d. 78
- e. 90

16. A web page designer creates an animation in which a dot on a computer screen has position:

$$\vec{r} = [4.0 \text{ cm} + (2.5 \text{ cm/s}^2)t^2]\hat{i} + (5.0 \text{ cm/s})t\hat{j}$$

(a) Find the magnitude and direction of the dot's average velocity between $t = 0$ and $t = 2.0$ s. (b) Find the magnitude and direction of the instantaneous velocity at $t = 0$

Ans. A) $v_{av} = 7.1 \text{ cm/s}$, $\theta = 45^\circ$

B) $v = 5 \text{ m/s}$, $\theta = 90^\circ$

17. An object moves in a horizontal circle at constant speed v (in units of m/s). It takes the object T seconds to complete one revolution. Derive an expression that gives the radial acceleration of the ball in terms of v and T , but not r . (a) If the speed doubles, by what factor must the period T change if a_{rad} is to remain unchanged?

Ans.

if the speed doubles, T must also double to keep a_{rad} the same