

# PHY2048 EXAM 1 (PRACTICE)

Fall 2019

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## Abstract

This exam consists of xx multiple choice questions. **You must record your answers on a Scantron sheet.** Don't record your answers on this print-out; I will not accept it as a submission. Fill out the Scantron sheet in with a pencil, not a pen. **Don't forget to include your name, the course, and exam number on the Scantron sheet.**

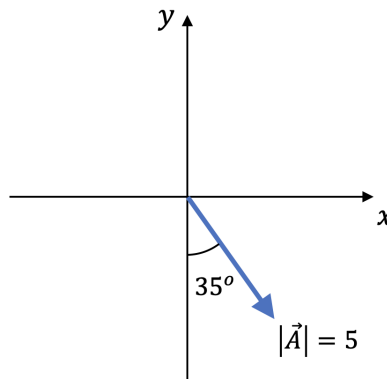


Figure 1: Figure for Problem 1

1. What is the  $y$ -component of the vector  $\vec{A}$ , shown in Figure 1 above?
  - (a)  $-2.87$
  - (b)  $2.87$
  - (c)  $-4.10$
  - (d)  $4.10$
2. Consider the vector  $\vec{A} = -2\hat{i} + 4\hat{j}$ . What is the direction of  $\vec{A}$ ? Measure the angle **counter-clockwise from the  $+x$ -axis**.
  - (a)  $27^\circ$
  - (b)  $63^\circ$
  - (c)  $117^\circ$
  - (d)  $243^\circ$

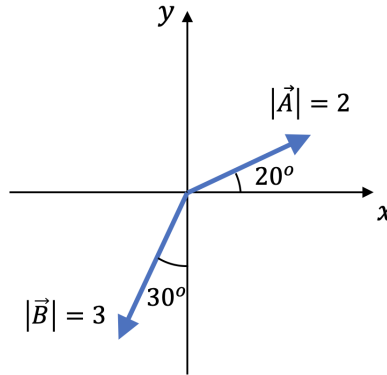


Figure 2: Figure for Problems 3 and 4

3. Consider the vectors  $\vec{A}$  and  $\vec{B}$ , as shown in Figure 2 above. What is the  $x$ -component of  $\vec{A} + \vec{B}$ ?
  - (a) 0.4
  - (b) 1.5
  - (c) 1.9
  - (d) 3.4
4. Consider the vectors  $\vec{A}$  and  $\vec{B}$ , as shown in Figure 2 above. What is  $\vec{A} \cdot \vec{B}$ ?
  - (a) 3.9
  - (b)  $-3.9$
  - (c) 4.6
  - (d)  $-4.6$
5. Consider the vectors  $\vec{A} = -\hat{i} + 3\hat{j}$  and  $\vec{B} = 2\hat{i} + \hat{k}$ . What is the cross product,  $\vec{A} \times \vec{B}$ ?
  - (a)  $3\hat{i} + \hat{j} - 6\hat{k}$
  - (b)  $-3\hat{i} + \hat{j} + 6\hat{k}$
  - (c)  $3\hat{i} - \hat{j} + 6\hat{k}$
  - (d)  $-3\hat{i} - \hat{j} + 6\hat{k}$
6. Under what conditions can kinematics be used?
  - (a) Kinematics can always be used
  - (b) Only if the acceleration of an object is constant
  - (c) Only if the speed of an object is constant
  - (d) Only if the motion of an object is in a straight line
7. A jogger runs half of a circular track in 100s. If the radius of the track is 100m, what is the jogger's average **velocity**?
  - (a) 2 m/s
  - (b) 3.14 m/s
  - (c) 4 m/s
  - (d) 6.28 m/s

8. A car accelerates at  $4.7 \text{ m/s}^2$ , from rest, to a top speed of  $57 \text{ m/s}$ . How long does it take the car to reach its top speed?
- (a)  $4.7\text{s}$
  - (b)  $12.1\text{s}$
  - (c)  $57\text{s}$
  - (d)  $267.9\text{s}$
9. An Olympic sprinter can run the  $100\text{m}$  dash in about  $10\text{s}$ . If the sprinter's acceleration were constant during the sprint, what would it be?
- (a)  $2 \text{ m/s}^2$
  - (b)  $5 \text{ m/s}^2$
  - (c)  $10 \text{ m/s}^2$
  - (d)  $20 \text{ m/s}^2$
10. The observatory on the 82nd floor of the Empire State Building is  $320\text{m}$  above the ground. If you dropped a penny from there, with what speed would it hit the ground?
- (a)  $8 \text{ m/s}$
  - (b)  $10 \text{ m/s}$
  - (c)  $80 \text{ m/s}$
  - (d)  $6,400 \text{ m/s}$
11. How fast would you have to throw an object upward for it to reach a height of  $12.5\text{m}$ ?
- (a)  $0 \text{ m/s}$
  - (b)  $10 \text{ m/s}$
  - (c)  $15.8 \text{ m/s}$
  - (d)  $250 \text{ m/s}$
12. A car accelerates from rest at  $6 \text{ m/s}^2$  for  $5\text{s}$ . What is the car's average velocity during this time?
- (a)  $0 \text{ m/s}$
  - (b)  $15 \text{ m/s}$
  - (c)  $30 \text{ m/s}$
  - (d)  $45 \text{ m/s}$
13. A car accelerates from rest at  $5 \text{ m/s}^2$  for  $200\text{m}$ . Suddenly, the car brakes at  $7 \text{ m/s}^2$  until stopped. How long does the entire trip take?
- (a)  $6.4\text{s}$
  - (b)  $8.9\text{s}$
  - (c)  $10.2\text{s}$
  - (d)  $15.3\text{s}$

14. A bicycle's velocity points in the  $-x$ -direction while its acceleration points in the  $+x$ -direction. Which of the following statements about the bicycle is true?
- (a) The bicycle is slowing down
  - (b) The bicycle is speeding up
  - (c) The bicycle's speed isn't changing
  - (d) There isn't enough information given to know the behavior of the bicycle's speed
15. An object moves with the following equation of motion:

$$x(t) = \alpha t + \beta t^3 - \gamma t^5$$

with the constants  $\alpha = 1 \text{ m/s}$ ,  $\beta = 2.5 \text{ m/s}^3$ , and  $\gamma = 1.5 \text{ m/s}^5$ . What is the object's acceleration at  $t = 0.5\text{s}$ ?

- (a)  $-1.75 \text{ m/s}^2$
  - (b)  $2.41 \text{ m/s}^2$
  - (c)  $3.75 \text{ m/s}^2$
  - (d)  $4.75 \text{ m/s}^2$
16. A projectile is launched with a speed of  $15 \text{ m/s}$  at an angle of  $30^\circ$ . At its peak, what is its speed?
- (a)  $0 \text{ m/s}$
  - (b)  $7.5 \text{ m/s}$
  - (c)  $13 \text{ m/s}$
  - (d)  $15 \text{ m/s}$
17. A projectile is launched with a speed of  $15 \text{ m/s}$  at an angle of  $30^\circ$ . After  $1\text{s}$ , what is the projectile's acceleration?
- (a)  $2.5 \text{ m/s}^2$
  - (b)  $10 \text{ m/s}^2$
  - (c)  $13 \text{ m/s}^2$
  - (d)  $15 \text{ m/s}^2$
18. A projectile is fired off the roof of a  $15\text{m}$  tall building, with a speed of  $17 \text{ m/s}$  and angle of  $40^\circ$  above the horizontal. What is the maximum height, above the ground, of the projectile?
- (a)  $3\text{m}$
  - (b)  $12\text{m}$
  - (c)  $15\text{m}$
  - (d)  $18\text{m}$

19. A projectile is fired off the roof of a 15m tall building, with a speed of 17 m/s and angle of  $40^\circ$  above the horizontal. How far away from the building does the projectile land?
- (a) 14.3m
  - (b) 24.7m
  - (c) 28.6m
  - (d) 39m
20. Which of the following statements is true regarding the trajectory of a projectile?
- (a) The trajectory is always symmetric
  - (b) The trajectory is symmetric only if the projectile starts and ends at the same height
  - (c) The trajectory is symmetric only if the projectile starts and ends at the same location
  - (d) The trajectory is never symmetric
21. During uniform circular motion, which of the following quantities is constant?
- (a) Position
  - (b) Speed
  - (c) Velocity
  - (d) Acceleration
22. The International Space Stations (ISS) moves with a roughly uniform, circular motion, with a period of 92.7 minutes and a speed of 7.66 km/s. What is the radius of the ISS' orbit?
- (a) 113km
  - (b) 710km
  - (c) 6,781km
  - (d) 42,604km
23. The International Space Stations (ISS) moves with a roughly uniform, circular motion, with a period of 92.7 minutes and a speed of 7.66 km/s. What is the angular velocity of the ISS?
- (a) 0.00082 rad/s
  - (b) 0.00113 rad/s
  - (c) 0.0678 rad/s
  - (d) 0.82 rad/s
24. The International Space Stations (ISS) moves with a roughly uniform, circular motion, with a period of 92.7 minutes and a speed of 7.66 km/s. What is the angular acceleration of the ISS?
- (a) 0 rad/s<sup>2</sup>
  - (b) 0.00865 rad/s<sup>2</sup>
  - (c) 8.65 rad/s<sup>2</sup>
  - (d) 865 rad/s<sup>2</sup>

25. True or false: the weight pulling an object downward, and the equal/opposite normal force pushing the object upward, form an action/reaction pair as defined by Newton's third law?

- (a) True
- (b) False

26. A 3.5kg box is pushed along a flat surface by the following forces:

$$\vec{F}_1 = (10\text{N})\hat{i} - (5\text{N})\hat{j}$$
$$\vec{F}_2 = -(2\text{N})\hat{i} + (3\text{N})\hat{j}$$

What is the acceleration of the box? Consider the  $+y$ -direction to be upward.

- (a) 2.29 m/s<sup>2</sup>
- (b) 3.43 m/s<sup>2</sup>
- (c) 8 m/s<sup>2</sup>
- (d) 10 m/s<sup>2</sup>

27. A 3.5kg box is pushed along a flat surface by the following forces:

$$\vec{F}_1 = (10\text{N})\hat{i} - (5\text{N})\hat{j}$$
$$\vec{F}_2 = -(2\text{N})\hat{i} + (3\text{N})\hat{j}$$

What is the normal force on the box?

- (a) 27N
- (b) 33N
- (c) 37N
- (d) 43N

28. A box of mass  $m$  is pushed with an equation of motion:

$$x(t) = \alpha t + \beta t^3 - \gamma t^5$$

The net force acting on this box must be given by equation equation:

- (a)  $\Sigma F(t) = m\alpha t + m\beta t^3 - m\gamma t^5$
- (b)  $\Sigma F(t) = m\alpha + 3m\beta t^2 - 5m\gamma t^4$
- (c)  $\Sigma F(t) = 6\beta t - 20\gamma t^3$
- (d)  $\Sigma F(t) = 6m\beta t - 20m\gamma t^3$

29. An elevator accelerates upward at 2 m/s<sup>2</sup>. If a 5kg box sits on the floor of the elevator, what is the normal force on the box?

- (a) 0N
- (b) 40N
- (c) 50N
- (d) 60N

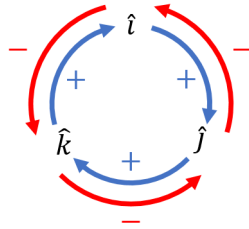
## FORMULA SHEET

- Vectors:

$$\vec{A} \cdot \vec{B} = AB \cos \theta$$

$$= A_x B_x + A_y B_y + A_z B_z$$

$$|\vec{A} \times \vec{B}| = AB \sin \theta$$



- Kinematics:

$$g = 10 \text{ m/s}^2$$

$$\vec{v}_{av} = \frac{\Delta \vec{x}}{\Delta t}; \quad \vec{v}(t) = \frac{d\vec{x}}{dt}$$

$$\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t}; \quad \vec{a}(t) = \frac{d\vec{v}}{dt}$$

$$\Delta x = v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + a t$$

$$v^2 = v_0^2 + 2a\Delta x$$

- Circular motion:

$$a_c = \frac{v^2}{r} = \omega^2 r$$

$$v = \omega r$$

$$\omega = \frac{2\pi}{T}$$

- Forces:

$$\sum \vec{F} = m\vec{a}$$

$$W = mg$$

## ANSWERS

- |         |         |
|---------|---------|
| 1. (c)  | 16. (c) |
| 2. (c)  | 17. (b) |
| 3. (a)  | 18. (d) |
| 4. (d)  | 19. (d) |
| 5. (a)  | 20. (b) |
| 6. (b)  | 21. (b) |
| 7. (a)  | 22. (c) |
| 8. (b)  | 23. (b) |
| 9. (a)  | 24. (a) |
| 10. (c) | 25. (b) |
| 11. (c) | 26. (a) |
| 12. (b) | 27. (c) |
| 13. (d) | 28. (d) |
| 14. (a) | 29. (d) |
| 15. (c) |         |