St John Baptist De La Salle Catholic School, Addis Ababa

Grade 11 Physics Midterm Examination

1st Quarter

October, 2023

Notes, and use of other aids is **NOT** allowed. Read all directions carefully and **write your answers in the answer sheet**. To receive full credit, you must show all of your work.

Name:_____ Roll Number:_____ Section:___Time Allowed: **45 min**

Multiple Choice Questions

1. Which of the following passwords would be computationally secure?
   A. A three digit number B. A 40 digit alphanumeric password
   C. A one digit number D. The password 'password'

2. Which of the following steps in the scientific process comes later compared to the others?
   A. Hypothesizing B. Questioning C. Analysis D. Experimentation

3. Which of the following fields of physics was a topic of the Nobel Prize in Physics this year?
   A. Quantum Optics B. Astronomy C. High energy physics D. Biophysics

4. Let $\vec{C} = \vec{A} + \vec{B}$. In which of the following conditions is $|\vec{C}|$ maximum?
   A. $\vec{A} \parallel \vec{B}$ B. $\vec{A} \perp \vec{B}$ C. $\vec{A} = \vec{B}$ D. None of the above

5. If the vector $6\hat{i} - 4\hat{j}$ starts at the point $P = (-2, 5, -1)$, at what point does it end?
   A. (-4,1,1) B. (4,-1,1) C. (4,1,-1) D. (-4,-1,-1)

6. Which of the following vectors are parallel?
   A. $\vec{v} = 9\hat{i} - 6\hat{j} - 24\hat{k}$ and $\vec{w} = -15\hat{i} + 10\hat{j} + 40\hat{k}$ B. $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$
   C. $2\hat{i}$ and $4\hat{k}$ D. None of the above

7. Let $\vec{u} = 8\vec{i} - \vec{j} + 3\vec{k}$ and $\vec{v} = 7\vec{j} - 4\vec{k}$. Which of the following is equal to $|-9\vec{v} - 2\vec{u}|$?
   A. $\sqrt{2893}$ B. $\sqrt{4877}$ C. 26 D. 90

8. If the magnitude of $|\vec{A} + \vec{B}|$ is equal to the magnitude of $|\vec{A} - \vec{B}|$, what is the angle between $\vec{A}$ and $\vec{B}$?
   A. $\frac{\pi}{6}$ B. $\frac{\pi}{4}$ C. $\frac{\pi}{3}$ D. $\frac{\pi}{2}$

9. Which of the following is a vector quantity?
   A. Current Density B. Speed C. Power D. Volume

10. If three vectors sum up to zero, what can we say about the vectors?
A. The vectors must be collinear B. The vectors must be coplanar
C. All three vectors must be equal D. All three vectors must be orthogonal to each other

Workout Problems

11. Let $\vec{A} = 4\hat{i} + 3\hat{j}$, $\vec{B} = 6\hat{i} + 6\hat{j}$. If $\vec{A} \cdot \vec{B} = 40$, what is the angle between the vectors $\vec{A}$ and $\vec{B}$.

12. If $|\vec{A}| = 2$, $|\vec{B}| = 7$. Find the angle between the vectors $\vec{A}$ and $\vec{B}$ if $|\vec{A} + \vec{B}| = 9$ and $|\vec{A} - \vec{B}| = 9$. Show all your steps.

13. Let $\vec{U} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{V} = \hat{i} + 2\hat{j} + 4\hat{k}$. What is the projection of $\vec{B}$ along $\vec{A}$? What about the component of $\vec{A}$ along $\vec{B}$?

14. The scalar triple product of three vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$ is defined as $(\vec{a} \times \vec{b}) \cdot \vec{c}$. Let there be three vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$ with equal magnitudes, M. If the vectors $\vec{a}$ and $\vec{b}$ have a separation angle of $\frac{\pi}{3}$, and $\vec{b} \times \vec{a}$ makes an angle of $\frac{\pi}{4}$ to $\vec{c}$, compute the scalar triple product.

15. Find the work done against gravity to move a 15 kg baby from the point (3,4) to (8,12).(Assume $g = 9.8\hat{j} m/s^2$)