

St John Baptist De La Salle Catholic School, Addis Ababa  
Grade 12 Physics Midterm Examination  
2<sup>nd</sup> Quarter

December, 2024

Name: \_\_\_\_\_ Roll Number: \_\_\_\_\_ Section: \_\_\_\_\_ Time Allowed: **1 hour**

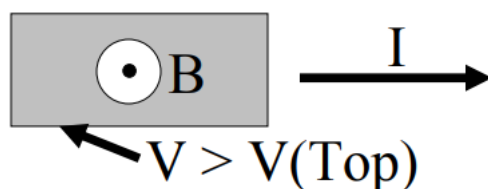
Constant	Symbol	Value
Speed of light	$c$	$2.998 \times 10^8 \text{ m/s}$
Vacuum permittivity	$\epsilon_0$	$8.854 \times 10^{-12} \text{ F/m}$
Elementary charge	$e$	$1.602 \times 10^{-19} \text{ C}$
Gravitational constant	$G$	$6.674 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
Magnetic constant	$\mu_0$	$4\pi \times 10^{-7} \text{ T} \cdot \text{m/A}$
Permittivity of free space (in terms of $\mu_0$ )	$\epsilon_0$	$\frac{1}{\mu_0 c^2}$

## Multiple Choice Questions

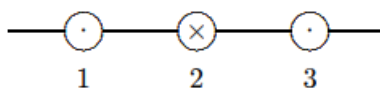
**Choose one choice that best-fits as an answer to the question. Please provide answers on the answer box provided at the end of the exam.**

- (1 point) When an object is placed in front of a plane mirror the image is:  
A. Upright, magnified and real    B. Upright, the same size and virtual    C. Inverted, demagnified and real    D. Inverted, magnified and virtual    E. Upright, magnified and virtual
- (1 point) An object is placed at the focal point in front of a concave mirror. The image is located:  
A. The distance  $d > R$     B. The distance  $d < F$     C. The distance  $F < d < R$     D. The focal point    E. No image is formed
- (1 point) Suppose you wanted to start a fire using sunlight and a mirror. Which one of the following statements is most accurate?  
A. It would be best to use a plane mirror.  
B. It would be best to use a convex mirror.  
C. It would be best to use a concave mirror, with the object to be ignited positioned at the center of curvature of the mirror.  
D. It would be best to use a concave mirror, with the object to be ignited positioned half way between the mirror and its center of curvature.  
E. One cannot start a fire using a mirror, since mirrors only form virtual images
- (1 point) When an object is placed 15 cm from a mirror, a virtual image is formed. Which of the following conclusions are false?  
A. The lens may be converging or diverging.  
B. If the image is upright the mirror must be a diverging mirror.  
C. If the image is reduced, the mirror must be a diverging mirror.  
D. If the mirror is a diverging mirror, the image distance must be less than 15 cm.  
E. If the mirror is a converging mirror, the focal length must be less than 15 cm.

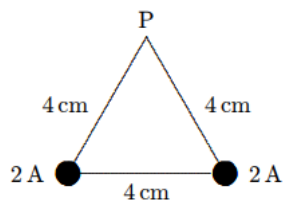
5. (1 point) A long straight wire carries a current  $I$  and generates a magnetic field  $B$ . If the current quadruples and the wire moves twice as far away, by what factor does the magnetic field change?  
A. 1    B. 2    C. 4    D. 9    E. 0.5    F. 0.25
6. (1 point) The wingspan (tip to tip) of a Boeing 747 jetliner is 59 m. The plane is flying horizontally at a speed of 220 m/s. The vertical component of the earth's magnetic field is  $5.0 \times 10^{-6}$  T. What is the emf induced between the wing tips?    A. 1.34 V    B. 0.065 V    C. 3 V    D. 0.098 V    E. None
7. (1 point) If a current is passed through a spring, does the spring stretch or compress?    A. It tends to compress.    B. It tends to stretch.    C. Nothing happens.    D. Can not be determined from the given information.    E. None.
8. (1 point) A conducting slab has current to the right. A  $\mathbf{B}$ -field is applied out of the page. Due to magnetic forces on the charge carriers, the bottom of the slab is at a higher electric potential than the top of the slab. On the basis of this experiment, the sign of the charge carriers that make up the current in the slab is:



- A. positive    B. negative    C. cannot determined
9. (1 point) Two long parallel wires carry currents of 5.0 A and 8.0 A in the opposite directions. The wires are separated by 0.30 m. Find the magnetic force per unit length between the two wires.  
A.  $2.7 \times 10^{-5} N$  attractive    B.  $7.2 \times 10^{-5} N$  attractive    C.  $2.7 \times 10^{-5} N$  repulsive    D.  $7.2 \times 10^{-5} N$  repulsive    E. None
10. (1 point) Two long parallel wires placed side-by-side on a horizontal table carry identical size currents in opposite directions. The wire on your right carries current toward you, and the wire on your left carries current away from you. From your point of view, the magnetic field at the point exactly midway between the two wires  
A. points up.    B. points down.    C. points toward you.    D. is zero    E. None
11. (1 point) The diagram shows three equally spaced wires that are perpendicular to the page. The currents are all equal, two being out of the page and one being into the page. Rank the wires according to the magnitudes of the magnetic forces on them, from least to greatest.

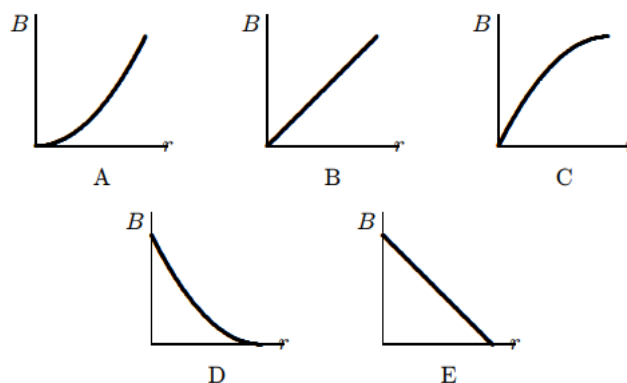


- A. 1, 2, 3    B. 2, 1 and 3 tie    C. 2 and 3 tie, then 1    D. 1 and 3 tie, then 2    E. 3, 2, 1
12. (1 point) Two long straight wires pierce the plane of the paper at vertices of an equilateral triangle as shown below. They each carry 2 A, out of the paper. The magnetic field at the third vertex (P) has magnitude (in T):



- A.  $1.0 \times 10^{-5}$    B.  $1.7 \times 10^{-5}$    C.  $2.0 \times 10^{-5}$    D.  $5.0 \times 10^{-5}$    E.  $8.7 \times 10^{-5}$

13. (1 point) Which graph correctly gives the magnitude of the magnetic field outside an infinitely long straight current-carrying wire as a function of the distance  $r$  from the wire?



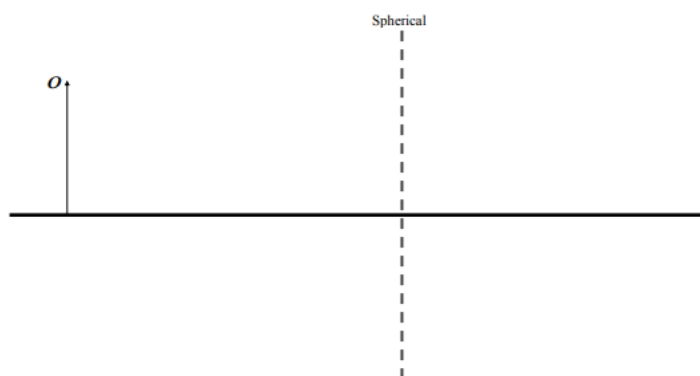
14. (1 point) Which of the following statements is correct about the effect and formation of field?

- A. A magnetic field exerts a nonzero force on a stationary charge object.
- B. A magnetic field exerts a nonzero force on a conducting wire placed in the field.
- C. A uniform magnetic field can be created at all points around a long current carrying wire.
- D. A magnetic field can be created in the space surrounding any charged object that is in motion.

## Free Response Questions

15. (3 points) A 5 foot tall woman is standing in front of the convex side of a spherical mirror. The diameter of the spherical mirror is 20 ft.

- A Use ray tracing to find the location, size, orientation, and type of image. Be sure to state these features next to your image.



- B Use the mirror equation to calculate the magnification of the image.

C State whether the produced image is virtual or real — upright or inverted — magnified or diminished and why.

16. (3 points) Two parallel conductors carry current in opposite directions. One conductor carries a current of 10A. Point A is at the midpoint between the wires and point C is a distance  $d/2$  to the right of the 10 A current. If the distance between the wires is 0.18 m and I is adjusted so that the magnetic field at C is zero.

A Draw the setup

B Find the value of the current.

C Find the value of the magnetic field at A.

### Extra Credit Problems

17. (2 points) A long straight cylindrical wire conductor of radius  $R$  carries a current  $I$  (out of the page) of uniform current. Determine the magnetic field due to this current at  $r \geq R$

### Answer Box for Multiple Choice Questions

Name \_\_\_\_\_ Section \_\_\_\_\_ Roll No. \_\_\_\_\_

- |          |           |           |
|----------|-----------|-----------|
| 1. _____ | 6. _____  | 11. _____ |
| 2. _____ | 7. _____  | 12. _____ |
| 3. _____ | 8. _____  | 13. _____ |
| 4. _____ | 9. _____  | 14. _____ |
| 5. _____ | 10. _____ |           |