

DIAGNOSTIC TEST IN GENERAL PHYSICS 2
SY 2022-2023

Instructions: Read each question carefully and shade the correct answer in the answer sheet provided to you. Do not write anything on this test questionnaire.

1. If a positively charged sphere is taken close to another uncharged sphere, then which of the following statements is TRUE?
 - A. Attraction occurs before induction
 - B. Induction occurs before the attraction
 - C. Attraction or repulsion may occur immediately
 - D. Induction and attraction occur simultaneously
2. An isolated charged point particle produces an electric field with magnitude E at a point 2m away. At a point 1m from the particle, the magnitude of the field is _____.
 - A. the same
 - B. half as much
 - C. twice as much
 - D. four times as much
3. Two charges, $+Q$ and $-Q$, are placed a distance d from a negative charge $-q$. The charges, $+Q$ and $-Q$, are located along lines perpendicular to each other as shown in the diagram below.

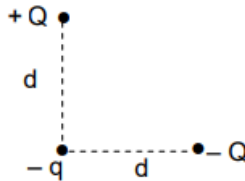


Figure 1. Two charges, $+Q$ and $-Q$, are placed a distance d from a negative charge $-q$.

(Source: <https://images.app.goo.gl/1AQAFEwmXTadX1Zt7>)

Which one of the following arrows correctly shows the direction of the net force acting on charge $-q$ due to the presence of charges $+Q$ and $-Q$?

- A.
- B.
- C.
- D.

4. Positive charge $+Q$ is uniformly distributed on the upper half a semicircular rod and negative charge $-Q$ on the lower half. What is the direction of the electric field at point P, the center of the semicircle?

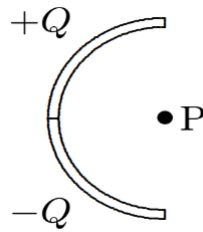






Figure 2. Two charges, $+Q$ and $-Q$, are placed a distance point P.

(Source: <https://images.app.goo.gl/xeZd4iyQ4R8RXoKi9>)

- A. 
- B. 
- C. 
- D. 

5. There are three charges q_1 , q_2 , and q_3 having charges of 6 pC, 5 pC and 3 pC respectively enclosed in a surface. What is the total flux enclosed by the surface?
- A. $-22.13 \text{ Nm}^2/\text{C}$
 B. $-17.54 \text{ Nm}^2/\text{C}$
 C. $1.03 \text{ Nm}^2/\text{C}$
 D. $1.58 \text{ Nm}^2/\text{C}$
6. Gauss's law provides a convenient way to calculate the electric field outside and near each of the following isolated charged conductors except for a _____.
- A. cube
 B. large plate
 C. sphere
 D. solid rod

7. An electric field due to a positive charge is represented by the illustration below. Between which of the following two points does the electric field do zero work on a moving charge?

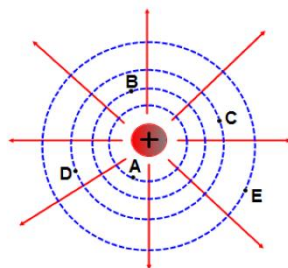
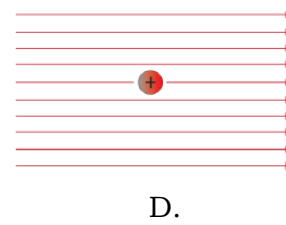
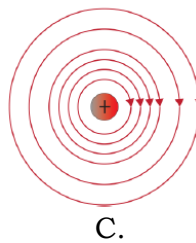
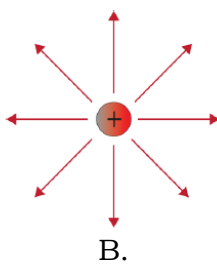
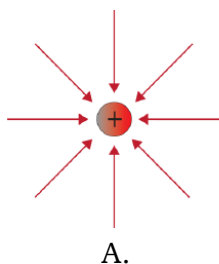


Figure 3. Electric field of a positively charged particle.

(Source: <https://physexams.com/img/courses/Electrostatic/electric%20flux/electric%20flux-3.png>)

- A. A and B
 B. B and C
 C. C and D
 D. D and E
8. Which of the following equations describes the work done by \vec{F} in terms of potential energy if the force is conservative?
- A. $W_{a \rightarrow b} = \Delta U = \frac{1}{2}mv^2$
 B. $W_{a \rightarrow b} = -\Delta U = mgh$
 C. $W_{a \rightarrow b} = \Delta U = -(U_b + U_a)$
 D. $W_{a \rightarrow b} = -\Delta U = -(U_b + U_a)$
9. Which of the following is TRUE about a point charge q produces an electric field \vec{E} at all point in space?
- A. The field produced by a neutral point charge points toward the charge.
 B. The field produced by a positive point charge points toward the charge.
 C. The field produced by a positive point charge points away from the charge.
 D. The field produced by a negative point charge points away from the charge.
10. Which of the following represents the electric field map due to a single positive charge?



11. A proton (charge $+e = 1.602 \times 10^{-19} \text{ C}$) moves a distance $d = 0.50 \text{ m}$ in a straight line between points a and b in a linear accelerator. The electric field is uniform along this line, with magnitude $E = 1.5 \times 10^7 \text{ V/m} = 1.5 \times 10^7 \text{ N/C}$ in the direction from a to b. For the proton to be able to move from point a to point b, how much force must be exerted on the proton?
- $2.4 \times 10^{-12} \text{ N}$
 - $3.7 \times 10^{-10} \text{ N}$
 - $4.8 \times 10^{-9} \text{ N}$
 - $5.2 \times 10^{-8} \text{ N}$
12. Given n capacitors with charge Q and capacitance C , you will get the greatest energy stored in _____.
- series circuits
 - closed circuits
 - parallel circuits
 - complex circuits
13. Two capacitors C_1 and C_2 are connected in circuit with values of $6.0 \mu\text{F}$ and $3.0 \mu\text{F}$, respectively. What will be the equivalent capacitance of these capacitors when connected in series?
- $0.5 \mu\text{F}$
 - $1.5 \mu\text{F}$
 - $2.0 \mu\text{F}$
 - $3.1 \mu\text{F}$
14. A $20 \mu\text{F}$ capacitor is connected to a source of potential difference of 150 V . What is now the resulting charge on the capacitor?
- $5.4 \times 10^{-4} \text{ C}$
 - $8.6 \times 10^{-4} \text{ C}$
 - $3.0 \times 10^{-3} \text{ C}$
 - $4.2 \times 10^{-3} \text{ C}$
15. Which refers to the rate at which charge flows past a point in a circuit?
- Capacitor
 - Current
 - Resistance
 - Voltage
16. Which of the following shows the relationship between resistivity and conductivity?
- Resistivity of a material is proportional to the conductivity of a material.
 - Resistivity of a material is low, the conductivity of the material is also low.
 - Resistivity and Conductivity depend on the movement of electrons through a material
 - Resistivity measures how much a material resist the electricity flow while conductivity measures how easily electricity flows through a material.

17. What is the resistance of a silver wire 1.00 mm in diameter with a length of 125 m, if the resistivity of silver is $1.47 \times 10^{-8} \Omega \cdot \text{m}$?
- $0.002 \times 10^{-12} \Omega$
 - $0.02 \times 10^{-12} \Omega$
 - $1.00 \times 10^{-12} \Omega$
 - $1.47 \times 10^{-12} \Omega$
18. What does current relationship ohmic conductor have over a large range applied voltages?
- Linear voltage-current relationship
 - Circular voltage-current relationship
 - Random voltage-current relationship
 - Vibratory voltage-current relationship
19. What power is dissipated in a circuit through which 12 A flows across a potential drop of 3.0 V with resistance 1Ω ?
- 3 W
 - 12 W
 - 36 W
 - 144 W
20. A power transmission line is hung from metal towers with glass insulators having a resistance of $1.0 \times 10^9 \Omega$. What current flows through the insulator if the voltage is 200 kV? (Some high-voltage lines are DC)
- $0.1 \times 10^{-3} \text{ V}$
 - $0.2 \times 10^{-3} \text{ V}$
 - $1.0 \times 10^{-3} \text{ V}$
 - $2.0 \times 10^{-3} \text{ V}$
21. When a voltmeter-ammeter is applied for the measurement of resistance, the voltmeter reads a value of 8.28 V and Ammeter reading is 4.14 A. What will be the value of the resistance?
- 0Ω
 - 1Ω
 - 2Ω
 - 20Ω
22. A $20\text{-}\Omega$ resistor is connected in parallel to another resistor R. The equivalent resistance of the pair is 12Ω . What is the resistance of R?
- 12Ω
 - 20Ω
 - 30Ω
 - 40Ω

23. The figure below is a circuit composed of two source and 3 resistors.

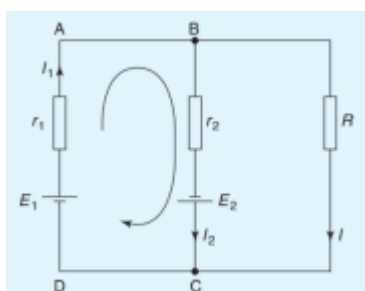


Figure 4. Circuit diagram

Source: <https://cnx.org/contents/7DqkHtKM@2/Kirchhoff-s-Rules>

Applying voltage rule of Kirchhoff, which is the correct interpretation of the loop?

- A. $E_3 - E_2 = I_1 r_1 + I_2 r_2$
- B. $E_3 = E_2 + I_1 r_1 + I_2 r_2$
- C. $E_3 + E_2 = I_1 r_1 + I_2 r_2$
- D. $E_3 + I_1 r_1 = E_2 + I_2 r_2$

24. In what direction will the magnetic field lines point in the region just outside the south pole?

- A. Go around the south pole
- B. Point toward the south pole
- C. Point away from the south pole
- D. Are less concentrated than at the north pole

25. What would be the magnetic flux in a surface perpendicular to the magnetic field, if the uniform magnetic field is doubled?

- A. Doubled
- B. Halved
- C. Quadruple
- D. Tripled

26. Consider the image of the loop of wire carrying a current in a magnetic field.

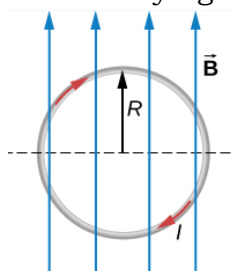


Figure 5. A loop of wire carrying a current in a magnetic field.

Source:

[https://phys.libretexts.org/Bookshelves/University_Physics/Book%3A_University_Physics_\(OpenStax\)/](https://phys.libretexts.org/Bookshelves/University_Physics/Book%3A_University_Physics_(OpenStax)/)

What is the magnetic force on the upper half of the loop?

- A. $dF = IB \sin \theta dl$
- B. $dF = IB R \sin \theta d\theta$
- C. $F = 2IBR$
- D. $F = -2IBR$

27. The force shown below is exerted on an electron as it moves through the magnetic field. In what direction does the electron move?

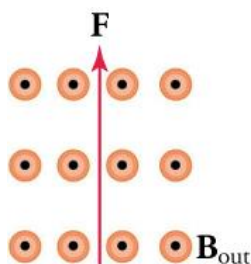


Figure 6. Magnetic force and Magnetic Field

Source: <https://courses.lumenlearning.com/physics/chapter/22-4-magnetic-field-strength-force-on-a-moving-charge-in-a-magnetic-field/>

- A. Upwards
- B. Downwards
- C. Left to right
- D. Right to left

28. The figure below consists of two long, straight, and parallel conductors separated by a distance r .

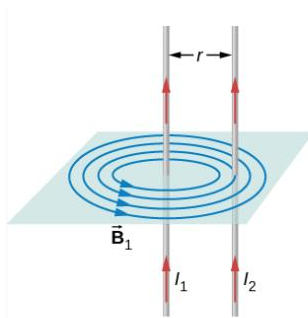


Figure 7. Two long, straight, and parallel conductors separated by a distance r

Source: [https://phys.libretexts.org/Bookshelves/University_Physics/Book%3A_University_Physics_\(OpenStax\)](https://phys.libretexts.org/Bookshelves/University_Physics/Book%3A_University_Physics_(OpenStax))

What is the force per unit length between the parallel conductors?

- A. $F_2 = I_2 l B_1$
- B. $B_2 = I_2 l F_2$
- C. $\frac{F}{l} = \frac{\mu_0 I_1 I_2}{2\pi r}$
- D. $\frac{F}{l} = \frac{2\pi r}{\mu_0 I_1 I_2}$

29. A magnetic field B is generated by a ring at a point x away from the center on the axis of the ring with current I flowing around the ring as shown in the diagram below.

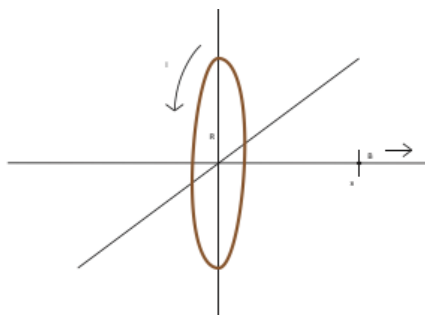


Figure 8. Two long

Source: "Sears and Zemansky's University Physics with Modern Physics" 12th Edition.

What is the magnitude of the magnetic field B ?

- A. $Bx = \frac{\mu_0 IR^2}{2(x^2 + R^2)^{\frac{3}{2}}}$
- B. $Bx = \frac{2\mu_0 IR^2}{(x^2 + R^2)^{\frac{3}{2}}}$
- C. $Bx = \frac{\mu_0 IR^2}{2(x^2 + R^2)^{\frac{1}{2}}}$
- D. $Bx = \frac{2\mu_0 IR}{(x^2 + R^2)^{\frac{3}{2}}}$

30. What is common between electrostatic and non-electrostatic field?

- A. Both are produced by charges.
- B. Both are produced by direct current.
- C. Both are created from an induced current
- D. Both are created from time varying magnetic field through a given region of space.

31. Why is it possible to draw in a tablet with a specially designed pen?

- A. The screen has magnetic field that it converts the pen's tip into an induced emf and translates into a magnetic field converted into the line you draw in the screen.
- B. The screen can induced current that converts the pen's tip into a magnetic field and translates into an induced emf converted into the line you draw in the screen.
- C. The pen's tiny magnetic field from the tip causes a changing magnetic field that is felt in the wires which translates into an induced emf that is converted into the line you draw in the screen.
- D. The pen's tip causes to generate electric current that is felt and read by the wires of the screen which translate into a electrostatic force that is converted into the line you draw in the screen.

32. A circular loop of wire is placed in a magnetic field as shown below in Figure 2. If the magnetic field is increasing, what direction is the induced current in?

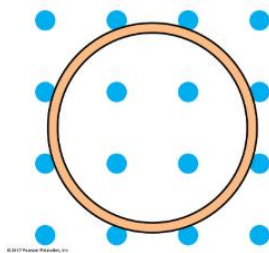


Figure 9. A circular loop placed in a magnetic field

(Source: <http://www.chegg.com>)

- A. Clockwise
- B. Into the page
- C. Out of range
- D. Counterclockwise

33. Is the situation shown in Figure 4 below possible?

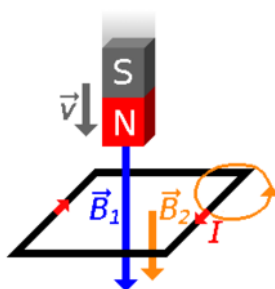


Figure 10. A magnet is thrust in a coil.

(Source: <http://www.commonswikimedia.org>)

- A. No, the magnet will both gain mechanical energy and electrical energy that will violate the Law of Conservation of Energy.
 - B. Yes, the magnet will gain electrical energy and zero mechanical energy that will not violate the Law of Conservation of Energy.
 - C. Yes, the flux will increase and the possible direction of inducing flux is opposite to the inducing current. It doesn't violate the Law of Conservation of Energy.
 - D. No, the flux might decrease and the possible direction of inducing flux is in the same direction with inducing current. It violates the Law of Conservation of Energy.
34. The speed of electromagnetic waves is extremely close to the measured value of what energy?
- A. Electricity
 - B. Heat
 - C. Light
 - D. Sound

35. Which of the following conditions will total internal reflection occur?
- I. The angle of incidence is larger than or equal to critical angle.
 - II. The angle of incidence is smaller than or equal to critical angle.
 - III. The ray in material a is incident on a second material b whose index of refraction is double than that of material a .
 - IV. The ray in material a is incident on a second material b whose index of refraction is smaller than that of material a .
- A. I only
B. IV only
C. I and III
D. II and IV
36. A light beams into a diamond at angle of incidence of 30.00° . What is the angle between the yellow ($n = 2.417$) and blue ($n = 2.444$) parts of the refracted light?
- A. 0.085°
B. 0.130°
C. 0.215°
D. 0.280°
37. How do we locate the image formed by a plane mirror by using a ray diagram ?
- A. Drawing one ray emitted by the object and applying the law of reflection.
B. Drawing one ray emitted by the object and applying the law of refraction.
C. Drawing two rays emitted by the object and applying the law of reflection.
D. Drawing two rays emitted by the object and applying the law of refraction.
38. If you are standing in front of a plane mirror, what must be minimum length of the mirror to see your full image?
- A. Half as your height
B. Same as your height
C. Four-fifths as your height
D. Three-fourths as your height
39. A concave mirror has a focal length of 20cm. If the image formed is located at the radius of curvature, where is the object located in front of the mirror?
- A. 40cm
B. 20cm
C. 10cm
D. 5cm
40. A camera employs a _____ lens to form _____ images.
- A. Diverging, real
B. Converging, real
C. Diverging, virtual
D. Converging, virtual

41. Retina is the part of the eye where the image will be formed. At which part of the retina the nerves carrying all the information exit along the optic nerves?
- A. Rods
 - B. Fovea
 - C. Cones
 - D. Blind spot
42. The meeting of two out of phase light waves with same amplitude resulted to
- A. Super crest
 - B. Super trough
 - C. Cancellation of wave
 - D. Partial cancellation of wave
43. Light of wavelength 580 nm is incident on a slit of width 0.300 mm. An observing screen is placed 2.00m from the slit. Find the position of the first order dark fringe from the center of the screen.
- A. 0.26 mm
 - B. 1.9 mm
 - C. 3.9 mm
 - D. 7.7 mm
44. According to the special theory of relativity, all laws of nature are the same in reference frames that _____.
- A. Accelerate
 - B. Decelerate
 - C. Move at constant speed
 - D. Move at varying speed
45. The Special Theory of Relativity is concerned with the comparison of measurements made in different inertial frames moving with constant velocity relative to one another. Which of the following event is true based on the special theory of relativity?
- A. Clocks that are moving run faster than when they are at rest.
 - B. Clocks that are moving run slower than when they are at rest.
 - C. Clocks run at the same rate regardless of whether they are moving or not.
 - D. Clocks run at rates that depend on an observer's inertial frame of reference.
46. If the person on the platform sees that the length of the train is reduced while the person on the train will see the length of the platform is reduced, this refers to?
- A. Time Dilation
 - B. Proper time
 - C. Proper length
 - D. Length contraction

47. While the spaceship is still at rest on earth, a woman on board finds that a wooden rod she is carrying is 1 meter long. When the spaceship is moving very fast deep into the outer space, what will the woman find out about the length of the same wooden rod she is still carrying?
- A. It will be longer.
 - B. It will be shorter.
 - C. It will gain mass.
 - D. It will still be of the same length.
48. When does light behave as if it were composed of particles?
- A. Under all conditions.
 - B. When it propagates in space.
 - C. When it interacts with matter.
 - D. Under conventional situation.
49. Carbon-11 is a radioactive isotope of carbon. Its half-life is 20 minutes. What fraction of the initial number of C-11 atoms in a sample will have decayed away after 80 minutes?
- A. $1/8$
 - B. $1/4$
 - C. $7/8$
 - D. $15/16$
50. How old is a bottle of wine if the tritium (^3H) content (called activity) is 25% that of a new wine? The half-life of tritium is 12.5 years.
- A. $1/4$ yr
 - B. 3.1 yr
 - C. 25 yr
 - D. 50 yr