

# Physics 132, Practice Final Exam Multiple Choice Questions

Circle the letter that corresponds to your choice for the correct answer to each problem.

1. A square loop of wire lies in the plane of the page. A decreasing magnetic field is directed into the page. The induced current in the loop is:

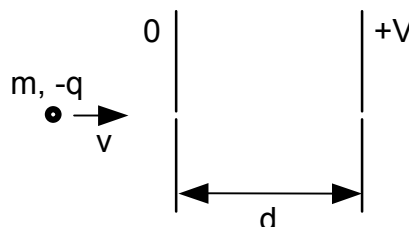
A) counterclockwise.  
**B) clockwise.**  
 C) zero.  
 D) depends upon whether or not B is decreasing at a constant rate.  
 E) clockwise in two of the loop sides and counterclockwise in the other two.

2. A point charge,  $-3q$ , lies at the center of a conducting, cubical shell with sides of length  $2d$ . The shell has a net charge of  $-3q$ . The net charge on the outer surface of the shell is:

A)  $6q$                       B)  $3q$                       C) zero                      D)  $-3q$                       **E)  $-6q$**

3. A particle (mass  $m$ , charge  $-q$ ) with speed  $v$  enters the region between two parallel plates through a very small hole, as shown. The potential difference between the two plates is  $V$  and their separation is  $d$ . The change in kinetic energy of the particle after it traverses this region is best given by:

A)  $-qV/d$   
 B)  $2qV/mv^2$   
**C)  $qV$**   
 D)  $\frac{1}{2}mv^2$   
 E) none of these



4. Charge is distributed uniformly on the surface of a large flat plate. The electric field 2 cm from the plate is 30 N/C. The electric field 4 cm from the plate is:

A) 120 N/C                      B) 80 N/C                      **C) 30 N/C**                      D) 15 N/C                      E) 7.5 N/C

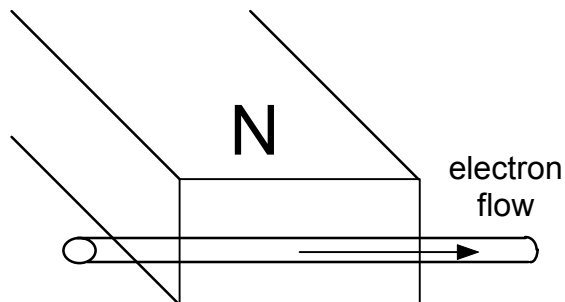
5. Two small charged objects repel each other with a force  $F$  when separated by a distance  $d$ . If the charge on each object is reduced to one-fourth of its original value and the distance between is reduced to  $d/2$ , the force becomes:

A)  $F/16$                       B)  $F/8$                       **C)  $F/4$**                       D)  $F/2$                       E)  $F$

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6. The figure shows the motion of *electrons* in a wire which is near the North pole of a magnet. The wire will be pushed:

- A) toward the magnet
- B) away from the magnet
- C) downwards
- D) upwards**
- E) along its length



7. Two wires made of different materials have the same uniform current density. They carry the same current only if:

- A) their lengths are the same.
- B) their cross-sectional areas are the same.**
- C) both their lengths and cross-sectional areas are the same.
- D) the potential differences across them are the same.
- E) the electric fields in them are the same.

8. In the formula  $\mathbf{F} = q\mathbf{v} \times \mathbf{B}$ :

- A)  $\mathbf{F}$  must be perpendicular to  $\mathbf{v}$  but not necessarily to  $\mathbf{B}$ .
- B)  $\mathbf{F}$  must be perpendicular to  $\mathbf{B}$  but not necessarily to  $\mathbf{v}$ .
- C)  $\mathbf{v}$  must be perpendicular to  $\mathbf{B}$  but not necessarily to  $\mathbf{F}$ .
- D) all three vectors must be mutually perpendicular.
- E) none of the above.**

9. Two point charges,  $8 \times 10^{-9}$  C and  $-2 \times 10^{-9}$  C are separated by 4 m. The electric field magnitude (in units of V/m) midway between them is:

- A)  $9 \times 10^9$       B) 13,500      C) 135,000      D)  $36 \times 10^{-9}$       **E) 22.5**

10. Two point charges,  $q_1$  and  $q_2$ , are placed a distance  $r$  apart. The electric field is zero at a point P between the charges on the line segment connecting them. We conclude that:

- A)  $q_1$  and  $q_2$  must have the same magnitude and sign
- B) P must be midway between  $q_1$  and  $q_2$
- C)  $q_1$  and  $q_2$  must have the same sign but may have different magnitudes**
- D)  $q_1$  and  $q_2$  must have equal magnitudes and opposite signs
- E)  $q_1$  and  $q_2$  must have opposite signs and may have different magnitudes

11. Resistances of  $2.0 \, \Omega$ ,  $4.0 \, \Omega$ , and  $6.0 \, \Omega$ , and a 24 V battery are all in series. The current in the  $2.0 \, \Omega$  resistor is:

- A) 12 A      B) 4.0 A      C) 2.4 A      **D) 2.0 A**      E) 0.50 A

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12. A current of 0.3 A is passed through a lamp for 2 minutes using a 6 V supply. The energy dissipated by the lamp during the 2 minutes is:

- A) 1.8 J      B) 12 J      C) 20 J      D) 36 J      **E) 216 J**

13. Let  $Q$  denote charge,  $V$  denote potential difference, and  $U$  denote stored energy. Of these quantities, capacitors in series must have the same:

- A)  $Q$  only**      D)  $Q$  and  $U$  only  
B)  $V$  only      E)  $V$  and  $U$  only  
C)  $U$  only

14. Choose the correct statement:

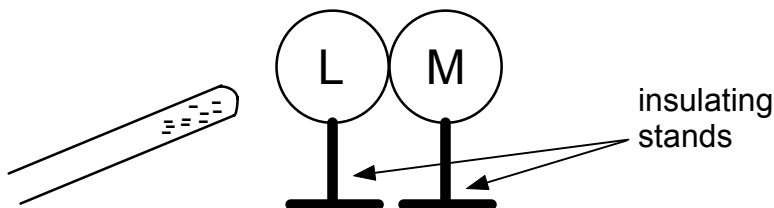
- A) A proton tends to go from a region of low potential to a region of high potential  
B) The potential of a negatively charged conductor must be negative  
C) If  $E=0$  at a point  $P$ , then  $V$  must be zero at  $P$   
D) If  $V=0$  at a point  $P$ , then  $E$  must be zero at  $P$   
**E) None of the above are correct**

15. If 500 J of work are required to carry a 40 C charge from one point to another, the potential difference between these two points is:

- A) 12.5 V**      D) depends on the path  
B) 20,000 V      E) none of these  
C) 0.08 V

16. Two uncharged metal spheres, L and M, are in contact. A negatively charged rod is brought close to L, but not touching it, as shown. The two spheres are slightly separated and the rod is then withdrawn. As a result:

- A) both spheres are neutral.  
B) both spheres are positive.  
C) both spheres are negative.  
D) L is negative and M is positive.  
**E) L is positive and M is negative.**



17. Each plate of a capacitor stores a charge of magnitude  $1 \times 10^{-3}$  C when a 100 V potential difference is applied. The capacitance is:

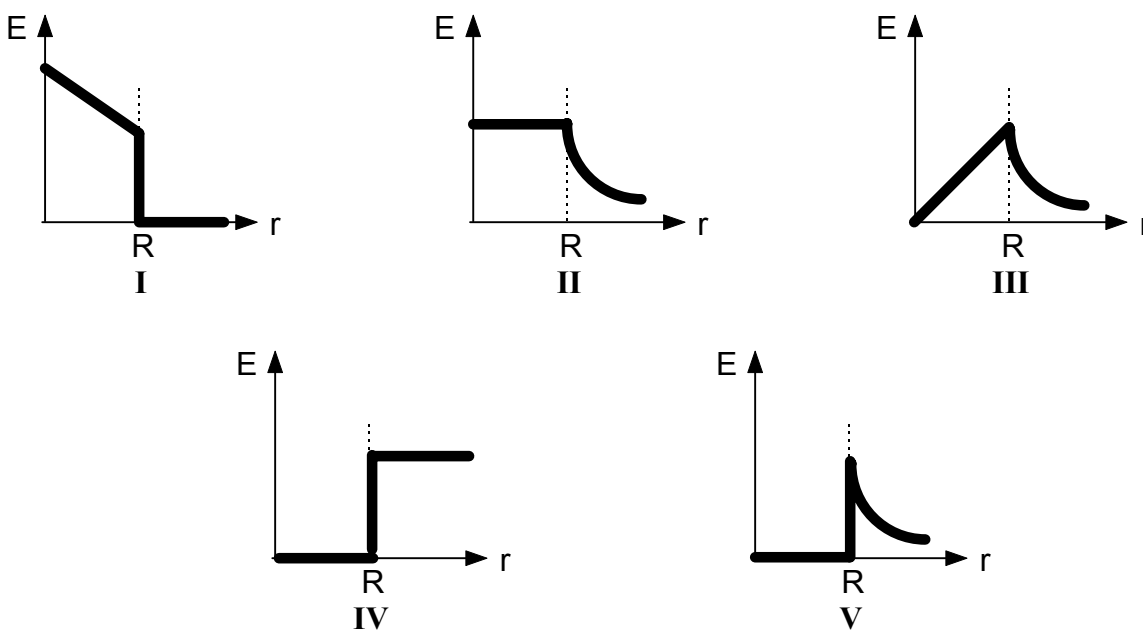
- A)  $5 \mu\text{F}$       D)  $100 \mu\text{F}$   
**B)  $10 \mu\text{F}$**       E) none of these  
C)  $50 \mu\text{F}$

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18. Two wires made of the same material have the same length but different diameters. They are connected in parallel to a battery. The quantity that is NOT the same for the wires is:

- A) the end-to-end potential difference
- B) the current**
- C) the current density
- D) the electric field
- E) the electron drift velocity

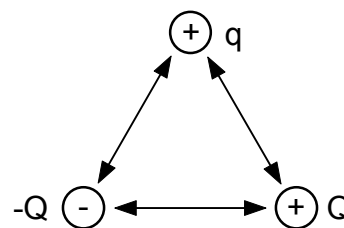
19. A solid insulating sphere of radius  $R$  contains a uniform volume distribution of positive charge. Which of the graphs below correctly gives the magnitude  $E$  of the electric field as a function of  $r$ ?



- A) I.
- B) II.
- C) III.**
- D) IV.
- E) V.

20. Charges  $Q$ ,  $-Q$ , and  $q$  are placed at the vertices of an equilateral triangle as shown. The total force exerted on the charge  $q$  is:

- A) toward charge  $Q$ .
- B) toward charge  $-Q$ .
- C) away from charge  $Q$ .
- D) left.**
- E) right.



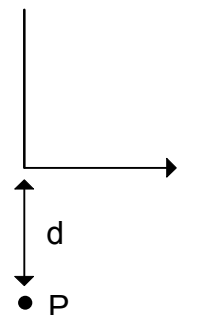
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21. Three resistors,  $R_1$ ,  $R_2$ ,  $R_3$ , are in series with each other.  $R_1 < R_2 < R_3$ . The current through  $R_1$  is  $i$ . Which statement is true?

- A)  $R_1$  has the largest potential difference across it.
- B)  $R_3$  has the largest potential difference across it.**
- C) The potential difference across each resistor is the same.
- D) The power dissipated by each resistor is the same.
- E) If the resistors are made of the same material, and have the same cross-sectional area, then  $R_1$  is the longest.

22. A current  $i$  goes through a wire that extends from infinitely far up, follows a  $90^\circ$  bend, and continues infinitely far to the right as shown. What is the magnitude of the magnetic field at P, a distance  $d$  below?

- A)  $\frac{2\mu_0 i}{\pi d}$
- B)  $\frac{\mu_0 i}{\pi d}$
- C)  $\frac{\mu_0 i}{2\pi d}$
- D)  $\frac{\mu_0 i}{4\pi d}$**
- E) zero



23. A certain physics textbook shows a region of space in which two electric field lines cross each other. We should conclude that:

- A) at least two point charges are present.
- B) an electrical conductor is present.
- C) an insulator is present.
- D) the field points in two directions at the same place.
- E) the author of the textbook made a mistake.**

24. The capacitance of a parallel-plate capacitor can be increased by:

- A) increasing the charge.
- B) decreasing the charge.
- C) increasing the plate separation.
- D) decreasing the plate separation.**
- E) decreasing the plate area.

25. Charge  $Q$  is distributed uniformly throughout a spherical insulating shell. The net electrical flux in  $\text{Nm}^2/\text{C}$  through the outer surface of the shell is:

- A) zero
- B)  $Q/\epsilon_0$**
- C)  $2Q/\epsilon_0$
- D)  $Q/4\epsilon_0$
- E)  $Q/2\pi\epsilon_0$

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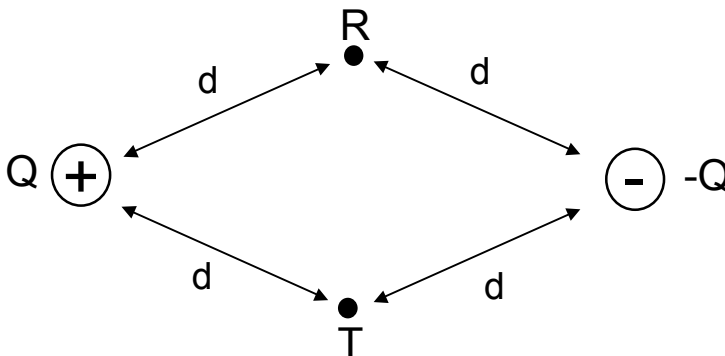
26. A 2 ohm resistor and 4 ohm resistor are connected in parallel to a 6 volt battery. The power dissipated by the 2 ohm resistor is:

- A) 8 W
- B) 6 W
- C) 9 W
- D) **18 W**
- E) None of these

27. A kiloampere - hour is a unit of:

- A) current
- B) charge per time
- C) power
- D) **charge**
- E) energy

28. Points R and T are each a distance  $d$  from each of two equal and opposite charges as shown. If  $k = 1/4\pi\epsilon_0$ , the work required to move a negative charge  $q$  from R to T is:



- A) **zero**
- B)  $kqQ/d^2$
- C)  $kqQ/d$
- D)  $kqQ/(4d^2)$
- E)  $kqQ/(2d)$

29. The current is zero in a conductor when no potential difference is applied because:

- A) the electrons are not moving.
- B) the electrons are not moving fast enough.
- C) **for every electron with a given velocity,  $v$ , there is another with velocity,  $-v$ .**
- D) equal numbers of electrons and protons are moving together.
- E) otherwise Ohm's law would not be valid.