1 Midterm Re-exam v3

(1) **1**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A proton moves in a uniform electric field directed along the positive y-axis. What is the direction of the electric force acting on the proton?

 a. Along the negative z-axis
 b. Along the positive z-axis
 c. Along the negative y-axis
 d. Along the positive y-axis ✓
 e. The force is zero because the proton is neutral.

(2) **2**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

Three charges $+q$, $+Q$, and $-Q$ are placed at the corners of an equilateral triangle. What is the direction of the net force on the $+q$ charge due to the other two charges?

 a. Vertically upward
 b. Vertically downward
 c. Horizontally to the right ✓
 d. Horizontally to the left
 e. Toward the $-Q$ charge

(3) **3**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

What is the magnitude of the electric force between two charges $+q$ and $-Q$ separated by a distance a?

 a. $\frac{kqQ}{a}$
 b. $\frac{2kqQ}{a}$
 c. $\frac{kqQ}{a^2}$ ✓
 d. $\frac{2kqQ}{a^2}$
 e. $\frac{kqQ}{a^3}$

(4) **4**

A solid conductor is in electrostatic equilibrium. Which of the following statements is true?

    a. The electric field inside the conductor is maximum at the center.
    b. The electric field inside the conductor is zero. ✓
    c. The electric field just outside the conductor is zero.
    d. The potential inside the conductor varies linearly with distance.
    e. The charge is uniformly distributed throughout the conductor.

(5) **5**

Two parallel wires carry currents in the same direction. What is the direction of the magnetic force between them?

    a. Attractive ✓
    b. Repulsive
    c. No force
    d. Perpendicular to the wires
    e. Along the direction of the current

(6) **6**

A proton moves in a straight line through a region with both electric and magnetic fields. If the magnetic field is directed upward, what must be the direction of the electric field?

    a. Into the page ✓
    b. Out of the page
    c. To the left
    d. To the right
    e. Downward

(7) **7**

A capacitor with plate area A and separation d is filled with air. If the separation d is doubled, what happens to the capacitance?

a. It doubles.
b. It quadruples.
c. It is halved. ✓
d. It is quartered.
e. It remains the same.

(8) **8**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A uniform magnetic field passes through a rectangular loop of wire. If the angle between the field and the normal to the loop is 30°, what is the magnetic flux through the loop?

a. Zero
b. $BA \cos 30°$ ✓
c. $BA \sin 30°$
d. $BA \tan 30°$
e. BA

(9) **9**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A metal sphere of radius r_1 with charge q is connected to an uncharged metal sphere of radius r_2. At equilibrium, what is true about the potentials of the two spheres?

a. The potentials are equal.
b. The potentials are equal. ✓
c. The potentials are inversely proportional to the radii.
d. The potentials are proportional to the radii.
e. The potentials are zero.

(10) **10**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A negatively charged conductor attracts a neutral object. What is the reason for this attraction?

a. The neutral object has a net positive charge.
b. The neutral object has a net negative charge.
c. The neutral object becomes polarized. ✓

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d. The neutral object gains electrons.

e. The neutral object loses electrons.

(11) **11**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

Three resistors $3\,\Omega$, $6\,\Omega$, and $9\,\Omega$ are connected in parallel. What is the equivalent resistance?

a. $1\,\Omega$

b. $2\,\Omega$

c. $1.64\,\Omega$ ✓

d. $3\,\Omega$

e. $18\,\Omega$

(12) **12**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

Two charges $-Q$ are fixed a distance L apart. A third charge $+q$ is placed midway between them. What is the net force on one of the $-Q$ charges?

a. $\frac{kQ^2}{L^2}$

b. $\frac{kQq}{L^2}$

c. $\frac{kQq}{4L^2}$ ✓

d. $\frac{kQ^2}{4L^2}$

e. Zero

(13) **13**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A particle of charge $-q$ is released from rest between two fixed charges $+Q$. What is the motion of the particle?

a. It moves to the right indefinitely.

b. It moves to the left indefinitely.

c. It oscillates between the two charges. ✓

d. It remains at rest.

e. It moves in a circular path.

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(14) **14**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A uniform electric field exists between two parallel plates. If the distance between the plates is doubled, what happens to the potential difference?

    a. It doubles.
    b. It quadruples.
    c. It doubles. ✓
    d. It is halved.
    e. It remains the same.

(15) **15**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

Two identical resistors are connected in series to a battery. If they are reconnected in parallel, what happens to the total power dissipated?

    a. It is halved.
    b. It is quartered.
    c. It doubles.
    d. It quadruples. ✓
    e. It remains the same.

(16) **16**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A charged particle moves in a circular path in a uniform magnetic field. How much work is done by the magnetic force in one full revolution?

    a. $\pi r^2 F$
    b. $2\pi r F$
    c. $\pi r F$
    d. Zero ✓
    e. $2r F$

(17) **17**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A negatively charged particle is moved between two points in an electric field. For which pair of points is no work done?

a. A and B
b. A and C ✓
c. A and D
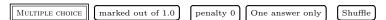d. B and C
e. B and D

(18) **18**

A positively charged particle is moved by an external force from point A to point B. For which motion is positive work required?

a. From A to B
b. From B to A
c. From C to A ✓
d. From C to D
e. From D to B

(19) **19**

The electric potential in a region is given by $V = ax - bx^2$. At what point is the electric field zero?

a. $x = 0$
b. $x = \frac{a}{2b}$ ✓
c. $x = ab$
d. $x = \frac{3a}{2b}$
e. At no point

(20) **20**

A loop of wire is rotated in a uniform magnetic field. At what angle is the torque on the loop maximum?

a. $0°$
b. $30°$
c. $45°$
d. $90°$ ✓
e. $180°$

(21) **21**

A solid conducting sphere of radius R has a charge $+Q$. What is the potential at the center of the sphere?

   a. $\frac{kQ}{R}$ ✓
   b. $\frac{kQ}{R^2}$
   c. Zero
   d. Undefined
   e. $\frac{kQ}{2R}$

(22) **22**

A capacitor of capacitance C_1 is connected to an uncharged capacitor of capacitance C_2. What is true about the charges and potentials after equilibrium is reached?

   a. $Q_1 = Q_2$ and $V_1 = V_2$
   b. $Q_1 = Q_2$ and $V_1 = \frac{1}{2}V_2$ ✓
   c. $Q_1 = \frac{1}{2}Q_2$ and $V_1 = V_2$
   d. $Q_1 = \frac{1}{2}Q_2$ and $V_1 = \frac{1}{2}V_2$
   e. $Q_1 = 2Q_2$ and $V_1 = V_2$

(23) **23**

A metal sheet is placed halfway between the plates of a capacitor. What happens to the capacitance?

   a. It doubles.
   b. It quadruples.
   c. It remains the same. ✓
   d. It is halved.
   e. It is quartered.

(24) **24**

A particle moves through a uniform magnetic field. Which particle has a positive charge?

a. Particle A
b. Particle B ✓
c. Particle C
d. Particle D
e. Particle E

(25) **25**

MULTIPLE CHOICE | marked out of 1.0 | penalty 0 | One answer only | Shuffle

A long, straight wire carries a current I. What is the value of the line integral of the magnetic field around a closed path enclosing the wire?

a. $\mu_0 I$ ✓
b. $\frac{\mu_0 I}{2\pi}$
c. $\frac{\mu_0 I}{2\pi a}$
d. $\frac{\mu_0 I}{2\pi a^2}$
e. Zero

Total of marks: 25