Physics 182
Spring 2026

Exam 3

Multiple Choice. For all questions/problems, choose the one alternative that BEST completes the statement or answers the question, and code your choice, A, B, C, D, or E on your scan sheet. For numerical answers, BEST means the closest to what you calculated. Each question is equally weighted.

1) A uniformly charged rod with total charge Q and total length L (λ = Q/L = constant) is oriented as shown. Which expression ,when integrated, will yield the electric potential at the point P?

A) $\int_0^L \frac{K\lambda dx}{(x^2+y^2)}$

B) $\int_0^L \frac{K\lambda dx}{x^2}$

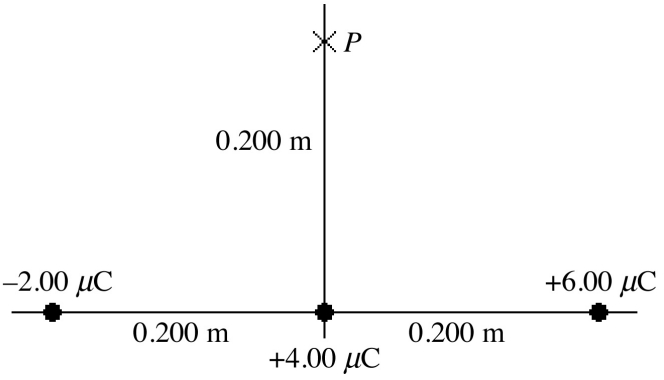
C) $\int_0^L \frac{K\lambda dx}{(x+y)}$

D) $\int_0^L \frac{K\lambda dx}{\sqrt{x^2+y^2}}$

E) $\int_0^L \frac{K\lambda x dy}{\sqrt{(x^2+y^2)^3}}$

Answer: D

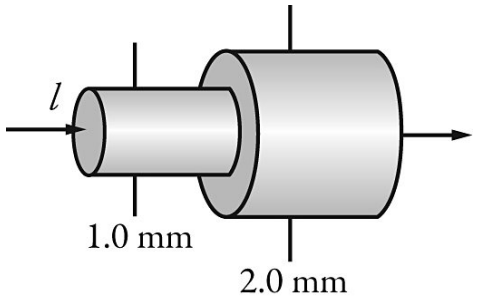
2) Three point charges of -2.00 μC, +4.00 μC, and +6.00 μC are placed along the *x*-axis as shown in the figure. What is the electrical potential at point *P* due to these charges?



A) +307 kV
B) -307 kV
C) +154 kV
D) 0 kV
E) -154 kV

Answer: A

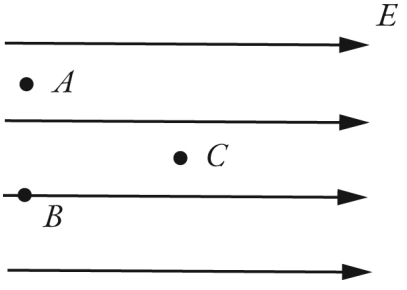
3) The figure shows two connected wires that are made of the same material. The current entering the wire on the left is 2.0 A and in that wire the electron drift speed is v_d. What is the electron drift speed in the wire on the right side?



A) $2v_d$
B) $4v_d$
C) $v_d/4$
D) $v_d/2$
E) v_d

Answer: C

4) Suppose a region of space has a uniform electric field, directed towards the right, as shown in the figure. Which statement about the electric potential is true?



A) The potential at points *A* and *B* are equal, and the potential at point *C* is higher than the potential at point *A*.
B) The potential at point *A* is the highest, the potential at point *B* is the second highest, and the potential at point *C* is the lowest.
C) The potential at points *A* and *B* are equal, and the potential at point *C* is lower than the potential at point *A*.
D) The potential at all three locations (*A*, *B*, *C*) is the same because the field is uniform.
E) None of the above is correct.

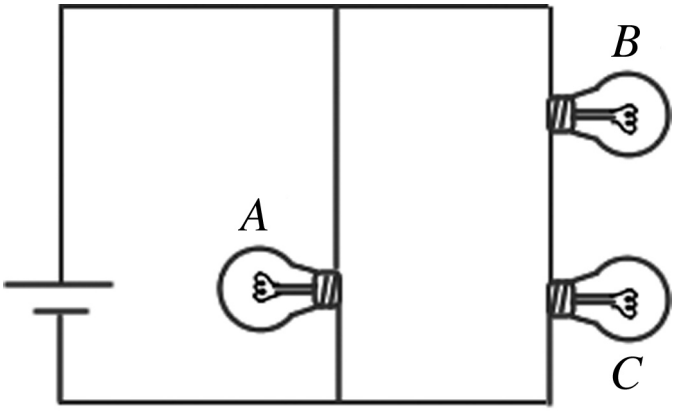
Answer: C

5) The resistivity of gold is $2.44 \times 10^{-8}\ \Omega \cdot$ m at room temperature. A gold wire that is 1.9 mm in diameter and 48 cm long carries a current of 800 mA. What is the electric field strength in the wire?

A) 0.017 V/m
B) 0.0017 V/m
C) 0.0054 V/m
D) 0.0088 V/m
E) 0.0069 V/m

Answer: E

6) In the circuit shown in the figure, all the lightbulbs are identical. Which of the following is the correct ranking of the brightness of the bulbs?



A) *A* is brightest, *C* is dimmest, and *B* is in between.
B) *A* and *B* have equal brightness, and *C* is the dimmest.
C) All three bulbs have the same brightness.
D) *A* is the brightest, and *B* and *C* have equal brightness but less than *A*.
E) *B* and *C* have equal brightness, and *A* is the dimmest.

Answer: D

7) When electric current is flowing in a metal, the electrons are moving

A) at the speed of light.
B) at nearly the speed of light.
C) at the speed of sound in the metal.
D) at the speed of sound in air.
E) at none of the above speeds.

Answer: E

8) An electron was accelerated from rest through a potential difference of 6100 V. What is its speed?

A) 4.6×10^7 m/s
B) 2.3×10^7 m/s
C) 3.4×10^6 m/s
D) 3.8×10^7 m/s
E) 3.1×10^7 m/s

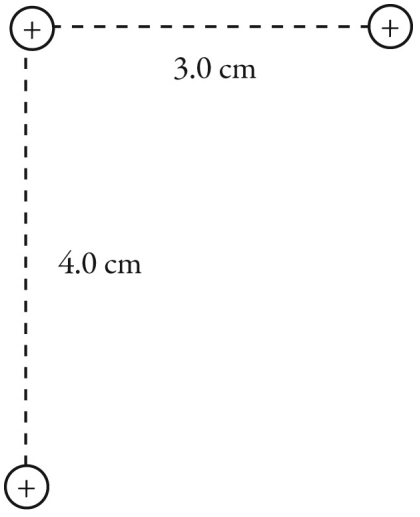
Answer: A

9) An uncharged 15.0-μF capacitor is connected in series with a 16-kΩ resistor, an ideal 10.0-V battery, and an open switch. What is the voltage across the capacitor 16 ms after closing the switch?

A) 0.94 V
B) 16 V
C) 1.9 V
D) 0.12 V
E) 0.64 V

Answer: E

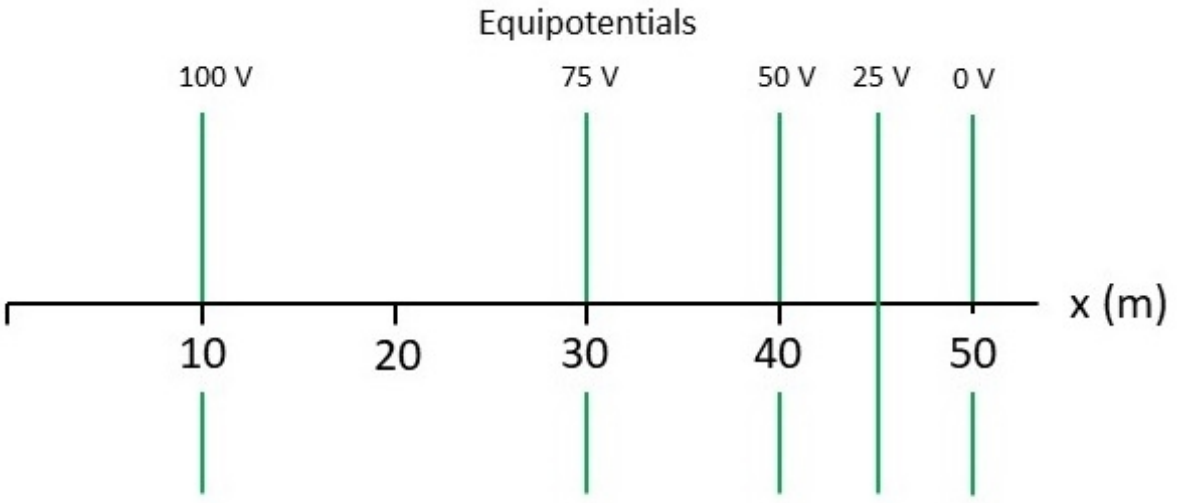
10) Consider the group of three+2.1 nC point charges shown in the figure. What is the electric potential energy of this system of charges relative to infinity?



A) 3.4×10^{-6} J
B) 4.8×10^{-6} J
C) 3.5×10^{-6} J
D) 3.2×10^{-6} J
E) 3.1×10^{-6} J

Answer: E

11) The magnitude and direction of the electric field at x = 35m is closest to.



A) 2.5 V/m to the left
B) 2.5 V/m to the right
C) 1.15 V/m to the right
D) 1.15 V/m to the left
E) 0.0 V/m

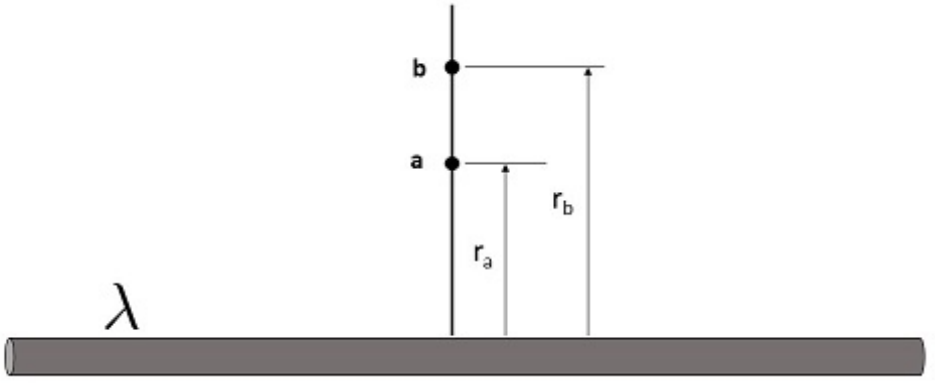
Answer: B

12) The heater element of a particular 120-V toaster is a 4.3-m length of nichrome wire, whose diameter is 0.18 mm. The resistivity of nichrome at the operating temperature of the toaster is $1.3 \times 10^{-6}\ \Omega \cdot \text{m}$. If the toaster is operated at a voltage of 120 V, how much power does it draw?

A) 72 W
B) 66 W
C) 68 W
D) 70 W
E) 63 W

Answer: B

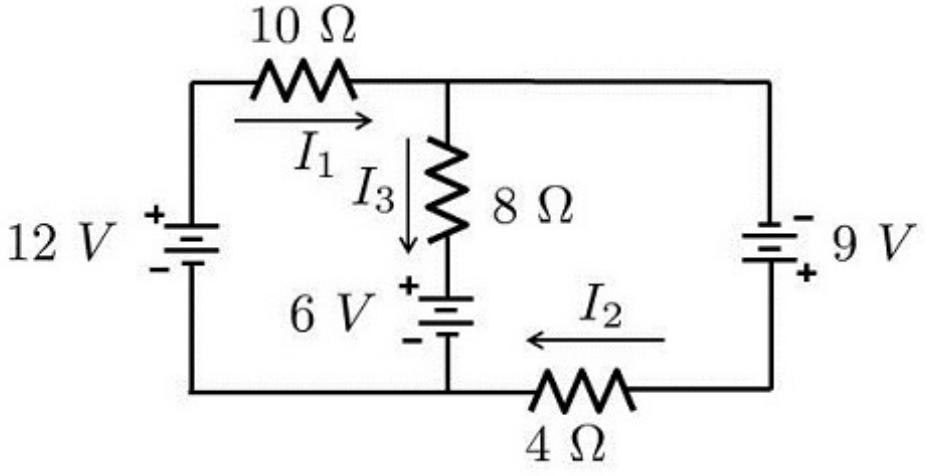
13) An infinitely long charged rod has charge density λ = 257.0 nC/m. Find the potential difference $V_a - V_b$ between points r_a = 5.0 m and r_b = 7.0 m on a line perpendicular to the axis of the rod.



A) 1.6 kV
B) 7.0 kV
C) 0.26 kV
D) 0.03 kV
E) 0.264 kV

Answer: A

14) For the assumed current directions shown in the circuit diagram below, what set of three equations for the three unknown currents will give the correct currents? Note that you do not have to solve for the currents.
(Caution: the choices may go onto the next page.)



A) $I_1 = I_2 + I_3$
$-10I_2 + 8I_3 = 4$
$4I_2 - 8I_1 = 15$

B) $I_1 = I_2 + I_3$
$12I_1 + 6I_3 = 5$
$-9I_2 + 6I_3 = 8$

C) $I_1 = I_2 - I_3$
$10I_1 + 8I_2 + 4I_3 = 7$
$3I_1 - 4I_2 - 8I_3 = 23$

D) $I_1 = I_2 + I_3$
$10I_1 + 8I_3 = 6$
$4I_2 - 8I_3 = 15$

E) $10I_1 + 4I_2 = 21$
$10I_1 + 8I_3 = 6$
$4I_2 - 8I_3 = 15$

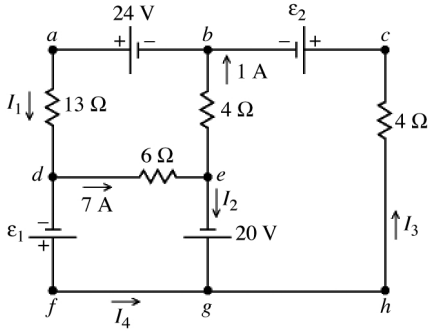
Answer: D

15) Near the end of his life, Nikola Tesla became obsessed with these animals.

A) Cats
B) Pigeons
C) Seagulls
D) Dogs
E) Squirrels

Answer: B

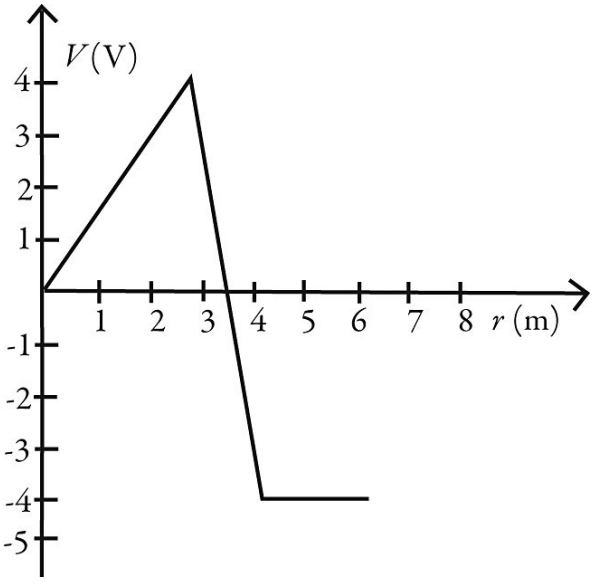
16) A multiloop circuit is shown in the figure. It is not necessary to solve the entire circuit. The current I_2 is closest to



A) zero.
B) 8 A down.
C) 6 A up.
D) 8 A up.
E) 6 A down.

Answer: E

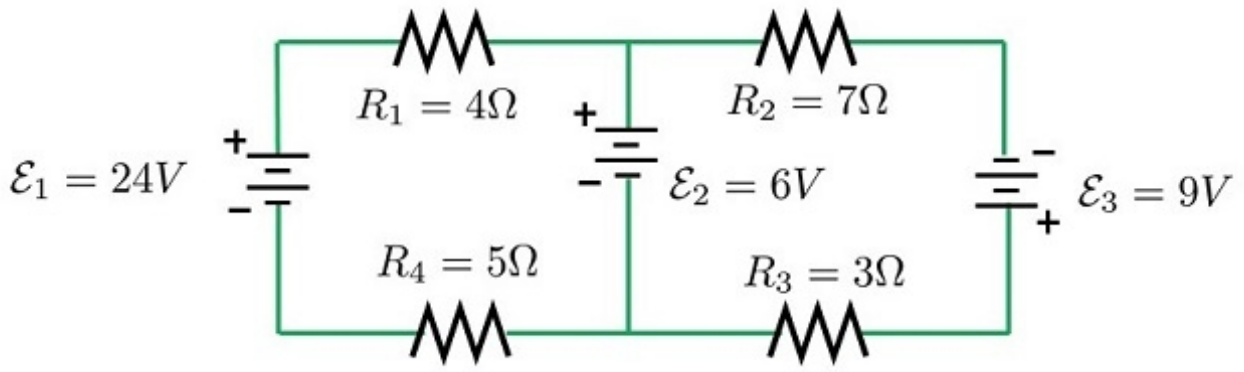
17) The graph in the figure shows the variation of the electric potential V (measured in volts) as a function of the radial direction r (measured in meters). For which range or value of r is the magnitude of the electric field the largest?



A) from r = 3 m to r = 4 m
B) at r = 4 m
C) from r = 0 m to r = 3 m
D) from r = 4 m to r = 6 m
E) at r = 3 m

Answer: A

18) What are the magnitude and direction of the current through the $R_3 = 3\Omega$ resistor?



A) 1.5 A to the right
B) 1.5 A to the left
C) 2.0 A to the left
D) 3.7 A to the right
E) 2.0 A to the right

Answer: B

19) What length of a certain metal wire of diameter 0.15 mm is needed for the wire to have a resistance of 15 Ω? The resistivity of this metal is $1.68 \times 10^{-8}\ \Omega \cdot \text{m}$.

A) 16 mm
B) 16 cm
C) 1.6 m
D) 160 m
E) 16 m

Answer: E

20) A very small object carrying -6.0 μC of charge is attracted to a large, well-anchored, positively charged object. How much kinetic energy does the negatively charged object gain if the potential difference through which it moves is 3.0 mV?

A) 0.50 kJ
B) 18 nJ
C) 3.0 nJ
D) 0.50 J
E) 6.0 μJ

Answer: B