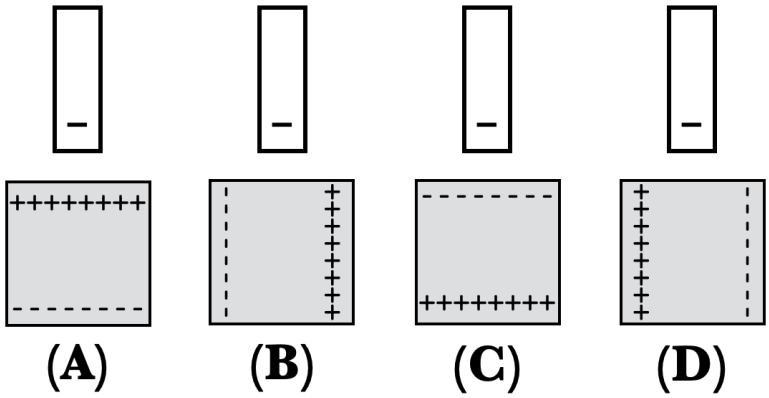
Physics 102 Name:_____

April 24-28 **Exam 2** 23 questions, 141 points

1. A negatively charged rod approaches a neutral metal block from above.

[4] (a) _____ Which of the following shows the resulting charge distribution on the block?

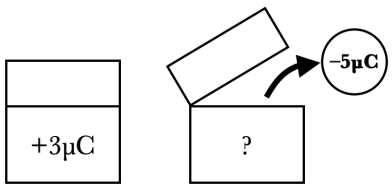


[2] (b) _____ This is due to the flow of. . . across the metal.

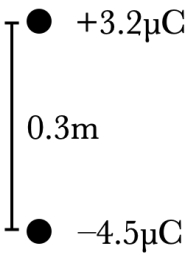
A) electrons **B)** protons **C)** both of these

[4] 2. _____ The total charge of a box with its contents is $+3\,\mu$C. We remove an object from inside the box which has a charge of $-5\,\mu$C. What is the total charge of the box now?

A) $-8\,\mu$C **B)** $-2\,\mu$C **C)** $+2\,\mu$C
D) $+3\,\mu$C **E)** $+5\,\mu$C **F)** $+8\,\mu$C



3. A $3.2\,\mu$C charge is placed so that it is 0.3 m above a $-4.5\,\mu$C charge.



4 (a) _____ What is the magnitude of the force on the $3.2\,\mu$C charge?

A) 0.048 N **B)** 0.13 N **C)** 0.16 N **D)** 0.432 N **E)** 1.44 N

4 (b) _____ What is the potential energy of the two charges, if $PE_\infty = 0$ (as usual)?

A) 0.048 N **B)** 0.13 N **C)** 0.16 N **D)** 0.432 N **E)** 1.44 N

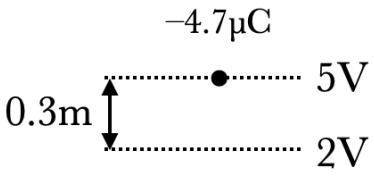
2 (c) _____ If released, the $3.2\,\mu$C will move

A) upward ↑ **B)** downward ↓

2 (d) _____ As the charges move in the direction you indicated in the previous part, the potential energy of the charges

A) increases **B)** decreases

4. Given these equipotential lines,



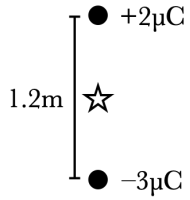
4 (a) _____ What is the average electric field between these lines?

A) $0.1\,\mathrm{V/m}\uparrow$ **B)** $0.9\,\mathrm{V/m}\uparrow$ **C)** $10\,\mathrm{V/m}\uparrow$
D) $0.1\,\mathrm{V/m}\downarrow$ **E)** $0.9\,\mathrm{V/m}\downarrow$ **F)** $10\,\mathrm{V/m}\downarrow$

4 (b) _____ If you moved a $-4.7\,\mu$C charge from the top line to the bottom line, what is the change in the charge's potential energy PE?

A) $-14.1\,\mu\mathrm{J}$ **B)** $-3\,\mu\mathrm{J}$ **C)** $-0.6\,\mu\mathrm{J}$
D) $0.6\,\mu\mathrm{J}$ **E)** $3\,\mu\mathrm{J}$ **F)** $14.1\,\mu\mathrm{J}$

5. Consider a $2\,\mu$C charge and a $-3\,\mu$C charge that are 1.2 m apart.



4 (a) _____ Find the electric potential halfway in between these charges (at the star).

A) $-150.0\,\text{kV}$ **B)** $-90.0\,\text{kV}$ **C)** $-25.0\,\text{kV}$
D) $-15.0\,\text{kV}$ **E)** $75.0\,\text{kV}$ **F)** $125.0\,\text{kV}$

4 (b) _____ What is the magnitude of the electric field halfway between the two charges?

A) $15\,\text{kN/C}$ **B)** $25\,\text{kN/C}$ **C)** $75\,\text{kN/C}$
D) $90\,\text{kN/C}$ **E)** $125\,\text{kN/C}$ **F)** $150\,\text{kN/C}$

4 6. _____ A functioning battery always maintains a constant
A) current **B)** energy **C)** potential difference **D)** power

7. Suppose a $I = 0.57\,\text{A}$ current flows through a mystery box; the current flows from a potential $V = 0\,\text{V}$ to a potential $V = 3.4\,\text{V}$.

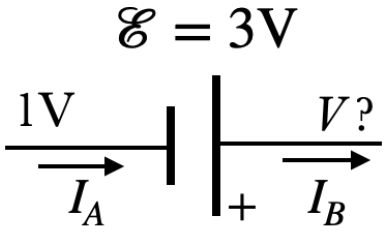
4 (a) _____ Which of these is true?

A) The box releases power from the current
B) The box supplies power to the current

4 (b) _____ How much power?

A) $0.17\,\text{W}$ **B)** $1.9\,\text{W}$ **C)** $1.94\,\text{W}$ **D)** $5.96\,\text{W}$

8. Consider this battery with an emf of $\mathcal{E} = 3\,\mathrm{V}$.



[4] (a) _____ If the potential at the negative end of the battery is 1 V, the potential at the positive end of the battery is

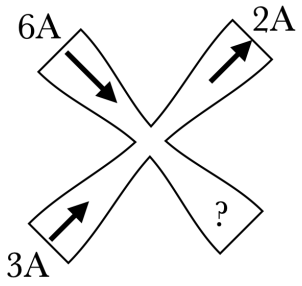
A) -2 V **B)** 1 V **C)** 2 V **D)** 3 V **E)** 4 V

[2] (b) _____ Which current is larger?

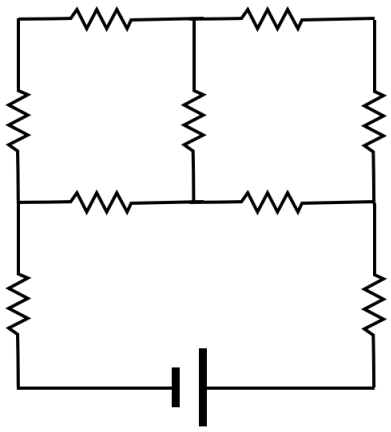
A) I_A, going into the battery
B) I_B, coming out of the battery
C) Both currents are the same

[4] 9. _____ This shows a junction. What is the current in the wire labelled with the "?"?

A) 1 A ↘ **B)** 1 A ↖ **C)** 5 A ↘ **D)** 5 A ↖
E) 7 A ↘ **F)** 7 A ↖ **G)** 11 A ↘ **H)** 11 A ↖

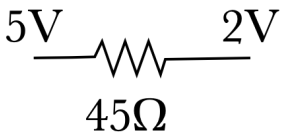


4 10. How many different currents are in this circuit? _____
Label them I_A, I_B, etc.



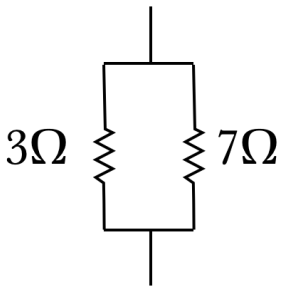
11. A $45\,\Omega$ resistor has a potential of $-5\,\text{V}$ on the left and $+2\,\text{V}$ on the right.

2 (a) _____ What direction is current running through the resistor?
A) to the left ← **B)** to the right →

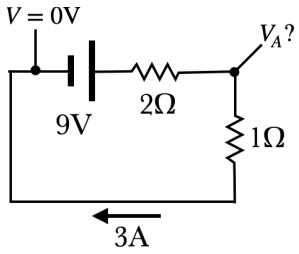


4 (b) _____ What is the magnitude I of that current?
A) 0.04 A **B)** 0.11 A **C)** 0.16 A
D) 6.43 A **E)** 288.66 A **F)** 315 A

4 12. _____ What is the equivalent resistance of these two resistors?
A) $0.48\,\Omega$ **B)** $2.1\,\Omega$ **C)** $10\,\Omega$ **D)** $21\,\Omega$



13. Consider this circuit; the current through it is 3 A.



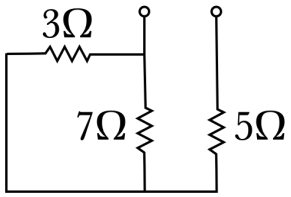
4 (a) _____ What is the *potential difference* ΔV across the 2 Ω resistor?

A) 1 V **B)** 2 V **C)** 3 V
D) 4.5 V **E)** 6 V **F)** 9 V

4 (b) _____ If the potential at the negative end of the battery is $V = 0$ V, what is the *potential* V at V_A?

A) 0 V **B)** 1 V **C)** 2 V **D)** 3 V
E) 4.5 V **F)** 6 V **G)** 9 V

14. Consider this set of resistors, with the two terminals shown.



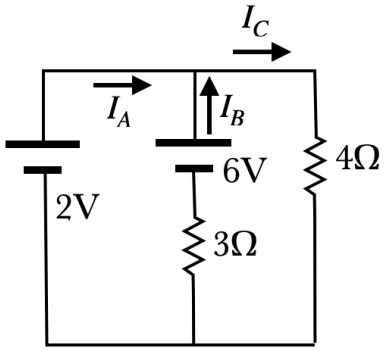
4 (a) _____ Which pair of resistors are in parallel with each other?

A) 3 Ω and 5 Ω **B)** 5 Ω and 7 Ω
C) 3 Ω and 7 Ω **D)** none of these

4 (b) _____ What is the equivalent resistance of these two resistors?

A) 1.48 Ω **B)** 3.33 Ω **C)** 5.48 Ω
D) 5.58 Ω **E)** 7.1 Ω **F)** 15 Ω

15. Consider this circuit.



4 (a) _____ Which of the following is true?

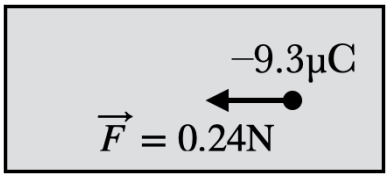
A) $I_A = I_B + I_C$ **B)** $I_B = I_A + I_C$ **C)** $I_C = I_A + I_B$

4 (b) Write a loop rule equation involving the two batteries.

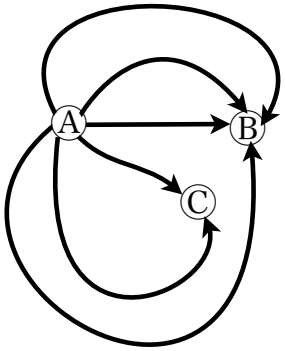
4 (c) Find I_A.

4 16. _____ A $-9.3\,\mu$C charge is placed in an electric field, and feels a force of 0.24 N to the left. The electric field at this point is

A) 0.03 MN → **B)** 0.03 MN ←
C) 2.23 MN → **D)** 2.23 MN ←
E) 38.75 MN → **F)** 38.75 MN ←

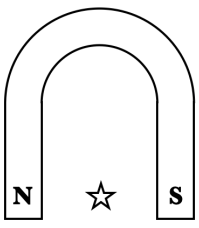


3 | 17. Here is an electric field created by several charges. What is the charge (+ or −) of each of them? A_____ B_____ C_____

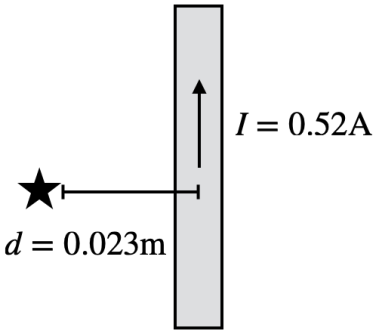


2 | 18. _____ These two magnets will. . . each other.
A) attract **B)** repel

2 | 19. _____ A horseshoe magnet is a bar magnet that is bent into this curved shape. What is the direction of the magnetic field at the star? (In other words, in what direction would a compass point if placed at the star?)
A) ↑ **B)** ← **C)** ↓ **D)** →



20. Consider a long straight wire carrying $I = 0.52\,\text{A}$ upward.

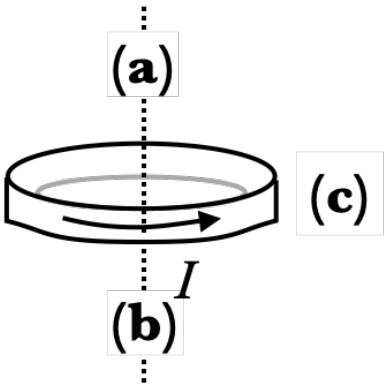


4 (a) _____ What is the direction of the magnetic field at the star?

A) $\leftarrow$ **B)** $\rightarrow$ **C)** $\uparrow$ **D)** $\downarrow$
E) $\odot$ (out of the page) **F)** $\otimes$ (into the page)

4 (b) Find the magnitude of the magnetic field at the star.

21. This loop of wire carries a current counterclockwise as seen from above. What is the direction of the magnetic field...



2 (a) _____ ...at (a)?

A) $\leftarrow$ **B)** $\rightarrow$ **C)** $\uparrow$ **D)** $\downarrow$
E) $\odot$ (out) **F)** $\otimes$ (in)

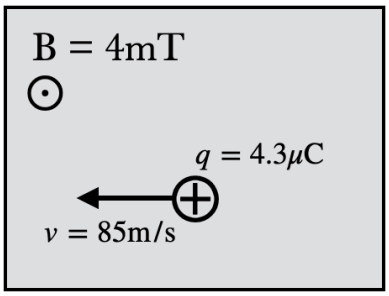
2 (b) _____ ...at (b)?

A) $\leftarrow$ **B)** $\rightarrow$ **C)** $\uparrow$ **D)** $\downarrow$
E) $\odot$ (out) **F)** $\otimes$ (in)

2 (c) _____ ...at (c)?

A) $\leftarrow$ **B)** $\rightarrow$ **C)** $\uparrow$ **D)** $\downarrow$
E) $\odot$ (out) **F)** $\otimes$ (in)

22. A magnetic field $B = 4 \times 10^{-3}\,\text{T}$ points out of the page in the grey area. A charge $q = +4.3 \times 10^{-6}\,\text{C}$ moves to the left at 85 m/s.



4 (a) _____ What is the direction of the force on the charge?

A) ← **B)** → **C)** ↑ **D)** ↓
E) ⊙ (out) **F)** ⊗ (in)

4 (b) What is the magnitude of the force on the charge?

4 (c) This charge will move in a circle. What is the radius of that circle, if the mass of the charge is $m = 2 \times 10^{-10}\,\text{kg}$?

2 23. _____ A square loop of wire enters a magnetic field which is pointing out of the page, which induces a current inside the loop. In which direction does the induced current flow?

A) clockwise ↻ **B)** counterclockwise ↺