

## HONORS FIZZIX: EXAM #9 Ch18-20

*SA / Free Response / Harder / Tuffer / Math-Based / Icky Section*

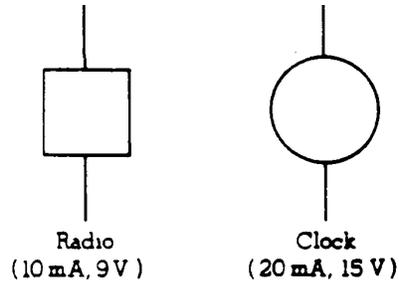
There are **five** problems; choose **THREE** for a total of **THREE** (3, ONE more than a couple, MINIMUM for a “few”,  $\sqrt{9}$ , # of Stooges, The Trinity, # of Strikes, # of Coins in a Fountain, # of French Hens, # Miles in a League, # in a Hat Trick, # of Little Pigs, The # of Billy Goats Gruff, # of Bears Goldilocks had to fight off, # minutes an egg needs, # English feet in a yard, # Books in LOTR Trilogy, # in ANY Trilogy, # Rings in a Circus, # Ships Columbus Sailed, #Witches in Macbeth, # Blind Mice, #Musketees, # Bee Gees, # Branches of US Government, # Sides to a Triangle, # Races in the Triple Crown (DUH), # Cousins of Donald Duck, # Dog Nights, # Stars in Orion’s Belt, # Fake Parts to the Atom you’ve been taught, # Quarks in a baryon (LIKE A PROTON...), # Earth Layers, # Barleycorns in an Inch, # King Lear’s Daughters, # Holes in a Bowling Ball, # Colors of a US Stop Light, # Lines in Haiku, # Lifeline in Millionaire, # Leaves on a Shamrock, # Scruple in a Dram, # Minutes in a Pro Boxing Match, # Teaspoons in a Tablespoon, # MegaJoules in a KwHr, # Newton’s Laws of Motion, # Points for a Field Goal, # Wise Men, # Tenors, # Gorgons, # Roman Furies, #Rings in a 3-ring binder, # Times one can say “Betelgeuse” before all heck breaks loose, #Level of Truth (It, Whole, & Nothing But), # of representations hands can have to decide a dispute, # Sounds Rice Crispies make, # Levels of human attributes in Clint Eastwood’s 1<sup>st</sup> REAL movie, # Chipmunks, ... Get it Yet? 3.) All count the same, so...

**Show all work and MAKE REASONING CLEAR!**

*No credit for “Then a Miracle Occurs and...”*

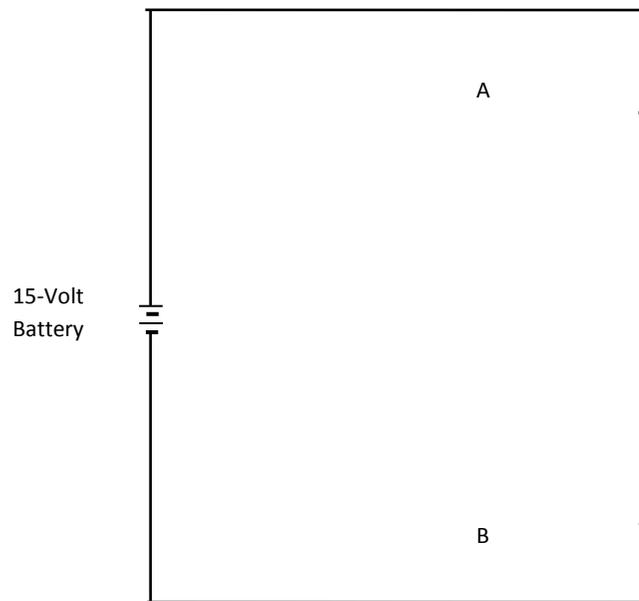
*This exam is DUE NO LATER THAN WEDNESDAY 04/06/2016 @ 2:30PM*

1.



A cabin contains only two small electrical appliances: a radio that requires 10-mA of current at 9 volts, and a clock that requires 20-mA at 15 V. A 15-V battery with negligible internal resistance supplies the electrical energy to operate the radio and the clock.

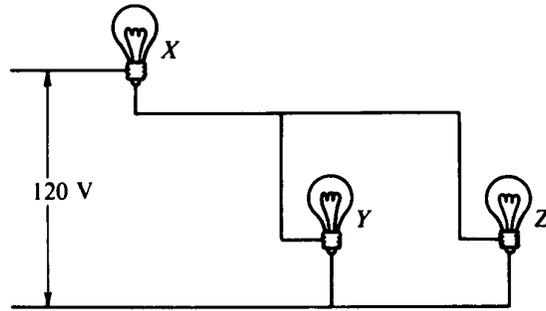
- a. Complete the diagram below to show how the radio, the clock, and a single resistor  $R$  can be connected between points  $A$  and  $B$  so that the correct potential difference is applied across each appliance. Use the symbols in the diagram above to indicate the radio and the clock.



- b. Calculate the resistance of  $R$ .

- c. Calculate the electrical energy that must be supplied by the battery to operate the circuits for 1 minute.

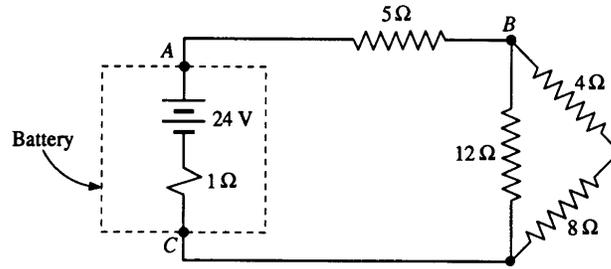
2.



In the circuit shown above, **X**, **Y**, and **Z** represent three light bulbs, each rated at 60-W, 120-V. Assume that the resistances of the bulbs are constant and do not depend on the current.

- What is the resistance of each bulb?
- What is the equivalent resistance of the three light bulbs when arranged as shown?
- What is the total power dissipation of this combination when connected to a 120-V source as shown?
- What is the current in bulb **X**?
- What is the potential difference across bulb **X**?
- What is the potential difference across bulb **Z**?

3.

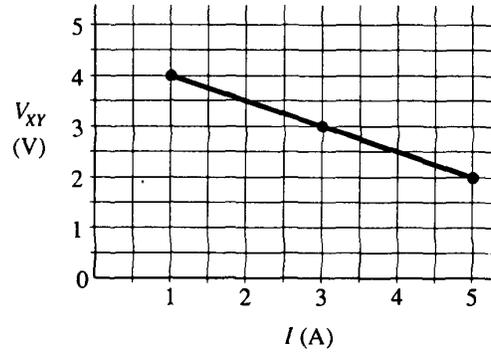
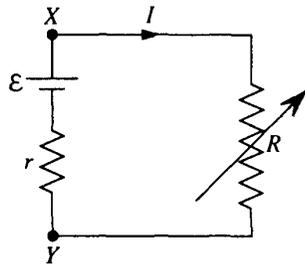


A battery with  $\mathcal{E}$  of 24-V and an internal resistance of  $1\text{-}\Omega$  is connected to an external circuit as shown above.

Determine each of the following:

- the equivalent resistance of the combination of the  $4\text{-}\Omega$ ,  $8\text{-}\Omega$ , and  $12\text{-}\Omega$  resistors.
- the current in the  $5\text{-}\Omega$  resistor.
- the terminal voltage,  $V_T$  of the battery.
- the rate at which energy is dissipated in the  $12\text{-}\Omega$  resistor.
- the magnitude of the potential difference  $V_T$ .
- the power delivered by the battery to the external circuit.

4.



A battery with *emf*  $\mathcal{E}$  and internal resistance  $r$  is connected to a variable resistance  $R$  at points  $X$  and  $Y$ , as shown above on the left. Varying  $R$  changes both the current  $I$  and the terminal voltage  $V_{XY}$ . The quantities  $I$  and  $V_{XY}$  are measured for several values of  $R$  and the data are plotted in a graph, as shown above on the right.

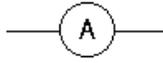
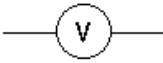
a. Determine the *emf*  $\mathcal{E}$  of the battery.

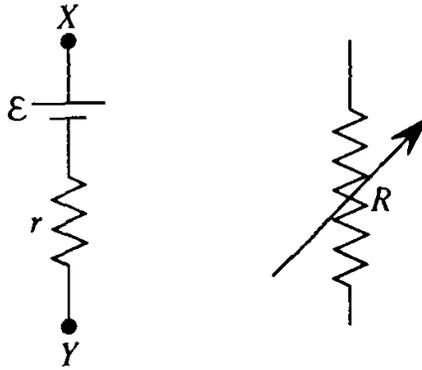
b. Determine the internal resistance  $r$  of the battery.

c. Determine the value of the resistance  $R$  that will produce a current  $I$  of 3-A.

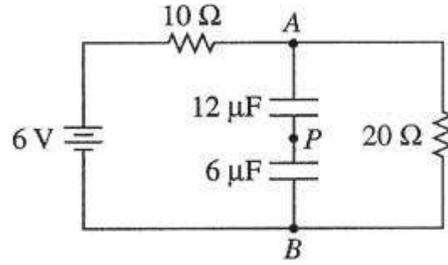
d. Determine the maximum current that the battery can produce.

#4 Continued:

e. The current and voltage measurements were made with an ammeter and a voltmeter. On the diagram below, show a proper circuit for performing these measurements. Use  to represent the ammeter and  to represent the voltmeter.



5.



A circuit contains two resistors ( $10\text{-}\Omega$  and  $20\text{-}\Omega$ ) and two capacitors ( $12\text{-}\mu\text{F}$  and  $6\text{-}\mu\text{F}$ ) connected to a  $6\text{ V}$  battery, as shown in the diagram above. The circuit has been connected for a long time.

- Calculate the total capacitance of the circuit.
- Calculate the current in the  $10\ \Omega$  resistor.
- Calculate the potential difference between points **A** and **B**.
- Calculate the charge stored on one plate of the  $6\ \mu\text{F}$  capacitor.
- The wire is cut at point **P**. Will the potential difference between points **A** and **B** increase, decrease, or remain the same?

\_\_\_\_\_increase

\_\_\_\_\_decrease \_\_\_\_\_remain the same

Justify your answer.