

## Questions 1-5 and 17 A & B will not be covered this semester

Concepts of Physics - PHYS 106  
Test 4  
December 4, 1995

NAME \_\_\_\_\_  
ID# \_\_\_\_\_  
SEAT# \_\_\_\_\_

Before beginning the test:

1. Fill in all "bubbles" on the response sheet corresponding to your student number.
2. On the card fill in 1 under "Mark Test Version Number".
3. To give permission to have your multiple choice score posted by ID number fill in the appropriate bubble. Otherwise leave it blank.
4. Print your name on the answer sheet and the front of the test. Complete ID# and Seat# information on this page.
5. **Sign your name on the back of the test.**

During the test:

1. Use a NUMBER 2 PENCIL. For the multiple choice questions fill in the correct answer on the answer sheet. If the correct answer is "None of the above," you must fill in (e) on the card and write the correct answer.
2. Answer questions 17 and 18 on these pages.

Turn in the test and the answer sheet when you are finished.

Each multiple choice question is worth 4 points and has only one correct answer.

**If the answer is "None of the above", you must place the correct answer in the blank.**

1. Does the freezer in the Activities Center by itself obey the Second Law of Thermodynamics?
  - (a) Yes, because all objects obey the Second law.
  - (b) Yes, because the freezer is a heat engine running backwards.
  - (c) No, because the Second Law does not apply to freezers and refrigerators.
  - (d) No, because the freezer is not a closed system.
  - (e) None of the above \_\_\_\_\_.
2. A refrigerator uses 25 joules of electrical energy to remove 100 joules of thermal energy from the inside of a refrigerator. How much thermal energy is exhausted by the refrigerator's coils?
  - (a) 25 Joules
  - (b) 75 Joules
  - (c) 100 Joules
  - (d) 125 Joules
  - (e) None of the above \_\_\_\_\_.
3. When Randy says "Humankind is running out of energy," what does he mean?
  - (a) The total amount of energy on Earth is decreasing.
  - (b) The amount of thermal energy on Earth is decreasing.
  - (c) The amount of high entropy energy on Earth is decreasing.
  - (d) The amount of low entropy energy on Earth is decreasing.
  - (e) None of the above \_\_\_\_\_.

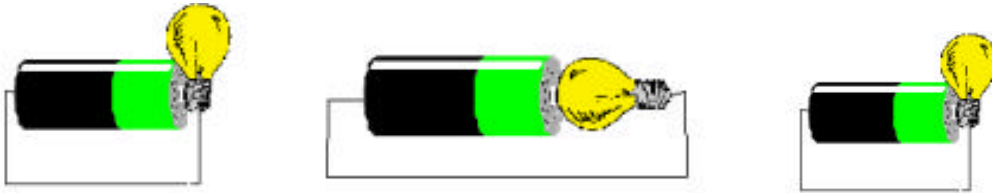
4.... In a closed system, we never saw a cool object become cooler while a warm object became warmer. Why?

- (a) Energy of the system would not be conserved.
- (b) Energy of the system would decrease.
- (c) Entropy of the system would increase.
- (d) Entropy of the system would decrease.
- (e) More than one of the above. (List them. \_\_\_\_\_)

5.... A steam engine is operating at 500 K and exhausting to an environment at 300 K. What is the best possible efficiency of this engine?

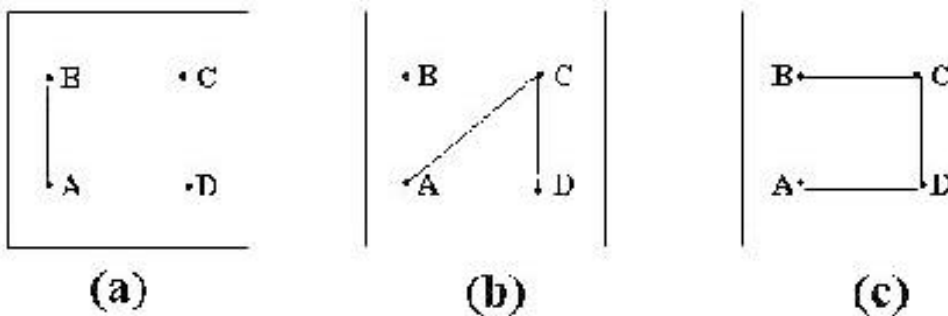
- (a) .33
- (b) .60
- (c) .66
- (d) 1.66
- (e) None of the above \_\_\_\_\_.

6.... Based on your experiences in the Activities Center determine which of the battery and bulb combinations shown below will result in the bulb turning on.



- (d) more than one the above. (List them. \_\_\_\_\_)
- (e) None of the above. (Draw one that will work. \_\_\_\_\_)

7.... Suzanne has a circuit puzzle which is similar to the ones in the Activities Center. She connects the wires from the battery and bulb to points A and B. The bulb turns on. From this information only, which of the drawings below could represent this puzzle?

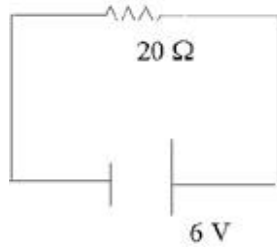


- (d) More than one of the above. (List them. \_\_\_\_\_)
- (e) None of the above. (Draw one that will work. \_\_\_\_\_)

8.... Kim plugs two toasters into outlets with voltages of 120 volts. One toaster has a current of 6 amperes while the other has a current of 4 amperes. Which toaster has the greater resistance?

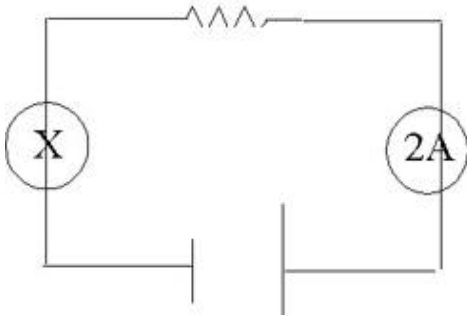
- (a) The toaster with 4 amperes.
- (b) The toaster with 6 amperes.
- (c) Both toasters have the same resistance because they are plugged into the same voltage.
- (d) Both toasters have the same resistance because they produce heat but not light.
- (e) None of the above \_\_\_\_\_.

9.... One of the resistors in the Activities Center had a resistance of 20 ohms as shown below. What was the current when the resistance was connected as shown below?



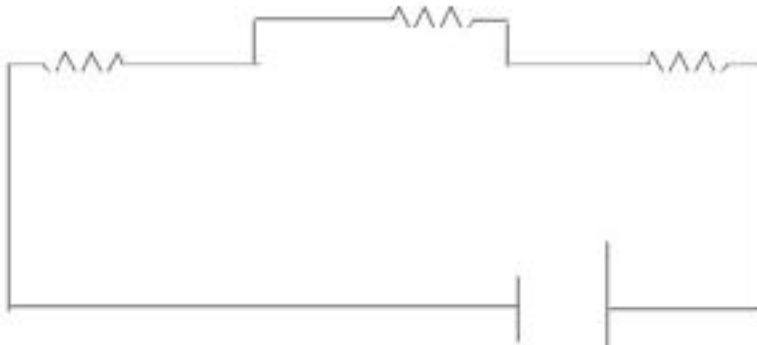
- (a) 120 ampere
- (b) 6 amperes
- (c) 3.3 amperes
- (d) 0.3 amperes
- (e) None of the above \_\_\_\_\_.

10.. What is the current at location "X" in the circuit below?



- (a) Less than 2 amperes.
- (b) Equal to 2 amperes.
- (c) Greater than 2 amperes.
- (d) Insufficient information is given to answer the question. (What else do you need? \_\_\_\_\_)
- (e) None of the above \_\_\_\_\_.

11.. One of the circuits in the most recent application could be drawn as shown below. What type of circuit is it?

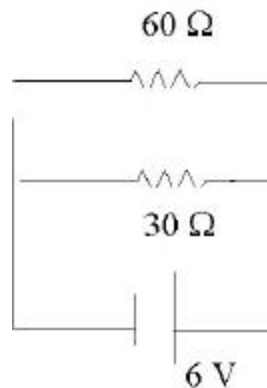


- (a) series
- (b) parallel
- (c) A combination of series and parallel.
- (d) Something different from either series or parallel.
- (e) None of the above \_\_\_\_\_.

12.. In one of the application activities you connected a circuit which contained two  $30\ \Omega$  resistors in parallel. This circuit was connected to a 6-volt battery. What was the current in each resistor?

- (a) .2 amperes
- (b) .4 amperes
- (c) 5 amperes
- (d) 10 amperes
- (e) None of the above\_\_\_\_\_.

13.. Suppose Kevin replaces one of the resistors in the circuit in question 12 with a 60 ohm resistor. Then, he has the circuit shown below. How will the current through the  $30\ \Omega$  resistor compare with the current calculated in question 12?

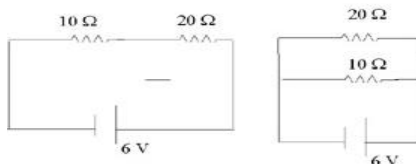


- (b)(a) The current through the  $30\ \Omega$  resistor will be greater than the value calculated in question 12.
- (b) The current through the  $30\ \Omega$  resistor will be equal to the value calculated in question 12.
- (c) The current through the  $30\ \Omega$  resistor will be less than the value calculated in question 12.
- (d) Insufficient information is given to answer the question. (What else do you need?\_\_\_\_\_)
- (e) None of the above\_\_\_\_\_.

14.. What is the resistance of a  $12\ \Omega$  and a  $24\ \Omega$  resistance connected in series?

- (a) .25  $\Omega$
- (c)  $8\ \Omega$
- (d)  $12\ \Omega$
- (e)  $24\ \Omega$
- (e) None of the above\_\_\_\_\_.

15.. Which of the circuits below will have the same current everywhere in the circuit?



**(a)**

**(b)**

- (c) Both will have the same current throughout the circuit.
- (d) Neither will have the same current throughout the circuit.
- (e) None of the above\_\_\_\_\_.

16.. Why can you conclude that the light bulbs on the bicycle generator are connected in parallel?

- (a) Because all bulbs turn on when the generator starts turning.
- (b) Because the bulbs are dim when we pedal slowly.
- (c) Because turning off the bulb causes all others to turn off.
- (d) More than one of the above. (List them. \_\_\_\_\_)
- (e) None of the above \_\_\_\_\_.

17. The K-State Power Plant, west of Lafene, contains an electrical generator which converts chemical potential energy (oil or gas) into electrical energy. The process is very similar to the steam engine in the Activities Center. Some of the waste energy from this process is not exhausted into the environment. Instead, it is used to heat water which is circulated through campus buildings and keeps us warm in the winter
- A. (6 pts) Draw a diagram which shows the transformation of energy in this process. Begin with chemical potential energy and end with the final energy form(s).
- B. (6 pts) Why does this use of waste energy slow the entropy increase in the world?
- C. (6 pts) The power plant produces 750 volts of electrical energy at a current of 15 amperes. What is its power output?

18. A common problem in apartments and dorms is blowing fuses when several people are simultaneously using hair dryers. To investigate this problem suppose that a circuit has a 15 ampere fuse. Two hair dryers are connected to this 120 volt circuit. One uses 9 amperes; the other, 6 amperes.

A... (6 pts) What is the resistance of each hair dryer?

B ... (6 pts) What is the total current passing through the fuse when both hair dryers are connected in the same circuit? Explain your answer. (Part of the question is to know the type of circuit involved.)

C (6 pts) Suppose that a light bulb with 0.5 amperes moving through it is connected to the same circuit as the two hair dryers. All objects are connected in the type of circuit normally used in homes. If the hair dryers and the light bulb are turned on, will a fuse blow? Explain how you reached your conclusion.