

SCIE 3101

Test II

MULTIPLE CHOICE.

- 1) An Earth satellite is in an elliptical orbit. The satellite travels fastest when it is
 - A) farthest from the earth.
 - B) it travels at a constant speed everywhere in orbit.
 - C) nearest the earth.**

- 2) Acceleration is greatest for a satellite when it is at the
 - A) apogee.
 - B) perigee.**
 - C) same at both places

- 3) A completely submerged object always displaces its own
 - A) weight of fluid.
 - B) density of fluid.
 - C) volume of fluid.**
 - D) all of these
 - E) none of these

- 4) What is the weight of water displaced by a 100-ton floating ship?
 - A) less than 100 tons
 - B) 100 cubic meters
 - C) 100 tons**
 - D) more than 100 tons
 - E) depends on the ship's shape

- 5) A rock suspended by a weighing scale weighs 5 N out of water and 3 N when submerged in water. What is the buoyant force on the rock?
 - A) 5 N
 - B) 2 N**
 - C) 8 N
 - D) 3 N
 - E) none of these

- 6) As a helium-filled balloon rises in the air, it becomes
 - A) heavier.
 - B) bigger.**
 - C) more dense.
 - D) all of these
 - E) none of these

- 7) Airplane flight is best illustrated by
 - A) Boyle's law.
 - B) Archimedes' principle.
 - C) Bernoulli's principle.**

- 8) When you touch a cold piece of ice with your finger, energy flows
 - A) from the ice to your finger.
 - B) from your finger to the ice.**
 - C) actually both ways

- 9) The lowest temperature possible in nature is
 - A) 4 K.
 - B) 0°C.
 - C) -273°C.**

- 10) Two identical blocks of iron, one at 10°C and the other at 20°C, are put in contact. Suppose the cooler block cools to 5°C and the warmer block warms to 25°C. This would violate the
 - A) first law of thermodynamics.
 - B) second law of thermodynamics.**
 - C) both of these
 - D) neither of these

- 11) Objects that radiate relatively well,
A) absorb radiation relatively well. B) reflect radiation relatively well.
 C) both of these D) neither of these
- 12) A good reflector of radiation is a
 A) good emitter of radiation. **B) poor absorber of radiation.**
 C) good absorber of radiation. D) none of these
- 13) The reason the Sun's radiant energy is of shorter wavelengths than the earth's is because the Sun
A) has a higher temperature than the earth.
 B) has much more thermal energy.
 C) is an energy source while the earth is primarily an energy receiver.
 D) all of these
 E) none of these
- 14) Increasing the temperature of 50 grams of water by 1°C requires
 A) 1 calorie. **B) 50 calories.** C) none of these
- 15) A positive ion has more
 A) electrons than protons. B) electrons than neutrons.
C) protons than electrons. D) protons than neutrons.
 E) neutrons than protons.
- 16) An ampere is a unit of electrical
A) current. B) pressure. C) resistance.
 D) all of these E) none of these
- 17) In an AC circuit, the electric field
 A) increases via the inverse square law.
 B) is the same everywhere.
C) changes magnitude and direction with time.
 D) is nonexistent.
 E) none of these
- 18) The electric power of a lamp that carries 2 A at 120 V is
 A) 60 W. B) 20 W. **C) 240 W.** D) 1/6 W. E) 2 W.
- 19) When a pair of 1 ohm resistors are connected in series, their combined resistance is
 A) 1 ohm, and when connected in parallel, 2 ohms.
 B) 1/2 ohm, and when in parallel, 2 ohms.
C) 2 ohms, and when in parallel, 1/2 ohm.
 D) 2 ohms, and when in parallel, 1 ohm.
 E) none of these

- 20) Two lamps, one with a thick filament and one with a thin filament, are connected in parallel to a battery. The voltage is greatest across the lamp with the
 A) thick filament. B) thin filament. **C) Both voltages are the same.**
- 21) Voltage can be induced in a wire by
 A) moving a magnet near the wire. B) changing the current in a nearby wire.
 C) moving the wire near a magnet. **D) all of these**
 E) none of these
- 22) Voltage produced by a generator alternates because
 A) the current it produces alternates.
 B) unlike a battery, it produces alternating current.
 C) in effect it is an ac motor in reverse.
 D) alterations in the mechanical energy input.
E) the changing magnetic field that produces it alternates.
- 23) A transformer actually transforms
 A) generators into motors. B) magnetic field lines.
C) voltage. D) nonsafe forms of energy to safe forms of energy.
 E) all of these
- 24) Metal detectors, like the ones used at airports, are activated by
 A) alternating current. B) electric fields.
C) electromagnetic induction. D) magnetic fields.
- 25) A certain transformer doubles input voltage. If the primary coil has 10 A of current, then the current in the secondary coil is
 A) 2 A. **B) 5 A.** C) 25 A. D) 10 A. E) none of these

Problems (SHOW ALL WORK ON THE ANSWER SHEET):

1. (5 points) When a 10-V battery is connected to a resistor, 2 A of current flow in the resistor. What is the resistor's value?

$$I = \frac{V}{R}$$

$$2A = \frac{10V}{R}$$

$$R = 5 \text{ ohms}$$

2. (5 points) The voltage across the input terminals of a transformer is 110 V. The primary has 50 loops and the secondary has 25 loops. The voltage the transformer puts out is

$$\frac{V_p}{T_p} = \frac{V_s}{T_s}$$
$$\frac{110V}{50} = \frac{x}{25}$$
$$x = 55V$$

3. (5 points) A 4 ohm resistor is connected in parallel with a 6 ohm resistor. This combination produces an equivalent resistance of

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$
$$= \frac{1}{4} + \frac{1}{6}$$
$$= \frac{3}{12} + \frac{2}{12}$$
$$= \frac{5}{12}$$
$$R_t = \frac{12}{5}$$
$$= 2.4 \text{ ohms}$$

4. (5 points) What is the ideal efficiency of an automobile engine in which gasoline is heated to 2700 K and the outdoor air is 300 K?

$$\text{ideal eff} = \frac{T_H - T_C}{T_H}$$
$$= \frac{2700K - 300K}{2700K}$$
$$= 0.89$$

5. (5 points) A 1.5L sample of gas was found to have a pressure of 760 mmHg. What would the volume of this gas be if the pressure were increased to 1280 mmHg?

$$P_1V_1 = P_2V_2$$
$$760\text{mmHg}(1.5L) = 1280\text{mmHg}(V_2)$$
$$V_2 = \frac{760\text{mmHg}(1.5L)}{1280\text{mmHg}}$$
$$= 0.89L$$