

JP's Physics 101 Test Bank 5

Multiple Choice

Identify the choice that best completes the statement or answers the question.

- _____ 1. A device that stores separated electrical charges is called _____ .
- A. a resistor
 - B. a conductor
 - C. a wire
 - D. a capacitor
 - E. an insulator
- _____ 2. When an electronic flash on a camera flashes, the burst of current used to create the flash of light is produced by the rapid discharge of
- A. a battery.
 - B. a coiled spring.
 - C. a capacitor.
 - D. a resistor.
 - E. an inductor.
- _____ 3. A capacitor is a device used to
- A. measure the volume of a glass container.
 - B. convert electricity into heat.
 - C. force current through a wire.
 - D. store separated electrical charges.
 - E. convert electricity into light.
- _____ 4. The two types of electrical charge are called
- A. up and down.
 - B. black and white.
 - C. left and right.
 - D. red and green.
 - E. positive and negative.
- _____ 5. A negatively charged object
- A. has a deficiency of electrons.
 - B. has a deficiency of neutrons.
 - C. has an excess of neutrons.
 - D. has an excess of electrons.
 - E. has an excess of protons.
- _____ 6. A positively charged object
- A. has a deficiency of protons.
 - B. has a deficiency of electrons.
 - C. has an excess of neutrons.
 - D. has a deficiency of neutrons.
 - E. has an excess of electrons.

- _____ 7. An object with no electrical charge
- A. has an excess of neutrons.
 - B. has an equal number of protons and electrons.
 - C. has an equal number of protons and neutrons.
 - D. has a deficiency of neutrons.
 - E. has an equal number of neutrons and electrons.
- _____ 8. The unit of electrical charge is the
- A. volt.
 - B. coulomb.
 - C. watt.
 - D. newton.
 - E. joule.
- _____ 9. An object can acquire an electrical charge by
- A. radiation, convection, or friction.
 - B. induction, convection, or radiation.
 - C. contact, induction, or convection.
 - D. friction, contact, or induction.
 - E. contact, friction, or convection.
- _____ 10. When you shuffle your feet as you walk across a carpet in the winter, you may become electrically charged through the process of
- A. conduction.
 - B. convection.
 - C. contact.
 - D. induction.
 - E. friction.
- _____ 11. In the process of _____, an object becomes charged by rubbing it against another object, resulting in the transfer of electrons from one material to the other.
- A. induction.
 - B. convection.
 - C. contact.
 - D. friction.
 - E. conduction.
- _____ 12. In the process of _____, an object becomes charged by touching it to another charged object, allowing transfer of electrons from one object to the other.
- A. contact.
 - B. convection.
 - C. induction.
 - D. friction.
 - E. conduction.
- _____ 13. In the process of _____, an object becomes charged by bringing a charged object nearby; separation of charges on the first object occurs and removal of one of these groups leaves the object charged.
- A. conduction.
 - B. contact.
 - C. convection.
 - D. induction.
 - E. friction.

- _____ 14. A material will be a _____ if it contains charges that are free to move around within the matter.
- A. solid
 - B. poor conductor
 - C. good conductor
 - D. good insulator
 - E. fluid
- _____ 15. A material will be a _____ if it contains charges that are free to move around within the matter.
- A. poor reflector
 - B. fluid
 - C. good insulator
 - D. poor conductor
 - E. poor insulator
- _____ 16. A material will be a _____ if it does not contain charges that are free to move around within the matter.
- A. poor conductor
 - B. poor insulator
 - C. solid
 - D. fluid
 - E. good conductor
- _____ 17. A material will be a _____ if it does not contain charges that are free to move around within the matter.
- A. good insulator
 - B. solid
 - C. good conductor
 - D. poor insulator
 - E. fluid
- _____ 18. Good electrical conductors are usually
- A. good thermal conductors.
 - B. good thermal insulators.
 - C. poor thermal conductors.
 - D. good electrical insulators.
 - E. transparent to light.
- _____ 19. Good electrical insulators are usually
- A. opaque to light.
 - B. poor thermal conductors.
 - C. poor thermal insulators.
 - D. good thermal conductors.
 - E. good electrical conductors.
- _____ 20. The lines of force for a point charge
- A. connect points of equal charge.
 - B. extend radially outward from it.
 - C. form concentric circles about it.
 - D. indicate the direction of motion of the point charge.
 - E. connect points of equal electric potential.

- _____ 21. The electric field inside a charged conductor (assuming no flow of current)
- A. increases linearly from the center to the outside.
 - B. is strongest at the center.
 - C. decreases linearly from the center to the outside.
 - D. depends on the material composing the conductor.
 - E. is zero.
- _____ 22. The electrostatic charges on a solid spherical conductor arrange themselves such that
- A. they are slightly more concentrated toward the center of the sphere.
 - B. they are evenly spaced throughout the volume of the sphere.
 - C. they lie entirely at the center of the sphere.
 - D. they lie entirely on the outside of the sphere.
 - E. they are slightly more concentrated toward the outside of the sphere.
- _____ 23. We are much more aware of gravitational forces than electrical forces in our lives because
- A. most of the matter we encounter has no net charge and feels no electrical force.
 - B. gravitational fields exist but electrical fields cannot.
 - C. gravity is a purely attractive force.
 - D. gravitational forces are inherently much stronger than electrical forces.
 - E. the charges we encounter are so far apart that the electrical forces between them are very weak.
- _____ 24. The unit used to measure electric force is the
- A. volt.
 - B. joule.
 - C. watt.
 - D. coulomb.
 - E. newton.
- _____ 25. According to Coulomb's law, the electrostatic force between two charges is proportional to _____ and inversely proportional to _____ .
- A. the product of the charges; the square of the distance between the charges.
 - B. the difference between the charges; the cube of the distance between the charges.
 - C. the sum of the charges; the square of the distance between the charges.
 - D. the product of the charges; the distance between the charges.
 - E. the sum of the charges; the distance between the charges.
- _____ 26. According to Coulomb's law, if the distance between two charges is doubled, the force each charge exerts on the other will be ____ its previous value.
- A. four times
 - B. the same as
 - C. one fourth of
 - D. double
 - E. one half of
- _____ 27. According to Coulomb's law, if the distance between two charges is cut in half, the force each charge exerts on the other will be ____ its previous value.
- A. one half of
 - B. one fourth of
 - C. the same as
 - D. double
 - E. four times

- _____ 28. According to Coulomb's law, if the electrostatic charge on each of two small spheres is doubled, the force each sphere exerts on the other will be ____ its previous value.
- A. one half of
 - B. four times
 - C. twice
 - D. the same as
 - E. one fourth of
- _____ 29. According to Coulomb's law, if the distance between two charges is tripled, the force each charge exerts on the other will be ____ its previous value.
- A. three times
 - B. one ninth of
 - C. the same as
 - D. nine times
 - E. one third of
- _____ 30. According to Coulomb's law, if the electrostatic charge on each of two small spheres is tripled, the force each sphere exerts on the other will be ____ its previous value.
- A. one third of
 - B. nine times
 - C. one ninth of
 - D. the same as
 - E. three times
- _____ 31. According to Coulomb's law, if the distance between two charges is quadrupled, the force each charge exerts on the other will be ____ its previous value.
- A. one sixteenth of
 - B. four times
 - C. sixteen times
 - D. the same as
 - E. one fourth of
- _____ 32. The unit of electric potential is the _____ .
- A. volt
 - B. watt
 - C. joule
 - D. coulomb
 - E. newton
- _____ 33. The volt is the unit of electric _____ .
- A. resistance
 - B. power
 - C. current
 - D. potential
 - E. charge
- _____ 34. The unit of electric current is the _____ .
- A. watt
 - B. joule
 - C. volt
 - D. ampere
 - E. coulomb

- _____ 35. The flow of electric charge is called _____ .
- A. voltage
 - B. resistance
 - C. power
 - D. potential
 - E. current
- _____ 36. If the charges in an electrical circuit always flow in the same direction, the current is called
- A. a constant current.
 - B. a direct current.
 - C. a basic current.
 - D. an oscillating current.
 - E. an alternating current.
- _____ 37. If the charges in an electrical circuit periodically switch their direction of flow, the current is called
- A. a constant current.
 - B. a direct current.
 - C. a basic current.
 - D. an alternating current.
 - E. an oscillating current.
- _____ 38. The charges in ____ circuit periodically switch their direction of flow, while the charges in ____ circuit always flow in the same direction.
- A. a DA; a DC
 - B. an AC; an AD
 - C. an AD; an AC
 - D. a DC; an AC
 - E. an AC; a DC
- _____ 39. The charges in ____ circuit always flow in the same direction while the charges in ____ circuit periodically switch their direction of flow.
- A. an AC; a DC
 - B. an AC; an AD
 - C. a DC; an AC
 - D. a DC; a DA
 - E. an AD; an AC
- _____ 40. If a charge of 12 coulombs flows through a wire every 3 seconds, the current in the wire is
- A. 12 amperes.
 - B. 4 amperes.
 - C. 9 amperes.
 - D. 3 amperes.
 - E. 36 amperes.
- _____ 41. If a charge of 12 coulombs flows through a wire every 4 seconds, the current in the wire is
- A. 3 amperes.
 - B. 4 amperes.
 - C. 8 amperes.
 - D. 12 amperes.
 - E. 48 amperes.

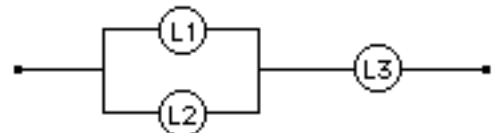
- _____ 42. If the current in a wire is 6 amperes, how much charge will flow through it in 3 seconds?
- A. 2 coulombs
 - B. 3 coulombs
 - C. 9 coulombs
 - D. 18 coulombs
 - E. 6 coulombs
- _____ 43. If the current in a wire is 6 amperes, how much charge will flow through it in 2 seconds?
- A. 2 coulombs
 - B. 8 coulombs
 - C. 6 coulombs
 - D. 12 coulombs
 - E. 3 coulombs
- _____ 44. According to Ohm's law, the current in a circuit is equal to
- A. the difference between voltage and resistance.
 - B. the product of resistance and voltage.
 - C. the ratio of resistance to voltage.
 - D. the sum of resistance and voltage.
 - E. the ratio of voltage to resistance.
- _____ 45. According to Ohm's law, the voltage drop across a light bulb in a circuit is equal to _____ in the bulb.
- A. the sum of resistance and current
 - B. the difference between current and resistance
 - C. the ratio of resistance to current
 - D. the product of resistance and current
 - E. the ratio of current to resistance
- _____ 46. According to Ohm's law, the resistance of a light bulb in a circuit is equal to _____ in the bulb.
- A. the sum of voltage and current
 - B. the difference between voltage and current
 - C. the ratio of voltage to current
 - D. the ratio of current to voltage
 - E. the product of voltage and current
- _____ 47. If a voltage of 10 volts produces a current of 2 amps in an electrical device, the resistance must be
- A. 2 ohms.
 - B. 5 ohms.
 - C. 10 ohms.
 - D. 20 ohms.
 - E. 8 ohms.
- _____ 48. If a voltage of 110 volts produces a current of 2 amps in an electrical device, the resistance must be
- A. 55 ohms.
 - B. 110 ohms.
 - C. 2 ohms.
 - D. 220 ohms.
 - E. 108 ohms.

- _____ 49. If a 100-ohm resistor has a 5-amp current flowing through it, the voltage drop across the resistor is
- A. 500 volts.
 - B. 100 volts.
 - C. 5 volts.
 - D. 20 volts.
 - E. 50 volts.
- _____ 50. If a 10-ohm resistor has a 5-amp current flowing through it, the voltage drop across the resistor is
- A. 5 volts.
 - B. 10 volts.
 - C. 15 volts.
 - D. 2 volts.
 - E. 50 volts.
- _____ 51. A voltage of 100 volts should produce a current of _____ in a 20-ohm resistor.
- A. 80 amps
 - B. 5 amps
 - C. 60 amps
 - D. 2000 amps
 - E. 120 amps
- _____ 52. A voltage of 60 volts should produce a current of _____ in a 6-ohm resistor.
- A. 360 amps
 - B. 66 amps
 - C. 36 amps
 - D. 6 amps
 - E. 10 amps
- _____ 53. Electric power is measured in
- A. watts.
 - B. coulombs.
 - C. ohms.
 - D. volts.
 - E. amperes.
- _____ 54. The power consumed by an electric light bulb is
- A. the ratio of the current passing through it to the voltage across it.
 - B. the ratio of the voltage across it to the current passing through it.
 - C. the difference between the voltage across it and the current passing through it.
 - D. the product of the voltage across it and the current passing through it.
 - E. the sum of the voltage across it and the current passing through it.
- _____ 55. If 120 volts are used to light a 60-watt light bulb, the current in the bulb will be
- A. 60 amps.
 - B. 2 amps.
 - C. 180 amps.
 - D. 120 amps.
 - E. 0.5 amps.

- _____ 56. If 120 volts are used to light a 30-watt light bulb, the current in the bulb will be
- A. 4 amps.
 - B. 0.25 amps.
 - C. 150 amps.
 - D. 30 amps.
 - E. 120 amps.
- _____ 57. If 120 volts are used to light a 100-watt light bulb, the current in the bulb will be
- A. 0.83 amps.
 - B. 100 amps.
 - C. 220 amps.
 - D. 20 amps.
 - E. 1.2 amps.
- _____ 58. If 120 volts are used to light a 150-watt light bulb, the current in the bulb will be
- A. 1.25 amps.
 - B. 120 amps.
 - C. 270 amps.
 - D. 30 amps.
 - E. 150 amps.
- _____ 59. A light bulb that draws a current of 1 amp when plugged into a 120-volt outlet would consume _____ of power.
- A. 120 watts
 - B. 1200 watts
 - C. 1.2 watts
 - D. 12 watts
 - E. 1 watt
- _____ 60. A light bulb that draws a current of 0.5 amp when plugged into a 120-volt outlet would consume _____ of power.
- A. 120 watts
 - B. 90 watts
 - C. 30 watts
 - D. 240 watts
 - E. 60 watts
- _____ 61. Electrical resistance is measured in _____ .
- A. ohms
 - B. joules
 - C. coulombs
 - D. amperes
 - E. volts
- _____ 62. Wires that are _____ have higher resistance.
- A. longer and thicker
 - B. longer and thinner
 - C. shorter and thinner
 - D. curved
 - E. shorter and thicker

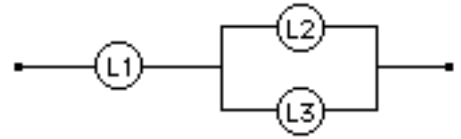
- _____ 63. Wires that are _____ have lower resistance.
- A. longer and thicker
 - B. straight
 - C. shorter and thinner
 - D. longer and thinner
 - E. shorter and thicker
- _____ 64. The resistance of the dry human body is about
- A. 100 ohms.
 - B. 1 ohm.
 - C. 100,000 ohms.
 - D. 1000 ohms.
 - E. 10 ohms.
- _____ 65. The resistance of the dry human body is about
- A. 100,000 ohms.
 - B. 0.00001 ohm.
 - C. 10 ohms.
 - D. 1000 ohms.
 - E. 0.01 ohm.
- _____ 66. The resistance of the dry human body is about 100,000
- A. coulombs.
 - B. amps.
 - C. watts.
 - D. joules.
 - E. ohms.
- _____ 67. If light bulb A has twice the resistance of light bulb B and the same current passes through each bulb, the voltage across bulb A will be ____ the voltage across bulb B.
- A. two times
 - B. one fourth of
 - C. four times
 - D. equal to
 - E. one half of
- _____ 68. If light bulb A has four times the resistance of light bulb B and the same current passes through each bulb, the voltage across bulb A will be ____ the voltage across bulb B.
- A. one half of
 - B. four times
 - C. two times
 - D. equal to
 - E. one fourth of
- _____ 69. If light bulb A has twice the resistance of light bulb B and the same voltage is applied across each bulb, the current in bulb A will be ____ the current in bulb B.
- A. one half of
 - B. two times
 - C. equal to
 - D. four times
 - E. one fourth of

- _____ 70. If light bulb A has four times the resistance of light bulb B and the same voltage is applied across each bulb, the current in bulb A will be ____ the current in bulb B.
- one fourth of
 - two times
 - one half of
 - four times
 - equal to
- _____ 71. If three light bulbs of different wattage are connected in parallel to a battery,
- the voltage drop across each bulb will be the same.
 - the light output of each bulb will be the same.
 - the current in each light bulb will be the same.
 - the resistance in each light bulb will be the same.
 - the power consumed by each light bulb will be the same.
- _____ 72. If three light bulbs of different wattage are connected in series to a battery,
- the voltage drop across each bulb will be the same.
 - the power consumed by each light bulb will be the same.
 - the resistance in each light bulb will be the same.
 - the light output of each bulb will be the same.
 - the current in each light bulb will be the same.
- _____ 73. If identical light bulbs A, B, and C are connected such that A and B are in parallel with each other and the AB combination is in series with C and the power supply, how will the brightness of the bulbs compare when the power is turned on?
- A and B will be the same, and C will be brighter.
 - All three bulbs will be equally bright.
 - All three will be different, with A faintest and C brightest.
 - All three will be different, with A brightest and C faintest.
 - A and B will be the same, and C will be fainter.
- _____ 74. Three light bulbs are connected as shown and the terminals (dots) are connected to a power supply. Which of these statements best describes the resulting circuit?

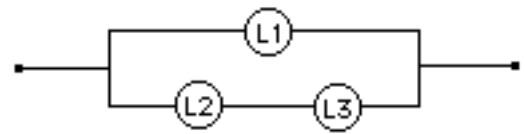


- L1, L2, and L3 are connected in series.
- L1 and L2 are connected in series and together are in parallel with L3.
- L1, L2, and L3 are all connected in parallel.
- L1 and L2 are connected in parallel and together are in parallel with L3.
- L1 and L2 are connected in parallel and together are in series with L3.

- _____ 75. Three light bulbs are connected as shown and the terminals (dots) are connected to a power supply. Which of these statements best describes the resulting circuit?



- A. L1, L2, and L3 are all connected in parallel.
 B. L1 and L2 are connected in parallel and together are in series with L3.
 C. L1, L2, and L3 are connected in series.
 D. L2 and L3 are connected in series and together are in parallel with L1.
 E. L2 and L3 are connected in parallel and together are in series with L1.
- _____ 76. Three light bulbs are connected as shown and the terminals (dots) are connected to a power supply. Which of these statements best describes the resulting circuit?



- A. L1 and L2 are connected in series and together are in parallel with L3.
 B. L2 and L3 are connected in series and together are in parallel with L1.
 C. L1, L2, and L3 are all connected in parallel.
 D. L2 and L3 are connected in parallel and together are in series with L1.
 E. L1 and L2 are connected in parallel and together are in series with L3.
- _____ 77. If identical light bulbs A, B, and C are connected such that B and C are in parallel with each other and the BC combination is in series with A and the power supply, how will the brightness of the bulbs compare when the power is turned on?
- A. All three bulbs will be equally bright.
 B. B and C will be the same, and A will be brighter.
 C. All three will be different, with A brightest and B faintest.
 D. All three will be different, with A faintest and B brightest.
 E. B and C will be the same, and A will be fainter.
- _____ 78. The electromagnetic spectrum includes all of the following except _____ .
- A. radio waves
 B. visible light
 C. microwaves
 D. sound waves
 E. x-rays
- _____ 79. The electromagnetic spectrum includes all of the following except _____ .
- A. shock waves
 B. radio waves
 C. microwaves
 D. visible light
 E. x-rays
- _____ 80. In order of increasing wavelength, the electromagnetic spectrum includes
- A. ultraviolet, visible light, and infrared.
 B. visible light, radio, and microwaves.
 C. x-rays, microwaves, and visible light.
 D. gamma rays, visible light, and ultraviolet.
 E. infrared, visible light, and ultraviolet.

- _____ 81. In order of decreasing wavelength, the electromagnetic spectrum includes
- A. infrared, visible light, and ultraviolet.
 - B. gamma rays, visible light, and ultraviolet.
 - C. x-rays, microwaves, and visible light.
 - D. ultraviolet, visible light, and infrared.
 - E. visible light, radio, and microwaves.
- _____ 82. Of all the electromagnetic waves, those with highest energy are _____ and those with lowest energy are _____ .
- A. visible light; infrared
 - B. gamma rays; radio waves
 - C. radio waves; x-rays
 - D. x-rays; microwaves
 - E. microwaves; ultraviolet
- _____ 83. Of all the electromagnetic waves, those with lowest energy are _____ and those with highest energy are _____ .
- A. radio waves; gamma rays
 - B. infrared; ultraviolet
 - C. visible; x-rays
 - D. gamma rays; radio waves
 - E. ultraviolet; infrared
- _____ 84. The color of visible light that has the longest wavelength is _____ .
- A. red
 - B. violet
 - C. green
 - D. blue
 - E. orange
- _____ 85. The color of visible light that has the shortest wavelength is _____ .
- A. green
 - B. red
 - C. blue
 - D. orange
 - E. violet
- _____ 86. Which of the following is true concerning electromagnetic waves in a vacuum?
- A. Those with long wavelengths travel more rapidly than those with short wavelengths.
 - B. Those with low frequencies travel more rapidly than those with high frequencies.
 - C. Those with short wavelengths travel more rapidly than those with long wavelengths.
 - D. They all travel at the same speed, independent of wavelength or frequency.
 - E. Those with high frequencies travel more rapidly than those with low frequencies.
- _____ 87. Which of the following is true concerning light waves in a vacuum?
- A. Those with high frequencies travel more rapidly than those with low frequencies.
 - B. They all travel at the same speed, independent of wavelength or frequency.
 - C. Those with long wavelengths travel more rapidly than those with short wavelengths.
 - D. Those with short wavelengths travel more rapidly than those with long wavelengths.
 - E. Those with low frequencies travel more rapidly than those with high frequencies.

- _____ 88. The speed of light in a vacuum
- A. is the same for all the different colors of light.
 - B. is chosen to be equal to the speed of yellow light, which moves faster than any other color.
 - C. is higher for green light than for violet light.
 - D. is higher for blue light than for red light.
 - E. is found by averaging the different speeds of all the different colors of light.
- _____ 89. Compared to visible light traveling in a vacuum, infrared rays would have
- A. the same speed and shorter wavelengths.
 - B. the same speed and longer wavelengths.
 - C. the same speed and the same wavelengths.
 - D. a lower speed and shorter wavelengths.
 - E. a lower speed and longer wavelengths.
- _____ 90. Compared to visible light traveling in a vacuum, ultraviolet rays would have
- A. the same speed and longer wavelengths.
 - B. a lower speed and longer wavelengths.
 - C. the same speed and shorter wavelengths.
 - D. a lower speed and shorter wavelengths.
 - E. the same speed and the same wavelengths.
- _____ 91. A material is said to be opaque if
- A. light can pass freely through it in a straight line.
 - B. it absorbs light and then re-emits it.
 - C. it cannot absorb any light.
 - D. it absorbs light and redistributes the energy as thermal energy.
 - E. it cannot vibrate at a resonant frequency to match the frequency of the light.
- _____ 92. A material is said to be transparent if
- A. it cannot emit any light.
 - B. it reflects light.
 - C. it absorbs light and redistributes the energy as thermal energy.
 - D. it can vibrate at a resonant frequency to match the frequency of the light.
 - E. light can pass freely through it in a straight line.
- _____ 93. Glass is
- A. opaque to visible light and infrared but transparent to ultraviolet.
 - B. opaque to visible light and ultraviolet but transparent to infrared.
 - C. opaque to ultraviolet but transparent to visible light and infrared.
 - D. opaque to ultraviolet and infrared but transparent to visible light.
 - E. opaque to visible light but transparent to ultraviolet and infrared.
- _____ 94. Glass is
- A. transparent to visible light but opaque to ultraviolet and infrared.
 - B. transparent to ultraviolet but opaque to visible light and infrared.
 - C. transparent to ultraviolet and infrared but opaque to visible light.
 - D. transparent to visible light and ultraviolet but opaque to infrared.
 - E. transparent to visible light and infrared but opaque to ultraviolet.

- _____ 95. Magnification of an object by a lens can be calculated as the ratio of the image distance to the object distance. What are the units of magnification?
- A. cm
 - B. none
 - C. cm^{-2}
 - D. cm^{-1}
 - E. cm^2
- _____ 96. Which of the following is true?
- A. The image seen in a plane mirror is a real image.
 - B. Only virtual images can be projected on a screen.
 - C. A light ray passing through the center of a converging lens will be bent to pass through the focus.
 - D. A virtual image is always upside down.
 - E. A real image is formed where the rays from an object meet after passing through a lens.
- _____ 97. Which of the following is true?
- A. Only real images can be projected on a screen.
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 - B. A virtual image is always upside down.
 - C. The image seen in a plane mirror is a real image.
 - D. Only virtual images can be projected on a screen.
 - E. A light ray passing through the center of a converging lens will not be bent.
- _____ 100. A converging lens is used to produce a real image of an object, with the image and object being equal in size. As the object is moved farther from the lens, what will happen to the image?
- A. The image will turn from upright to inverted.
 - B. The image will move farther from the lens.
 - C. The image will turn from inverted to upright.
 - D. The image will become smaller.
 - E. The image will become larger.

- _____ 101. A converging lens is
- A. uniform in thickness across its surface.
 - B. thicker in the middle than at the edges.
 - C. thicker at the edges and in the middle but thinner in between.
 - D. thicker at the edges than in the middle
 - E. thinner at the edges and in the middle but thicker in between.
- _____ 102. A diverging lens is
- A. thicker at the edges than in the middle
 - B. thicker in the middle than at the edges.
 - C. thinner at the edges and in the middle but thicker in between.
 - D. uniform in thickness across its surface.
 - E. thicker at the edges and in the middle but thinner in between.
- _____ 103. A converging lens is
- A. thinner in the middle than at the edges.
 - B. uniform in thickness across its surface.
 - C. thicker at the edges and in the middle but thinner in between.
 - D. thinner at the edges than in the middle
 - E. thinner at the edges and in the middle but thicker in between.
- _____ 104. A diverging lens is
- A. thinner at the edges and in the middle but thicker in between.
 - B. uniform in thickness across its surface.
 - C. thicker at the edges and in the middle but thinner in between.
 - D. thinner in the middle than at the edges.
 - E. thinner at the edges than in the middle
- _____ 105. A diverging lens produces
- A. a diminished, real image.
 - B. a diminished, virtual image.
 - C. an enlarged, real image.
 - D. an enlarged, virtual image.
 - E. a lifesized imaginary image.
- _____ 106. When a converging lens is used as a magnifying glass, the image produced is
- A. real and inverted.
 - B. virtual and upright.
 - C. virtual and inverted.
 - D. real and upright.
 - E. none of the above - a converging lens cannot be used as a magnifying glass.
- _____ 107. When you use a converging lens as a magnifying glass, the object must be placed
- A. behind you.
 - B. between you and the lens.
 - C. beyond the focal point.
 - D. at the focal point.
 - E. inside the focal point.

- _____ 108. An object placed outside the focal point of a converging lens will form an image that is always
- A. imaginary and inside out.
 - B. real and upright.
 - C. virtual and inverted.
 - D. real and inverted.
 - E. virtual and upright.
- _____ 109. Which of the following is true? When used alone,
- A. diverging lenses can form only real images.
 - B. converging lenses can form only inverted images.
 - C. converging lenses can form only virtual images.
 - D. diverging lenses can form only virtual images.
 - E. converging lenses can form only real images.
- _____ 110. Which of the following is true? When used alone,
- A. converging lenses can form only virtual images.
 - B. converging lenses can form only upright images.
 - C. converging lenses can form only real images.
 - D. diverging lenses can form only inverted images.
 - E. diverging lenses can form only upright images.
- _____ 111. Which of the following is not true? When used alone,
- A. converging lenses can form virtual images.
 - B. converging lenses can form inverted images.
 - C. diverging lenses can form virtual images.
 - D. converging lenses can form real images.
 - E. diverging lenses can form real images.
- _____ 112. Dispersion of light in spherical drops of water produces the phenomenon we know as
- A. diffuse reflection.
 - B. a rainbow.
 - C. total internal reflection.
 - D. a mirage.
 - E. a virtual image.
- _____ 113. The colors seen in a rainbow
- A. are produced when sunlight is refracted by raindrops.
 - B. are the colors of the different molecules that make up water.
 - C. are produced by raindrops of different shapes.
 - D. are produced by raindrops of different colors.
 - E. are the colors of the different atoms that make up water.
- _____ 114. The order of colors seen in a primary rainbow is
- A. green (outside) to red (inside).
 - B. violet (outside) to yellow (inside).
 - C. completely random and therefore unpredictable.
 - D. blue (outside) to orange (inside).
 - E. red (outside) to violet (inside).

- _____ 115. The order of colors seen in a secondary rainbow is
- A. completely random and therefore unpredictable.
 - B. green (outside) to red (inside).
 - C. red (outside) to violet (inside).
 - D. violet (outside) to yellow (inside).
 - E. blue (outside) to orange (inside).
- _____ 116. When you view a rainbow, the Sun will normally be
- A. in front of you.
 - B. anywhere in the sky – there is no special position required.
 - C. behind you.
 - D. below the horizon.
 - E. straight overhead.
- _____ 117. The law of reflection says
- A. the angle of reflection equals the angle of refraction.
 - B. the angle of reflection equals the angle of incidence.
 - C. all reflected rays are parallel to the incident ray.
 - D. all reflected rays are perpendicular to the incident ray.
 - E. all reflected rays are parallel to each other.
- _____ 118. A plane mirror produces an image that is
- A. virtual and enlarged.
 - B. virtual and upright.
 - C. virtual and inverted.
 - D. real and inverted.
 - E. real and upright.
- _____ 119. The image you see in the mirror on your bathroom wall is
- A. virtual and upright.
 - B. virtual and inverted.
 - C. real and inverted.
 - D. real and upright.
 - E. virtual and enlarged.
- _____ 120. Diffuse reflection occurs when
- A. the reflecting surface is extremely smooth compared to the wavelength of incident light.
 - B. incident light rays interfere with each other.
 - C. reflected light rays interfere with each other.
 - D. the reflecting surface is rough compared to the wavelength of incident light.
 - E. reflected light rays interfere with incident light rays.
- _____ 121. Refraction refers to
- A. the bending of light rays as they pass from one medium into another.
 - B. the reversal of left and right as seen in a mirror image.
 - C. the interference between two light rays of slightly different frequencies.
 - D. the apparent reduction in the size of an object as seen through a lens.
 - E. the bouncing of light rays off the boundary between two different media.

- _____ 122. Fermat's principle of least time
- A. applies to both reflection and refraction.
 - B. applies to reflection but not to refraction.
 - C. applies to neither reflection nor refraction.
 - D. applies to refraction but not to reflection.
 - E. is no longer believed to be true.
- _____ 123. Which of these phenomena is *not* attributed to refraction?
- A. An object submerged in water appears to be closer to the surface than it really is.
 - B. Objects appear to us to be different colors.
 - C. An object submerged in water appears to be magnified.
 - D. The setting sun appears to be just above the horizon moments after it has actually set.
 - E. The highway ahead appears to be wet, but it is only a mirage.
- _____ 124. A light ray passing from air into water at an angle of 30° from the normal in air
- A. would make an angle greater than 30° from the normal in water.
 - B. would be completely absorbed by the water surface.
 - C. would be completely reflected by the water surface.
 - D. would make an angle of 30° from the normal in water.
 - E. would make an angle less than 30° from the normal in water.
- _____ 125. A light ray passing from air into water at an angle of 20° from the normal in air
- A. would make an angle greater than 20° from the normal in water.
 - B. would be completely absorbed by the water surface.
 - C. would make an angle of 20° from the normal in water.
 - D. would be completely reflected by the water surface.
 - E. would make an angle less than 20° from the normal in water.
- _____ 126. A light ray passing from air into water at an angle of 15° from the normal in air
- A. would be completely reflected by the water surface.
 - B. would make an angle less than 15° from the normal in water.
 - C. would make an angle greater than 15° from the normal in water.
 - D. would make an angle of 15° from the normal in water.
 - E. would be completely absorbed by the water surface.
- _____ 127. A light ray passing from water into air at an angle of 20° from the normal in water
- A. would be completely absorbed by the water surface.
 - B. would make an angle less than 20° from the normal in air.
 - C. would make an angle of 20° from the normal in air.
 - D. would be completely reflected by the water surface.
 - E. would make an angle greater than 20° from the normal in air.
- _____ 128. A light ray passing from water into air at an angle of 30° from the normal in water
- A. would be completely reflected by the water surface.
 - B. would make an angle of 30° from the normal in air.
 - C. would make an angle greater than 30° from the normal in air.
 - D. would make an angle less than 30° from the normal in air.
 - E. would be completely absorbed by the water surface.

- _____ 129. A light ray passing from water into air at an angle of 15° from the normal in water
- A. would make an angle of 15° from the normal in air.
 - B. would make an angle less than 15° from the normal in air.
 - C. would make an angle greater than 15° from the normal in air.
 - D. would be completely reflected by the water surface.
 - E. would be completely absorbed by the water surface.
- _____ 130. Total internal reflection occurs when
- A. the angle of incidence is less than the critical angle.
 - B. the angle of refraction exceeds the critical angle.
 - C. the angle of reflection is less than the critical angle.
 - D. the angle of incidence exceeds the critical angle.
 - E. the angle of reflection is equal to the angle of incidence.
- _____ 131. A practical application of total internal reflection is found in
- A. rainbows.
 - B. diverging lenses.
 - C. fiber optics.
 - D. converging lenses.
 - E. bathroom mirrors.
- _____ 132. The critical angle is
- A. the angular radius of the arc of a rainbow.
 - B. the angle of incidence for which the angle of the refracted beam is the same.
 - C. the angle of incidence for which the angle of the reflected beam is the same.
 - D. the angle of incidence for which the angle of the refracted beam is 0° .
 - E. the angle of incidence for which the angle of the refracted beam is 90° .
- _____ 133. The critical angle for the water-air boundary is 48° . This means that a beam of light incident on the boundary from the water side at an angle from the normal of 50°
- A. will emerge in the air at an angle of 82° from the normal.
 - B. will undergo total internal reflection.
 - C. will emerge in the air at an angle of 50° from the normal.
 - D. will emerge in the air at an angle of 2° from the normal.
 - E. will emerge in the air at an angle of 98° from the normal.
- _____ 134. If T is directly proportional to L, then a plot of T vs L should be
- A. a circle.
 - B. a curve that is concave upward.
 - C. a curve that is concave downward.
 - D. a parabola.
 - E. a straight line passing through the origin.
- _____ 135. One cm equals _____ m.
- A. 0.001
 - B. 0.1
 - C. 0.01
 - D. 10
 - E. 100

- _____ 136. One m equals _____ cm.
A. 0.001
B. 100
C. 0.1
D. 10
E. 0.01
- _____ 137. How long is a meter stick?
A. 10 cm
B. 100 mm
C. 100 cm
D. 1000 cm
E. 36 inches
- _____ 138. How long is a meter stick?
A. 100 mm
B. 10 mm
C. 1000 mm
D. 36 inches
E. 10 cm
- _____ 139. One meter is equal to _____ millimeters.
A. 0.01
B. 10
C. 100
D. 1000
E. 0.001
- _____ 140. One centimeter is equal to _____ millimeters.
A. 10
B. 0.1
C. 1000
D. 100
E. 0.01
- _____ 141. One millimeter is equal to _____ centimeters.
A. 100
B. 0.1
C. 0.01
D. 10
E. 0.001
- _____ 142. One millimeter is equal to _____ meters.
A. 1000
B. 0.001
C. 100
D. 10
E. 0.01

- _____ 143. In the laboratory, the speed of sound is measured to be 344 meters per second, different from the actual value of 343 meters per second. What is the percent error in the measurement?
- A. 0.1%
 - B. 0.3%
 - C. 10%
 - D. 1%
 - E. 3%