PHYSICS 101 Practice questions

1. A book is at rest on top of a table. Which of the following is correct?

A. There is no force acting on the book.

B. The book has no inertia.

C. There is no force acting on the table.

D. The book is in equilibrium.

E. The inertia of the book is equal to the inertia of the table.

2. The property of a moving object to continue moving is what Galileo called

A. velocity.

B. speed.

C. acceleration.

D. inertia.

E. direction.

3. According to Newton's First Law of Motion,

A. an object in motion eventually comes to a halt.

B. an object at rest eventually begins to move.

C. an object in motion moves in a parabolic trajectory unless acted upon by a net force.

D. an object at rest always remains at rest.

E. an object at rest remains at rest unless acted upon by a net force.

4. If an object is moving, then the magnitude of its ____ cannot be zero.

A. speed

B. velocity

C. acceleration

D. A and B

E. A, B, and C

5. A car initially at rest accelerates in a straight line at 3 m/s^2. What will be its speed after 2 seconds?

A. 0 m/s

B. 5 m/s

C. 3 m/s

D. 6 m/s

E. 2 m/s

6. A body in free fall in a vacuum

A. will drop the same distance during each second of its fall.

B. will have the same average speed during each second of its fall.

C. will have a constant velocity during each second of its fall.

D. will not be accelerated during its fall.

E. will have the same acceleration during each second of its fall.

7. A bowling ball at a height of 36 meters above the ground is falling vertically at a rate of 12 meters per second. Which of these best describes its fate?

A. It will hit the ground in exactly three seconds at a speed of 12 m/s.

B. It will hit the ground in less than three seconds at a speed greater than 12 m/s.

C. It will hit the ground in more than three seconds at a speed less than 12 m/s.

D. It will hit the ground in less than three seconds at a speed less than 12 m/s.

E. It will hit the ground in more than three seconds at a speed greater than 12 m/s.

8. The speedometer in your car tells you the ____ of your car.

A. acceleration

B. average speed

C. instantaneous speed

D. velocity

E. inertia

9. To report the ____ of an object, we must specify both its speed and its direction .

A. acceleration

B. mass

C. velocity

D. length

E. position

10. Projectile 'A' is fired at an angle of 50° above the horizontal; projectile 'B' is fired with the same speed at an angle of 40° above the horizontal. Assuming level ground and negligible air resistance, which of the following is true?

A. 'A' will reach a greater height and have a greater range than 'B'.

B. 'A' will reach a greater height and have the same range as 'B'.

C. 'A' will reach a greater height and have a shorter range than 'B'.

D. 'A' will reach the same height and have the same range as 'B'.

E. 'A' will reach the same height and have a shorter range than 'B'.

11. In the absence of air resistance, the magnitude of the vertical component of a projectile's acceleration

A. is constant until the projectile hits the ground.

B. always decreases with time until the projectile hits the ground.

C. is equal to the magnitude of the horizontal component of the projectile's acceleration.

D. increases and/or decreases with time, depending on the projectile's velocity.

E. always increases with time until the projectile hits the ground.

12. A ball is thrown horizontally with a speed of 25 m/s from the top of a tower 20 meters high. Assuming level ground below and negligible air resistance, what will be the magnitude of the vertical velocity component when the ball hits the ground?

A. 25 m/s

B. 15 m/s

C. 20 m/s

D. 50 m/s

E. 10 m/s

13. Which of these is the best description of the trajectory of a projectile shot from the top of a high cliff at an angle of 60° below the horizontal (neglecting air resistance)?

A. The projectile will move downwards at a 60° angle in a straight line at a constant speed until it stops and then falls straight down.

B. The projectile will move downwards at a 60° angle in a straight line at a gradually diminishing speed until it stops and then falls straight down.

C. The projectile will move downwards at a 60° angle in a straight line at a gradually increasing speed until it stops and then falls straight down.

D. The projectile will gradually arc downward, following the curve of a circle.

E. The projectile will gradually arc downward, following the curve of a parabola.

14. A firefighter with a mass of 70 kg slides down a vertical pole, accelerating at 2 m/s^2. The force of friction that acts on the firefighter is

A. 70 N.

B. 560 N.

C. 140 N.

D. 700 N.

E. 0 N.

15. The _____ of an object on the Earth's surface are directly proportional to each other.

A. acceleration and mass

B. mass and weight

C. force and velocity

D. weight and acceleration

E. speed and velocity

16. The Moon's gravity is 1/6 of the Earth's gravity. The weight of a bowling ball on the Earth would be ____ its weight on the Moon.

A. equal to

B. 1/6 of

C. 6 times

D. 36 times

E. 1/36 of

17. When a certain net force is applied to one brick on a frictionless surface, it accelerates at 6 m/s^2. When the same net force is applied to three bricks that are cemented together,

A. they accelerate at 3 m/s^2.

B. they accelerate at 6 m/s^2.

C. they accelerate at 18 m/s^2.

D. they accelerate at 2 m/s^2.

E. they do not accelerate at all.

18. To accelerate a 6 kg mass at 2 m/s^2 requires a net force of ____ .

A. 3 N

B. 8 N

C. 12 N

D. 6 N

E. 2 N

19. A falling object is said to reach terminal speed

A. when it lands on the ground.

B. when its air resistance equals the force of gravity on it.

C. when there is no air resistance acting on it.

D. when there is no gravitational force acting on it.

E. when it stops falling.

20. For every action there is an equal and opposite reaction. This is a statement of

A. Newton's First Law of Motion.

B. Newton's Second Law of Motion.

C. Newton's Third Law of Motion.

D. Newton's Fourth Law of Motion.

E. Newton's Law of Action.

21. An airplane flying east at an airspeed of 200 km/h has a headwind blowing from the east at 50 km/h. How far will the plane fly relative to the ground in two hours?

A. 500 km

B. 250 km

C. 300 km

D. 400 km

E. 200 km

22. An airplane heading west at an airspeed of 100 km/h has a crosswind blowing from the south at 100 km/h. What will be the airplane's speed relative to the ground?

A. 0 km/h

B. 71 km/h

C. 100 km/h

D. 141 km/h

E. 200 km/h

23. ____ are examples of vector quantities.

A. Acceleration and time

B. Velocity and acceleration

C. Volume and velocity

D. Mass and volume

E. Time and mass

Exam #2 ---- (momentum, work, energy, rotation, etc.)

24. A green ball moving to the right at 3 m/s strikes a yellow ball moving to the left at 2 m/s. If the balls are equally massive and the collision is elastic,

A. the green ball will move to the left at 3 m/s while the yellow ball moves right at 2 m/s.

B. the green ball will move to the left at 2 m/s while the yellow ball moves right at 3 m/s.

C. The green ball will stop while the yellow ball moves right at 2 m/s.

D. The yellow ball will stop while the green ball moves left at 3 m/s.

E. Both balls will stick together and move to the right at 1 m/s.

25. An impulse of 100 N-s is applied to an object. If this same impulse is delivered over a longer time interval,

A. the force involved will be decreased.

B. the force involved will be increased.

C. the momentum transferred will be increased.

D. the momentum transferred will be decreased.

E. the acceleration involved will be increased.

26. Case 1: A net force of 10 N acts on a mass of 1 kg for a time of 0.2 s.

Case 2: A net force of 20 N acts on a mass of 1 kg for a time of 0.2 s.

Both cases result in acceleration of the mass. In comparison, Case 1 and Case 2 will

A. involve the same impulse and produce the same acceleration.

B. involve the same impulse and produce different accelerations.

C. involve different impulses and produce different accelerations.

D. involve different impulses and produce the same acceleration.

E. produce the same change of momentum.

27. Momentum is the product of

A. mass and velocity.

B. mass and acceleration.

C. velocity and acceleration.

D. force and inertia.

E. force and velocity.

28. If a moving object cuts its speed in half, how much momentum will it have?

A. the same amount as before

B. twice as much as before

C. one half as much as before

D. four times as much as before

E. one fourth as much as before

29. A 1-kg ball moving horizontally to the right at 3 m/s strikes a wall and rebounds, moving horizontally to the left at the same speed. What is the magnitude of the change in momentum of the ball?

A. 0 kg-m/s

B. 2 kg-m/s

C. 3 kg-m/s

D. 4 kg-m/s

E. 6 kg-m/s

30. Potential energy is the energy possessed by an object due to

A. its momentum.

B. its position.

C. its velocity.

D. its acceleration.

E. its shape.

31. Which of the following is true?

A. A body with zero velocity cannot have any potential energy.

B. A body with zero acceleration cannot have any kinetic energy.

C. A body with zero acceleration cannot have any potential energy.

D. A body with zero velocity cannot have any kinetic energy.

E. A body with zero potential energy cannot have any velocity.

32. If two objects of different mass have the same non-zero momentum,

A. the one with less mass will have the greater kinetic energy.

B. the one with more mass will have the greater kinetic energy.

C. they will have the same kinetic energy.

D. the one with the higher speed will have the greater mass.

E. the one with the lower speed will have the greater kinetic energy.

33. A car traveling at 60 km/hr passes a truck going 30 km/hr that has four times the mass of the car. Which of the following is true?

A. The car and the truck have the same momentum and the same kinetic energy.

B. The car has the same momentum and twice as much kinetic energy as the truck.

C. The car has the same momentum and four times as much kinetic energy as the truck.

D. The car has the same kinetic energy and twice as much momentum as the truck.

E. The car has the same kinetic energy and half as much momentum as the truck.

34. A swinging pendulum has ____ at the bottom (middle) of its arc.

A. minimum kinetic energy

B. minimum total energy

C. minimum potential energy

D. maximum total energy

E. maximum potential energy

35. Real machines are not 100% efficient because

A. some of the energy input is always transformed into thermal energy.

B. some of the energy input is always transformed into gravitational potential energy.

C. the energy input is always less than the energy output.

D. that would require the work output to be 100 times the work input, which is impossible.

E. that would require the work input to be 100 times the work output, which is impossible.

36. A physicist does 100 joules of work on a simple machine that raises a box of books through a height of 0.2 meters. If the efficiency of the machine is 60%, how much work is converted to thermal energy by this process?

A. 40 joules

B. 60 joules

C. 80 joules

D. 20 joules

E. 100 joules

37. When you run up two flights of stairs instead of walking up them, you feel more tired because

A. you do more work when you run than when you walk.

B. your power output is greater when you run than when you walk.

C. the gravitational force is greater on a running person than on a walking person.

D. the gravitational acceleration is greater on a running person than on a walking person.

E. a running person has more inertia than a walking person.

38. The work done against gravity in moving a box with a mass of 5 kilograms through a height of 3 meters is

A. 150 joules.

B. 150 newtons.

C. 15 joules.

D. 15 newtons.

E. 5/3 joules.

39. Angular momentum is the product of

A. rotational inertia and rotational velocity.

B. linear momentum and angle.

C. mass and velocity.

D. force and impulse.

E. acceleration and time.

40. When you stand in equilibrium on only one foot,

A. your center of mass will be directly above that foot.

B. your center of mass will be directly above the other foot.

C. your center of mass will be directly above a point equidistant between your two feet.

D. your rotational inertia will be zero.

E. you will always fall over.

41. When a car rounds a curve at high speed,

A. the tires exert a centripetal force on the road.

B. the road exerts a centripetal force on the tires.

C. the car exerts a centripetal force on the road.

D. the car body exerts a centripetal force on the tires.

E. there are no centripetal forces involved.

42. On a spinning disk, points closer to the outer edge will have ____ points near the center.

A. the same rotational speed as and greater tangential speed than

B. the same rotational speed as and lower tangential speed than

C. the same tangential speed as and greater rotational speed than D. the same tangential speed as and lower rotational speed than E. lower rotational speed and higher tangential speed than

43. A merry-go-round rotates 9 times each minute such that a point on its rim moves at a rate of 3 m/s. At a point 2/3 of the way out from the center to the rim, the tangential speed would be ____ .

A. 6 RPM

B. 2 m/s

C. 3 m/s

D. 9 RPM

E. 3 RPM

44. An empty soup can and a full one are rolled side-by-side down an incline. If they start together, which one will reach the bottom first?

A. The empty can arrives first.

B. The full can arrives first.

C. They will arrive together.

D. It depends on the diameters of the cans.

E. It depends on the kind of soup.

45. A mass of 1 kilogram is tied to a string and swung in a horizontal circle of radius 1 meter; if the mass is then decreased to 0.5 kilogram, the rotational inertia of this new system will be ____ as before.

A. twice as much

B. four times as much

C. the same

D. one half as much

E. one fourth as much

46. Torque is the product of

A. lever arm and force.

B. mass and radius.

C. rotational inertia and velocity.

D. force and velocity.

E. lever arm and rotational inertia.

47. A 60-kg grandfather and his 30-kg granddaughter are balanced on a seesaw. If the granddaughter is sitting 2 meters from the pivot point, the grandfather must be sitting ____ from it.

A. 4 meters

B. 2 meters

C. 3 meters

D. 1 meter

E. 0.5 meter

Exam #3 ---- (atoms, solids, liquids, gases, etc.)

48. Protons have ___ charge, neutrons have ___ charge, and electrons have ___ charge.

A. negative; positive; no

B. positive; no; negative

C. positive; negative; no

D. negative; no; positive

E. no; negative; positive

49. Which of the following is true?

A. Some atoms do not belong to any particular element.

B. Some atoms belong to more than one element.

C. All atoms are identical.

D. The number of protons in an atom determines which element it is.

E. The number of neutrons in an atom determines which element it is.

50. The mass of one hydrogen atom is approximately

A. one atomic mass unit.

B. two atomic mass units.

C. 12 atomic mass units.

D. 16 atomic mass units.

E. 1/2 atomic mass unit.

51. An element with an atomic number of 92 and an atomic mass number of 238 would have

A. 92 protons, 146 neutrons, and 92 electrons.

B. 92 protons, 146 neutrons, and 238 electrons.

C. 92 protons, 238 neutrons, and 146 electrons.

D. 146 protons, 92 neutrons, and 92 electrons.

E. 146 protons, 92 neutrons, and 146 electrons.

52. Brownian motion is the

A. random motion of microscopic particles being bombarded by even smaller atoms and molecules.

B. random motion of atoms and molecules being bombarded by larger microscopic particles.

C. vibration of atoms and molecules in a solid.

D. movement of electrons circulating within the atom.

E. very gradual flow of solid materials such as glass over long periods of time.

53. Chemical combinations of elements are called

A. mixtures.

B. groups.

C. shells.

D. nuclei.

E. compounds.

54. Which of the following is a list of elements?

A. hydrogen, nitrogen, air

B. hydrogen, oxygen, water

C. hydrogen, oxygen, nitrogen

D. air, nitrogen, oxygen

E. water, nitrogen, oxygen

55. Where on the periodic table would we find an element with one more proton and one more electron than silver?

A. Just above silver.

B. Just to the left of silver.

C. Just below silver.

D. Just to the right of silver.

E. None of these -- there is no such element.

56. Density is

A. mass times volume.

B. mass divided by volume.

C. mass plus volume.

D. volume divided by mass.

E. mass minus volume.

57. 1000 cubic centimeters of water should have a mass of approximately ____ .

A. 100 grams

B. 10 grams

C. 1 gram

D. 1 kilogram

E. 1000 kilograms

58. A material is said to be ____ if it changes shape when a deforming force acts on it and returns to its original shape when the deforming force is removed.

A. elastic

B. inelastic

C. plastic

D. stretchy

E. rigid

59. Hooke's Law relates the

A. distance a spring stretches to the force applied to the spring.

B. distance a spring stretches to the mass of the spring.

C. distance a spring stretches to the density of the spring.

D. density of a spring to the force applied to the spring.

E. density of a spring to the mass of the spring.

60. When the length of each edge of a cube is doubled, the cube's surface area increases by a factor of __ .

A. 2

B. 4

C. 6

D. 8

E. 16

61. When the length of each edge of a cube is tripled, the cube's volume

A. increases by a factor of 3.

B. decreases by a factor of 1/3.

C. increases by a factor of 9.

D. decreases by a factor of 1/9.

E. increases by a factor of 27.

62. The weight of a dome produces

A. tension forces parallel to the curve of the dome.

B. compression forces parallel to the curve of the dome.

C. compression forces perpendicular to the curve of the dome.

D. tension forces acting vertically.

E. tension forces acting horizontally.

63. The buoyant force

A. is the force of gravity acting on a submerged object.

B. is the difference between a submerged object's weight and the weight of an equal mass of water.

C. is the net upward force of the surrounding liquid acting on a submerged object.

D. is the net downward force of a submerged object acting on the surrounding liquid.

E. depends on the density of the submerged object.

64. The buoyant force on a block of wood floating in water

A. is equal to the weight of a volume of water with the same volume as the wood.

B. is equal to the weight of the wood.

C. is greater than the weight of the wood.

D. is less than the weight of the wood.

E. cannot be calculated because the block is not completely submerged.

65. An object with a mass of 1 kg displaces 700 ml of water. Which of the following is true?

A. The weight of this object is 10 N.

B. The weight of this object is 7 N.

C. The weight of this object is 3 N.

D. The buoyant force on this object is 3 N.

E. The buoyant force on this object is 10 N.

66. An object with a mass of 1 kg displaces 0.6 kg of water. Which of the following is true?

A. The buoyant force on this object is 10 N.

B. The buoyant force on this object is 6 N.

C. The buoyant force on this object is 4 N.

D. The density of this object is less than that of water.

E. This object will not sink in water.

67. The water pressure in a lake behind a dam depends on

A. the volume of lake water behind the dam.

B. the surface area of the lake.

C. the distance from the dam at which the pressure is measured.

D. the depth below the surface at which the pressure is measured.

E. the number of fish in the lake.

68. When air is removed from a metal can by a vacuum pump, the can buckles inwards and is crushed. This occurs because

A. the air pressure on the inside of the can is greater than the air pressure on the outside of the can.

B. the air pressure on the outside of the can is greater than the air pressure on the inside of the can.

C. the loss of air molecules from inside the can weakens the metal.

D. the opposite sides of the empty can strongly attract each other.

E. of Bernoulli's principle.

69. Bernoulli's principle explains why

A. a hot air balloon rises.

B. liquid rises in a drinking straw.

C. airplanes fly.

D. dead fish float.

E. submarines can remain submerged.

70. In order to decrease the pressure in an automobile tire, one normally

A. decreases the temperature of the tire.

B. increases the volume of the tire.

C. increases the density of air in the tire.

D. decreases the number of air molecules in the tire.

E. decreases the surface area of the tire.

71. According to Boyle's Law, if the volume occupied by a certain gas is doubled,

A. the pressure of the gas will be doubled.

B. the pressure of the gas will be quadrupled.

C. the pressure of the gas will remain constant.

D. the pressure of the gas will be halved.

E. the number of atoms in the gas will be halved.

72. Archimedes' Principle states that an object surrounded by air is buoyed up by a force equal to the

A. weight of the air it displaces.

B. weight of the object.

C. total pressure on the object.

D. difference between the weight of the object and the weight of the air it displaces.

E. weight of Archimedes.

Exam #4 ---- (heat transfer, waves, sound, music, etc.)

73. In general, when a liquid is heated

A. it will neither expand nor contract.

B. it will expand at a greater rate than a solid.

C. it will expand at a lesser rate than a solid.

D. it will contract at a greater rate than a solid.

E. it will contract at a lesser rate than a solid.

74. If a flat metal plate with a circular hole cut through it is heated,

A. the hole gets smaller.

B. the hole gets larger.

C. the hole stays exactly the same size.

D. the hole may get larger or smaller, depending on the material of the plate.

E. the hole may get larger or smaller, depending on how much the plate is heated.

75. Water has a higher specific heat capacity than iron. This means that

A. water is more dense than iron.

B. water is hotter than iron.

C. water heats more rapidly than iron.

D. water heats more slowly than iron.

E. water boils at a higher temperature than iron.

76. The specific heat capacity of water is 1 calorie per gram per degree Celsius. This means that it will take ____ calorie(s) to increase the temperature of 10 grams of water by 10 degrees.

A. 20

B. 0.1

C. 1

D. 10

E. 100

77. Water reaches its highest density at a temperature of ____ degrees Celsius.

A. 0

B. 4

C. 10

D. -10

E. -4

78. Which of these is an example of heat transfer by conduction?

A. The handle of a metal spoon becomes hot when you use it to stir a pot of soup on the stove.

B. The air near the ceiling is normally warmer than air near the floor.

C. You can boil water in a microwave oven.

D. You feel the heat from a bonfire even though you are several meters away from it.

E. Smoke rises up a chimney.

79. Rising air tends to

A. expand and become cooler.

B. expand and become warmer.

C. become denser and warmer.

D. become denser and cooler.

E. maintain a constant density and temperature.

80. Radiation is heat transfer by

A. molecular and electronic collisions.

B. electromagnetic waves.

C. bulk fluid motions.

D. atmospheric currents.

E. direct contact.

81. The pattern formed by overlapping waves in a bow wave is in the shape of the letter __ .

A. B

B. U

C. V

D. I

E. T

82. The Doppler effect causes

A. the observed pitch of a sound to be lower if the source of sound is approaching the observer.

B. the observed pitch of a sound to be higher if the source of sound is moving away from the observer.

C. the observed pitch of a sound to be lower if the source of sound is moving away from the observer.

D. the speed of sound to increase if the source of sound is moving away from the observer.

E. the speed of sound to decrease if the source of sound is moving away from the observer.

83. In a _____ wave, the medium vibrates in a direction that is perpendicular to the direction the wave travels.

A. sound

B. longitudinal

C. perpendicular

D. transverse

E. normal

84. The period of a pendulum depends on

A. the mass of the pendulum and the size of the arc it swings through.

B. the length of the pendulum and the size of the arc it swings through.

C. the mass of the pendulum and the acceleration of gravity.

D. the length of the pendulum and the acceleration of gravity.

E. the weight of the pendulum and the material it is made from.

85. A wave that has a relatively long wavelength will also have a relatively

A. high frequency.

B. long period.

C. large amplitude.

D. high speed.

E. small amplitude.

86. A train of freight cars, each 10 m long, rolls by at the rate of 2 cars each second. What is the speed of the train?

A. 10 m/s

B. 2 m/s

C. 5 m/s

D. 20 m/s

E. 12 m/s

87. Compared to a 500-Hz sound, a 300-Hz sound would have

A. a longer wavelength and the same speed.

B. a longer wavelength and a lower speed.

C. a longer wavelength and a higher speed.

D. a shorter wavelength and a lower speed.

E. a shorter wavelength and the same speed.

88. A vibrating string is being tuned to match a tuning fork with a frequency of 256 Hz. When 3 beats per second are heard, the vibration frequency of the string must be

A. 256 Hz.

B. 253 Hz.

C. 259 Hz.

D. either 253 or 259 Hz.

E. 3 Hz.

89. Constructive interference of sound waves occurs

A. whenever there is an echo.

B. when two waves arrive at the same point in phase with each other.

C. when two waves arrive at the same point out of phase with each other.

D. whenever sound waves are refracted by air layers of different temperatures.

E. whenever sound waves are reflected off distant buildings.

90. Pushing a person on a swing at the same rate as the natural frequency of the swing/pendulum is an example of

A. destructive interference.

B. constructive interference.

C. resonance.

D. the Doppler effect.

E. refraction.

91. Sound travels faster in air at

A. lower temperatures because the molecules move faster and collide more frequently.

B. lower temperatures because the molecules are closer together and collide more frequently.

C. higher temperatures because the molecules move faster and collide more frequently.

D. higher temperatures because the molecules are closer together and collide more frequently.

E. lower temperatures because the air is more solid then.

92. An intensity of 60 decibels is ___ times as intense as an intensity of 30 decibels.

A. 2

B. 30

C. 60

D. 90

E. 1000

93. The "highness" or "lowness" of a musical tone is called the ____ .

A. loudness

B. rhythm

C. scale

D. pitch

E. intensity

94. Partial tones whose frequencies are whole number multiples of the fundamental frequency are called

A. noise.

B. integers.

C. radicals.

D. harmonics.

E. tonics.

95. When a guitar string vibrates at the frequency of its third harmonic, it will have a node at each end and _____ in between.

A. no nodes

B. one node

C. two nodes

D. three nodes

E. four nodes

Exam #5 ---- (light, optics, electric charge, electric current, etc.)

96. A capacitor is a device used to

A. convert electricity into light.

B. convert electricity into heat.

C. force current through a wire.

D. store separated electrical charges.

E. measure the volume of a glass container.

97. A positively charged object

A. has a deficiency of protons.

B. has a deficiency of neutrons.

C. has a deficiency of electrons.

D. has an excess of electrons.

E. has an excess of neutrons.

98. Good electrical insulators are usually

A. good thermal conductors.

B. poor thermal conductors.

C. good electical conductors.

D. poor thermal insulators.

E. opaque to light.

99. The lines of force for a point charge

A. form concentric circles about it.

B. extend radially outward from it.

C. connect points of equal electric potential.

D. connect points of equal charge.

E. indicate the direction of motion of the point charge.

100. 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. the same as

B. double

C. one half of

D. four times

E. one fourth of

101. If the charges in an electrical circuit always flow in the same direction, the current is called

A. an alternating current.

B. a constant current.

C. a direct current.

D. an oscillating current.

E. a basic current.

102. If the current in a wire is 6 amperes, how much charge will flow through it in 2 seconds?

A. 12 coulombs

B. 2 coulombs

C. 8 coulombs

D. 6 coulombs

E. 3 coulombs

103. If a voltage of 110 volts produces a current of 2 amps in an electrical device, the resistance must be

A. 110 ohms.

B. 2 ohms.

C. 108 ohms.

D. 55 ohms.

E. 220 ohms.

104. If 120 volts are used to light a 30-watt light bulb, the current in the bulb will be

A. 120 amps.

B. 30 amps.

C. 150 amps.

D. 0.25 amps.

E. 4 amps.

105. Wires that are _____ have lower resistance.

A. longer and thicker

B. longer and thinner

C. shorter and thicker

D. shorter and thinner

E. straight

106. 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. two times

B. equal to

C. one half of

D. one fourth of

E. four times

107. If three light bulbs of different wattage are connected in series to a battery,

A. the voltage drop across each bulb will be the same.

B. the current in each light bulb will be the same.

C. the resistance in each light bulb will be the same.

D. the power consumed by each light bulb will be the same.

E. the light output of each bulb will be the same.

108. The speed of light in a vacuum

A. is found by averaging the different speeds of all the different colors of light.

B. is higher for blue light than for red light.

C. is higher for green light than for violet light.

D. is the same for all the different colors of light.

E. is chosen to be equal to the speed of yellow light, which moves faster than any other color.

109. A material is said to be transparent if

A. light can pass freely through it in a straight line.

B. it absorbs light and redistributes the energy as thermal energy.

C. it reflects light.

D. it can vibrate at a resonant frequency to match the frequency of the light.

E. it cannot emit any light.

110. Of all the electromagnetic waves, those with highest energy are ____ and those with lowest energy are ____ .

A. gamma rays; radio waves

B. radio waves; x-rays

C. x-rays; microwaves

D. microwaves; ultraviolet

E. visible light; infrared

111. Which of the following is true?

A. Only virtual images can be projected on a screen.

B. A light ray passing through the center of a converging lens will be bent to pass through the focus.

C. A virtual image is formed where the rays from an object meet after passing through a lens.

D. The image seen in a plane mirror is a virtual image.

E. A virtual image is always upside down.

112. When a converging lens is used as a magnifying glass, the image produced is

A. real and inverted.

B. real and upright.

C. virtual and inverted.

D. virtual and upright.

E. none of the above -- a converging lens cannot be used as a magnifying glass.

113. Which of the following is true? When used alone,

A. converging lenses can form only real images.

B. converging lenses can form only virtual images.

C. converging lenses can form only inverted images.

D. diverging lenses can form only real images.

E. diverging lenses can form only virtual images.

114. The colors seen in a rainbow

A. are produced by raindrops of different colors.

B. are produced by raindrops of different shapes.

C. are the colors of the different atoms that make up water.

D. are the colors of the different molecules that make up water.

E. are produced when sunlight is refracted by raindrops.

115. The law of reflection says

A. all reflected rays are perpendicular to the incident ray.

B. all reflected rays are parallel to the incident ray.

C. all reflected rays are parallel to each other.

D. the angle of reflection equals the angle of incidence.

E. the angle of reflection equals the angle of refraction.

116. A light ray passing from air into water at an angle of 30° from the normal in air

A. would make an angle of 30° from the normal in water.

B. would make an angle greater than 30° from the normal in water.

C. would make an angle less than 30° from the normal in water.

D. would be completely reflected by the water surface.

E. would be completely absorbed by the water surface.

117. The critical angle is

A. the angle of incidence for which the angle of the refracted beam is 0°.

B. the angle of incidence for which the angle of the refracted beam is 90°.

C. the angle of incidence for which the angle of the refracted beam is the same.

D. the angle of incidence for which the angle of the reflected beam is the same.

E. the angular radius of the arc of a rainbow.

Lab Questions (for the Final Exam)

118. How long is a meter stick?

A. 36 inches

B. 100 mm

C. 10 cm

D. 100 cm

E. 1000 cm

119. If T is directly proportional to L, then a plot of T vs L should be

A. a parabola.

B. a circle.

C. a curve that is concave upward.

D. a curve that is concave downward.

E. a straight line passing through the origin.

120. 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. 1%

B. 0.1%

C. 10%

D. 3%

E. 0.3%

Answers

1 D.. 2 D.. 3 E.. 4 D.. 5 D.. 6 E.. 7 B.. 8 C.. 9 C.. 10 B.. 11 A.. 12 C.. 13 E.. 14 B.. 15 B.. 16 C.. 17 D.. 18 C.. 19 B.. 20 C.. 21 C.. 22 D.. 23 B.. 24 B.. 25 A.. 26 C.. 27 A.. 28 C.. 29 E.. 30 B.. 31 D.. 32 A.. 33 E.. 34 C.. 35 A.. 36 A.. 37 B.. 38 A.. 39 A.. 40 A.. 41 B.. 42 A.. 43 B.. 44 B.. 45 D.. 46 A.. 47 D.. 48 B.. 49 D.. 50 A.. 51 A.. 52 A.. 53 E.. 54 C.. 55 D.. 56 B.. 57 D.. 58 A.. 59 A.. 60 B.. 61 E.. 62 B.. 63 C.. 64 B.. 65 A.. 66 B.. 67 D.. 68 B.. 69 C.. 70 D.. 71 D.. 72 A.. 73 B.. 74 B.. 75 D.. 76 E.. 77 B.. 78 A.. 79 A.. 80 B.. 81 C.. 82 C.. 83 D.. 84 D.. 85 B.. 86 D.. 87 A.. 88 D.. 89 B.. 90 C.. 91 C.. 92 E.. 93 D.. 94 D.. 95 C.. 96 D.. 97 C.. 98 B.. 99 B.. 100 E.. 101 C.. 102 A.. 103 D.. 104 D.. 105 C.. 106 E.. 107 B.. 108 D.. 109 A.. 110 A.. 111 D.. 112 D.. 113 E.. 114 E.. 115 D.. 116 C.. 117 B.. 118 D.. 119 E.. 120 E..

121) Suppose a certain carnival has a Ferris wheel where the seats are located halfway between the center and the outside rim.

Compared to an ordinary Ferris wheel, where the seats are on the outside rim, your angular speed while riding this Ferris wheel would be:

A) less and your tangential speed less.

B) less and your tangential speed the same.

C) the same and your tangential speed the same.

D) the same and your tangential speed less.

E) more and your tangential speed the same.

122) If you use larger diameter tires on your car for a given RPM (angular speed) your car's linear speed will be:

A) less.

B) the same.

C) more.

123. A torque acting on an object tends to produce:

A) change in equilibrium.

B) change in rotation.

C) change in linear motion.

D) change in velocity.

E) change in center of gravity.

_124) Consider two planets in space that gravitationally attract each other. If the masses of both planets are doubled, and the distance between them is also doubled, then the force between them is:

A) one quarter.

B) one half.

C) the same.

D) twice as much.

E) four times as much.

125) A "weightless" astronaut in an orbiting shuttle is:

A) shielded from Earth's gravitational field.

B) beyond the pull of gravity.

C) pulled only by gravitation to the shuttle which cancels Earth's gravitational pull.

D) like the shuttle, pulled by Earth's gravitation and falling towards Earth.

E) in a situation where their centripetal force is just canceled by their electrical force.

126) To say that an object is electrically polarized is to say:

A) it is electrically charged.

B) its internal electric field is zero.

C) it is only partially conducting.

D) its charges have been rearranged.

E) it is to some degree magnetic.

_127) When we say an appliance "uses up electricity," we really are saying that:

A) current disappears.

B) electric charges go away.

C) the power supply voltage is substantially reduced.

D) electrons are taken out of the circuit and put somewhere else.

E) electron kinetic energy is changed into some other kind of energy.

_128) An electric heater is rated at 300 W when used in a 110-V circuit.

The safety fuse in the circuit can handle 15 A of current. How many heaters can be safely operated in the circuit?

A) 2. B) 3. C) 4. D) 5. E) more than 5.

_ 129) Which statement is correct?

A) Charge flows in a circuit.

B) Voltage flows in a circuit.

C) Resistance flows in a circuit.

D) Resistance is established across a circuit.

E) Current causes voltage.

This and the following two questions concern the same physical situation.

130.A golf ball is hit upward at an angle θ from the horizontal and speed v = 40 m/s. It reaches a maximum height of 10 m as illustrated above. Assume the ballistic trajectory starts at ground level and ignore air resistance. Assume the shot is made on a wide, level field.

131.What is the initial angle θ ?

(a) θ = 20.5°

(b) θ = 46.4°

(c) θ = 57.3°

(d) θ = 70.2°

(e) θ = 81.1°

132. How long is the ball in the air?

(a) 1.15 s

(b) 2.86 s

(c) 3.12 s

(d) 3.37 s

(e) 3.59 s

133.Suppose we are free to vary the angle θ ($0 < \theta \leq 90°$), but everything else remains the same. The ball will have the highest speed when it hits the ground if

(a) θ = 90°

(b) θ = 45°

(c) All angles hit at the same speed.

134.Which one of the following most nearly is in free fall? Allow for air resistance.

(a) A feather dropped from the top of Loomis Lab.

(b) A bowling ball dropped from a height of 1 m.

(c) A bungee jumper suspended from a taut bungee cord at the lowest point on her trajectory.

135.A man of mass 80 kg is in an elevator in the Burj Khalifa in Dubai (now the tallest building in the world). The elevator has a cruising speed of 8 m/s and reaches this speed at t = 4 s after starting from

rest at t = 0 s. What is the man's apparent weight while the elevator is accelerating upward? Assume constant acceleration.

(a) 660 N

(b) 770 N

(c) 940 N

(d) 1010 N

(e) Not enough information given.

136.Two boats A and B are moving on the surface of Lake Michigan. We will describe their motion using x and y coordinates; assume that x is to the east and y is to the north. Boat A has velocity v x = 5 m/s, v y = -1 m/s. Boat B has velocity v x = 4 m/s, v y = 1 m/s. What is their relative speed?

(a) 2.0 m/s

(b) 2.2 m/s

(c) 4.1 m/s

(d) 5.0 m/s

(e) 25 m/s

137.This question and the following one concern the same physical situation.

Two astronauts with masses m 1 = 50 kg and m 2 = 70 kg are floating freely in orbit, watching the sun set. The little one pushes the big one. During the push, which astronaut experiences the larger force?

(a) the little one

(b) the big one

(c) They're the same.

138.Which astronaut experiences the larger acceleration?

(a) the little one

(b) the big one

(c) They're the sa

139.Which one of the following must be moving at constant velocity?

(a) a car moving down a straight road at constant speed

(b) a car moving around a circular race track at constant speed

(c) a car moving on a circular race track at varying speed.

140.This question and the following two concern the same physical situation.

141.A 30 kg boy is attached by a taut, ideal rope to a pole in the middle of an ice skating rink. The boy circles the pole at a speed v = 2.1 m/s and distance 3 m. What is the tension in the rope?

(a) 9 N

(b) 11 N

(c) 22 N

(d) 33 N

(e) 44 N

142.What is the boy's angular speed?

(a) 0.7 rad/s

(b) 0.9 rad/s

(c) 1.1 rad/s

(d) 1.3 rad/s

(e) 1.5 rad/s

143.Suppose that the boy is actually moving with angular speed 0.5 rad/s, and begins to slow down at a rate of 0.01 rad/s 2 . How many times does he go around the pole before stopping?

(a) once

(b) twice

(c) three times

144.You give the cart a push up a ramp, as shown in the following figure. The cart rolls up and then rolls back down the ramp. When the cart reaches the top, its acceleration is:

(a) zero

(b) downward

(c) upward

145.A block is sliding up an incline, turns around, and slides back down. There is friction between the block and the incline. Which one of the following is true?

(a) The magnitude of the acceleration is larger going up than going down.

(b) The magnitude of the acceleration is larger going down than going up.

(c) The magnitude of the acceleration is the same going up and going down.

This question and the following one concern the same physical situation.

146.A cart of mass M is on the frictionless horizontal table, and is connected to a mass m with an ideal string through a massless and frictionless pulley as shown in the figure at right.

When m is very large compared to M, what is the acceleration a of the cart?

(a) a = 0

(b) a is very large compared to g .

(c) a is close to g .

147.When m = M , what is the acceleration a of the cart?

(a) a = 0

(b) a = g /2

(c) a = g

148.There are three forces F 1 , F 2 and F 3 acting on the same mass, as illustrated below. The mass has zero acceleration. Using the coordinates shown in the figure, the force vectors in components read F 1 = (0.2, 2.1) and F3 = (-4.1, -3.8) (in N). Find the magnitude of F 2 .

(a) 2.8 N

(b) 3.3 N

(c) 3.8 N

(d) 4.3 N

(e) 4.7 N

149.Consider the two blocks connected with an ideal string through a massless and frictionless pulley as shown in the figure below. There is kinetic friction between the table and the block. The coefficient of kinetic friction between the block on the table and the table is μ_k .

Let a be the acceleration of block on the table to the right. The masses of the blocks are both equal to M. The tension in the string is T . Newton's second law tells us the following two equations.

$Ma = T - \mu_k Mg$

$- Ma = T - Mg$

150.Solving these simultaneous equations, obtain the acceleration a.

(a) $a = (1 - \mu_k) g / 2$

(b) $a = (1 + \mu_k) g / 2$

(c) $a = (1 - \mu_k) g$

(d) $a = (1 + \mu_k) g$

(e) $a = \mu_k g$

151.This question and the following one concern the same physical situation.

There is a block of mass M on the slope that makes an angle $\theta = 30°$ to the horizontal. The coefficient of static friction is 0.7.

The block is stationary on the slope. What is the magnitude of the friction force?

(a) $Mg \cos 30°$

(b) $0.7 Mg \cos 30°$

(c) $Mg \sin 30°$

152.How large can the angle θ be before the block starts to slip?

(a) $\theta = 25°$

(b) $\theta = 35°$

(c) $\theta = 47°$

(d) $\theta = 55°$

(e) θ = 63°

153.This and the following question concern the same physical situation.

A block of mass 23 kg is under various forces and moves along the x-axis. The x -component of its velocity is plotted as the function of time shown below.

What is the largest magnitude of the net force acting on the block before t = 60 s ?

(a) 23 N

(b) 30 N

(c) 39 N

(d) 46 N

(e) 52 N

154.What is the average velocity of the block during these 60 seconds ?

(a) 3.3 m/s

(b) 5.0 m/s

(c) 6.7 m/s

(d) 8.3 m/s

(e) 10 m/s

QUESTION 23**

This and the following question concern the same physical situation.

A ball is thrown upward with a certain initial velocity v0 from the top of a tower of height h at time t = 0. It reaches the highest point at time t = 2 seconds, and the ground at time t = 5 seconds.

155.What is the height of the tower?

(a) 7.5 m

(b) 11.5 m

(c) 16.5 m

(d) 20.5 m

(e) 24.5

156.Suppose the mass of the ball is doubled and the same experiment is repeated from the same tower with exactly the same initial velocity. How long does it take for the ball to reach the ground?

(a) 2 s

(b) 5 s

(c) 10 s

157.This and the following question concern the same physical situation.

There are three boxes on a horizontal surface as illustrated in the following figure. The masses of two of the boxes are known, as shown in the figure. A person pushes the leftmost box to the right with a force of 320 N. The boxes accelerate to the right at 8 m/s 2 .

158.What is the mass M of the middle box?

(a) 7 kg

(b) 9 kg

(c) 13 kg

(d) 17 kg

(e) 21 kg

159.What is the force exerted by the middle box on the leftmost box?

(a) 153 N

(b) 167 N

(c) 224 N

(d) 253 N

(e) 289 N