Science Bowl Practice Questions – Physics

1. Multiple Choice: For the hydrogen atom, which series describes electron transitions to the N=1 orbit, the lowest energy electron orbit? Is it the:

w) Lyman series
x) Balmer series
y) Paschen series
z) Pfund series

ANSWER: W -- LYMAN SERIES

2. Multiple Choice: Electric current may be expressed in which one of the following units?

w) coulombs/volt
x) joules/coulomb
y) coulombs/second
z) ohms/second

ANSWER: Y -- COULOMBS/SECOND

3. Short Answer: In the SI system of measure, what is the unit of capacitance?

ANSWER: FARAD

4. Multiple Choice: A Newton is equal to which of the following?

w) kilogram-meter per second
x) meter per second squared
y) kilogram-meter per second squared
z) kilogram per meter-second

ANSWER: Y -- KILOGRAM-METER PER SECOND SQUARED

5. Multiple Choice: For an object moving in uniform circular motion, the direction of the instantaneous acceleration vector is:

w) tangent to the path of motion
x) equal to zero
y) directed radially outward
z) directed radially inward

ANSWER: Z -- DIRECTED RADIALLY INWARD

6. Short Answer: A boy is standing on an elevator which is traveling downward with a constant velocity of 30 meters per second. The boy throws a ball vertically upward with a velocity of 10 meters per second relative to the elevator. What is the velocity of the ball, MAGNITUDE AND DIRECTION, relative to the elevator shaft the instant the boy releases the ball?

ANSWER: 20 METERS PER SECOND DOWN

7. Multiple Choice: Work is equal to which of the following?

w) the cross product of force and displacement.
x) the product of force times time
y) force divided by time
z) the dot product of force and displacement

ANSWER: Z -- THE DOT PRODUCT OF FORCE AND DISPLACEMENT

8. Multiple Choice: The work done by a friction force is:

w) always positive
x) always negative
y) always zero
z) either positive or negative depending upon the situation.

ANSWER: X -- ALWAYS NEGATIVE

9. Multiple Choice: As defined in physics, work is:

w) a scalar quantity
x) always a positive quantity
y) a vector quantity
z) always zero

ANSWER: W -- A SCALAR QUANTITY

10. Multiple Choice: A pendulum which is suspended from the ceiling of a railroad car is observed to hang at an angle of 10 degrees to the right of vertical. Which of the following answers could explain this phenomena?

w) The railroad car is at rest.
x) The railroad car is accelerating to the left.
y) The railroad car is moving with constant velocity to the right.
z) The railroad car is accelerating to the right.

ANSWER: X -- THE RAILROAD CAR IS ACCELERATING TO THE LEFT.

11. Multiple Choice: Two forces have magnitudes of 11 newtons and 5 newtons. The magnitude of their sum could NOT be equal to which of the following values?

w) 16 newtons
x) 5 newtons
y) 9 newtons
z) 7 newtons

ANSWER: X -- 5 NEWTONS

12. Short Answer: A ball leaves a girl's hand with an upward velocity of 6 meters per second. What is the maximum height of the ball above the girl's hand?

ANSWER: 1.8 METERS

13. Short Answer: A boy throws a ball vertically upward with a velocity of 6 meters per second. How long does it take the ball to return to the boy's hand?

ANSWER: 1.22 SECONDS (accept: 1.2 seconds)

14. Short Answer: A toy train moves in a circle of 8 meters radius with a speed of 4 meters per second. What is the magnitude of the acceleration of the train?

ANSWER: 2 METERS PER SECOND SQUARED

15. Short Answer: A certain machine exerts a force of 200 newtons on a box whose mass is 30 kilograms. The machine moves the box a distance of 20 meters along a horizontal floor. What amount of work does the machine do on the box?

ANSWER: 4000 JOULES

16. Short Answer: A box is initially at rest on a horizontal, frictionless table. If a force of 10 Newtons acts on the box for 3 seconds, what is the momentum of the box at the end of the 3 second interval?

ANSWER: 30 NEWTON-SECONDS or 30 KILOGRAM-METER PER SECOND

17. Multiple Choice: A block of metal which weighs 60 newtons in air and 40 newtons under water has a density, in kilograms per meter cubed, of:

w) 1000
x) 3000
y) 5000
z) 7000

ANSWER: X -- 3000

18. Short Answer: A 10 kilogram body initially moving with a velocity of 10 meters per second makes a head-on collision with a 15 kilogram body initially at rest. The two objects stick together. What is the velocity of the combined system just after the collision?

ANSWER: 4 METERS PER SECOND

19. Short Answer: A certain spring is known to obey Hooke's Law. If a force of 10 newtons stretches the spring 2 meters, how far will a 30 newton force stretch the spring?

ANSWER: 6 METERS

20. Short Answer: A helicopter is ascending vertically with a constant speed of 6 meters per second relative to the ground. At the instant the helicopter is 60 meters above the ground it releases a package. What is the magnitude and direction of the velocity of the package, relative to the ground, the instant the package is released by the helicopter?

ANSWER: 6 METERS/SECOND UP

21. Multiple Choice: If the distance between two objects, each of mass 'M', is tripled, the force of attraction between the two objects is:

w) 1/2 the original force
x) 1/3 the original force
y) 1/9 the original force
z) unchanged

ANSWER: Y -- 1/9 THE ORIGINAL FORCE

22. Short Answer: A 40 kilogram girl climbs a vertical distance of 5 meters in twenty seconds at a constant velocity. How much work has the girl done?

ANSWER: 2000 JOULES or 1960 JOULES

23. Short Answer: A machine performs 8 Joules of work in 2 seconds. How much power is delivered by this machine?

ANSWER: 4 WATTS

24. Multiple Choice: In physics, a radian per second is a unit of:

w) angular displacement
x) angular velocity
y) angular acceleration
z) angular momentum.

ANSWER: X -- ANGULAR VELOCITY

25. Multiple Choice: If the resultant force acting on a body of constant mass is zero, the body's momentum is:

w) increasing
x) decreasing
y) always zero
z) constant

ANSWER: Z – CONSTANT

26. Short Answer: What is the name of the first American physicist to win two Nobel prizes?

ANSWER: (JOHN) BARDEEN

27. Multiple Choice: Which of the following scientists is responsible for the exclusion principle which states that two objects may NOT occupy the same space at the same time? Was it:

w) Heisenberg
x) Bohr
y) Teller
z) Pauli

ANSWER: Z -- PAULI

28. Short Answer: Who shared the Nobel Prize in Physics in 1909 with Guglielmo Marconi for his contribution to the development of wireless telegraphy?

ANSWER: (CARL FERDINAND) BRAUN

29. Short Answer: Who first theoretically predicted the existence of the positron, a positively charged electron? He received the Nobel Prize in Physics in 1933.

ANSWER: (PAUL ADRIEN MAURICE) DIRAC

30. Short Answer: Name the female physicist who received the Nobel Prize in 1963 for her discovery concerning the shell structure of the nucleus.

ANSWER: (MARIA GOEPPERT) MAYER

31. Short Answer: The constant potential difference across a 2 ohm resistor is 20 volts. How many watts of power are dissipated by this resistor?

ANSWER: 200 WATTS

32. Short Answer: The potential difference across a 4 ohm resistor is 20 volts. Assuming that all of the energy dissipated by this resistor is in the form of heat, how many joules of heat are radiated in 10 seconds?

ANSWER: 1000 JOULES

33. Multiple Choice: The force acting between two point charges can be computed using which of the following laws?

w) Ohm's Law
x) Ampere's Law
y) Coulomb's Law
z) Newton's Second Law.

ANSWER: Y -- COULOMB'S LAW

34. Short Answer: Five volts are applied across the plates of a parallel plate capacitor. The distance of separation of the plates is .02 meters. What is the magnitude of the electric field inside the capacitor?

ANSWER: 250 VOLTS PER METER or 250 NEWTONS PER COULOMB

35. Short Answer: Used normally, a 150-watt, 120 volt light bulb requires how many amps of current?

ANSWER: 1.25 AMPS

36. Short Answer: If 10 joules of energy are required to move 5 coulombs of charge between two points, the potential difference between the two points is equal to how many volts?

ANSWER: 2 VOLTS

37. Multiple Choice: Induced electric currents can be explained using which of the following laws?

w) Gauss's Law
x) Faraday's Law
y) Ohm's Law
z) Ampere's Law

ANSWER: X -- FARADAY'S LAW

38. Multiple Choice: For a negative point charge, the electric field vectors:

w) circle the charge
x) point radially in toward the charge
y) point radially away from the charge
z) cross at infinity

ANSWER: X -- POINT RADIALLY IN TOWARD THE CHARGE

39. Multiple Choice: For an infinite sheet of positive charge, the electric field lines:

w) run parallel to the sheet of charge
x) are perpendicular to the sheet of charge and point in toward the sheet
y) are perpendicular to the sheet of charge and point away from the sheet
z) fall off as one over r squared

ANSWER: Y -- ARE PERPENDICULAR TO THE SHEET OF CHARGE AND POINT AWAY

40. Multiple Choice: Five coulombs of charge are placed on a thin-walled conducting shell. Once the charge has come to rest, the electric potential inside the hollow conducting shell is found to be:

w) zero
x) uniform inside the sphere and equal to the electric potential on the surface of the sphere
y) smaller than the electric potential outside the sphere
z) varying as one over r squared.

ANSWER: X -- UNIFORM INSIDE THE SPHERE AND EQUAL TO THE ELECTRIC OTENT

41. Short Answer: A two farad and a four farad capacitor are connected in series. What single capacitance is "equivalent" to this combination?

ANSWER: 4/3 FARADS

42. Multiple Choice: Three capacitors with different capacitances are connected in series. Which of the following statements is TRUE?

w) All three of the capacitors have the same potential difference between their plates.
x) The magnitude of the charge is the same on all of the capacitor plates.
y) The capacitance of the system depends on the voltage applied across the three capacitors.

ANSWER: X -- THE MAGNITUDE OF THE CHARGE IS THE SAME ON ALL OF THE CAPACITOR PLATES

43. Multiple Choice: For a parallel-plate capacitor with plate area "A" and plate separation "d", the capacitance is proportional to which of the following?

w) A divided by d squared
x) A times d
y) A divided by d
z) d divided by A

ANSWER: Y -- A DIVIDED BY D

44. Multiple Choice: A constant potential difference is applied across the plates of a parallel-plate capacitor. Neglecting any edge effects, the electric field inside the capacitor is:

w) constant
x) varying as one over r squared
y) decreasing as one moves from the positive to the negative plate z) zero

ANSWER: W -- CONSTANT

45. Short Answer: A 10 farad capacitor is used in a circuit. The voltage difference between the plates of the capacitor is 20 volts. What is the magnitude of the charge on each of the capacitor's plates?

ANSWER: 200 COULOMBS

46. Short Answer: A circuit which employs a DIRECT CURRENT source has a branch which contains a capacitor. After the circuit has reached a steady state, what is the magnitude of the current in the circuit branch which contains the capacitor?

ANSWER: THE CURRENT IS ZERO

47. Short Answer: A charged particle is moving in a UNIFORM magnetic field. If the direction of motion of the charged particle is parallel to the magnetic field, describe the shape of the charged particle's path.

ANSWER: STRAIGHT LINE

48. Multiple Choice: An infinitely long wire carries a current of three amps. The magnetic field outside the wire:

w) points radially away from the wire
x) points radially inward
y) circles the wire
z) is zero.

ANSWER: Y -- CIRCLES THE WIRE

49. Multiple Choice: A copper rod which is 1 centimeter in diameter carries a current of 5 amps. The current is distributed uniformly throughout the rod. The magnetic field half way between the axis of the rod and its outside edge is:

w) zero.
x) pointing radially outward
y) pointing radially inward
z) circles the axis of the rod

ANSWER: Z -- CIRCLES THE AXIS OF THE ROD

50. Multiple Choice: Iron is what type of magnetic material? Is it:

w) diamagnetic
x) paramagnetic
y) ferromagnetic
z) non-magnetic

ANSWER: Y – FERROMAGNETIC

51. Short Answer: The focal length of a concave mirror is 2 meters. An object is positioned 8 meters in front of the mirror. Where is the image of this object formed?

ANSWER: 8/3 METER or 2.66 METERS IN FRONT OF THE MIRROR

52. Short Answer: A converging thin lens has a focal length of 27 centimeters. An object is placed 9 centimeters from the lens. Where is the image of this object formed?

ANSWER: -13.5 CENTIMETERS or 13.5 CENTIMETERS ON THE OBJECT SIDE OF THE LENS

53. Short Answer: In Bohr's theory of the atom, what force was responsible for holding the electrons in their orbit?

ANSWER: COULOMB FORCE or THE FORCE OF ATTRACTION BETWEEN THE PROTON (NUCLEUS) AND THE ELECTRON

54. Short Answer: Davisson and Germer scattered electrons from a crystal of nickel. The scattered electrons formed a strong diffraction pattern. What important conclusion was drawn from this experiment?

ANSWER: ELECTRONS ACTED LIKE WAVES

55. Short Answer: The speed at which a wave propagates down a string is 300 meters per second. If the frequency of this wave is 150 Hertz, what is the wavelength of this wave?

ANSWER: 2 METERS

56. Multiple Choice: A standing wave is formed on a tightly stretched string. The distance between a node and an antinode is:

w) 1/8 wavelength
x) 1/4 wavelength
y) 1/2 wavelength
z) 1 wavelength

ANSWER: X -- 1/4 WAVELENGTH

57. Multiple Choice: When a physical property such as charge exists in discrete "packets" rather than in continuous amounts, the property is said to be:

w) discontinuous
x) abrupt
y) quantized
z) noncontinuous

ANSWER: Y – QUANTIZED

58. Short Answer: Assume a ray of light is incident on a smooth reflecting surface at an angle of incidence of 15 degrees to the normal. What is the angle between the incident ray and the reflected ray?

ANSWER: 30 DEGREES

59. Short Answer: The focal length of a concave spherical mirror is equal to 1 meter. What is the radius of curvature of this mirror?

ANSWER: 2 METERS

60. Short Answer: A virtual image can be formed by one or more of the following single mirrors? Identify them.

w) plane mirror
x) concave spherical mirror
y) convex spherical mirror
z) all of the above

ANSWER: Z -- ALL OF THE ABOVE (accept: A, B and C)

61. Short Answer: A quarter of a wavelength is equal to how many degrees of phase?

ANSWER: 90 DEGREES

62. Multiple Choice: An organ pipe which is open at both ends resonates at its fundamental frequency. Neglecting any end effects, what wavelength is formed by this pipe in this mode of vibration if the pipe is 2 meters long?

w) 2 meters
x) 4 meters
y) 6 meters
z) 8 meters.

ANSWER: X -- 4 METERS

63. Multiple Choice: Whose principle or law states that each point on a wavefront may be considered a new wave source? Is it:

w) Snell's Law
x) Huygen's Principle
y) Young's Law
z) Hertz's Law.

ANSWER: X -- HUYGEN'S PRINCIPLE

64. Short Answer: The frequency of a wave is 50 Hertz and its wavelength is 25 meters. What is the velocity of this wave?

ANSWER: 1250 METERS/SECOND

65. Multiple Choice: The wave nature of light is demonstrated by which of the following?

w) the photoelectric effect
x) color
y) the speed of light
z) diffraction

ANSWER: Z -- DIFFRACTION

66. Multiple Choice: The collision between a photon and a free electron was first explained by which of the following scientists?

w) Einstein
x) Heisenberg
y) Compton
z) Bohr

ANSWER: Y – COMPTON

67. Short Answer: Besides solid, liquid, and gas, what is the fourth form of matter?

ANSWER: PLASMA

68. Short Answer: What is 25,000 miles per hour on earth, and 5,300 miles per hour on the Moon?

ANSWER: ESCAPE VELOCITY

69. Short Answer: In Einstein's universe, what is the fourth dimension?

ANSWER: TIME

70. Multiple Choice: The Tesla and the Gauss are units of measure of:

w) conductance
x) magnetic field strength
y) magnetic flux
z) electrical current

ANSWER: X -- MAGNETIC FIELD STRENGTH

71. Short Answer: Shockley, Brattain and Bardeen won a Nobel prize for what small invention?

ANSWER: TRANSISTOR

72. Short Answer: What mechanical and electronic device has a name derived from a Czechoslovakian word meaning "work; compulsory service"?

ANSWER: ROBOT

73. Short Answer: What is the name of the temperature and pressure conditions at which water can be in the solid, liquid and gas phases simultaneously?

ANSWER: TRIPLE POINT

74. Multiple Choice: Which of the following colors of visible light has the longest wavelength? Is it:

w) violet
x) green
y) yellow
z) red

ANSWER: Z – RED

75. Multiple Choice: A 10 kilogram mass rests on a horizontal frictionless surface. A horizontal force of 5 Newtons is applied to the mass. After the force has been applied for 1 second, the velocity of the mass is:

w) 0 meters per second
x) 0.5 meters per second
y) 5 meters per second
z) 50 meters per second

ANSWER: X -- 0.5 METERS PER SECOND

76. Multiple Choice: A worker lifts a 10 kilogram block a vertical height of 2 meters. The work he does on the block is:

w) 5 Joules
x) 20 Joules
y) 49 Joules
z) 200 Joules

ANSWER: Z -- 200 JOULES

77. Multiple Choice: An impulse of 10 kilogram-meter per second acting on an object whose mass is 5 kilogram will cause a change in the objects velocity of:

w) 0.5 meters per second
x) 2 meters per second
y) 10 meters per second
z) 50 meters per second

ANSWER: X -- 2 METERS PER SECOND

78. Multiple Choice: The time needed for a net force of 10 newtons to change the velocity of a 5 kilograms mass by 3 meters/second is:

w) 1.5 seconds
x) 6 seconds
y) 16.7 seconds
z) 150 seconds

ANSWER: W -- 1.5 SECONDS

79. Multiple Choice: The value of G, the universal gravitational constant, was measured experimentally by:

w) Newton
x) Cavendish
y) Copernicus
z) Kepler

ANSWER: X -- CAVENDISH

80. Multiple Choice: Two steel balls are at a distance S from one another. As the mass of ONE of the balls is doubled, the gravitational force of attraction between them is:

w) quartered
x) halved
y) doubled
z) quadrupled

ANSWER: Y -- DOUBLED

81. Multiple Choice: If the distance between the earth and moon were halved, the force of the attraction between them would be:

w) one fourth as great
x) one half as great
y) twice as great
z) four times as great

ANSWER: Z -- FOUR TIMES AS GREAT

82. Multiple Choice: As a 10 kilogram mass on the end of a spring passes through its equilibrium position, the kinetic energy of the mass is 20 joules. The speed of the mass is:

w) 2.0 meters per second
x) 4.0 meters per second
y) 5.0 meters per second
z) 6.3 meters per second

ANSWER: W -- 2.0 METERS PER SECOND

83. Multiple Choice: As a longitudinal wave moves through a medium, the particles of the medium:

w) vibrate in a path parallel to the path of the wave
x) vibrate in a path perpendicular to the path of the wave
y) follow the wave along its entire path
z) do not move

ANSWER: W -- VIBRATE IN A PATH PARALLEL TO THE PATH OF THE WAVE

84. Multiple Choice: As a pendulum is raised to higher altitudes, its period:

w) increases
x) decreases
y) remains the same
z) decreases, then remains the same

ANSWER: W -- INCREASES

85. Multiple Choice: Two vibrating particles that are "out of phase" differ in the phase of their vibration by:

w) 1/4 cycle
x) 1/2 cycle
y) 3/4 cycle
z) 1 cycle

ANSWER: X -- 1/2 CYCLE

86. Multiple Choice: The SI unit of pressure is the:

w) Torr
x) dyne per centimeter squared
y) atmosphere
z) pascal

ANSWER: Z – PASCAL

87. Multiple Choice: An electroscope charged WITHOUT contacting a charged body is charged by:

w) induction
x) conduction
y) convection
z) insulation

ANSWER: W -- INDUCTION

88. Multiple Choice: The potential drop between the terminals of a battery is equal to the battery's EMF when:

w) no current is drawn from the battery
x) a very large current is drawn from the battery
y) the internal resistance of the battery is very large
z) the resistance in the external circuit is small

ANSWER: W -- NO CURRENT IS DRAWN FROM THE BATTERY

89. Multiple Choice: To convert a galvanometer to a voltmeter, you should add a:

w) high resistance in series
x) high resistance in parallel
y) low resistance in series
z) low resistance in parallel

ANSWER: W -- HIGH RESISTANCE IN SERIES

90. Multiple Choice: The greatest induced EMF will occur in a straight wire moving at constant speed through a uniform magnetic field when the angle between the direction of the wire's motion and the direction of the magnetic field is

w) 0 degrees
x) 30 degrees

y) 60 degrees
z) 90 degrees

ANSWER: Z -- 90 DEGREES

91. Multiple Choice: A 10 volt battery connected to a capacitor delivers a charge of 0.5 coulombs. The capacitance of the capacitor is:

w) 2 x 10-2 farads
x) 5 x 10-2 farads
y) 2 farads
z) 5 farads

ANSWER: X -- 5 x 10-2 FARADS

92. Multiple Choice: Two light rays will interfere constructively with maximum amplitude if the path difference between them is:

w) one wavelength
x) one-half wavelength
y) one-quarter wavelength
z) one-eighth wavelength

ANSWER: W -- ONE WAVELENGTH

93. Multiple Choice: Light is normally incident on a thin soap film and is reflected. If the wavelength of this light is "L" and the index of refraction of the soap film is "N", complete destructive interference will occur for a film thickness of:

w) L / 8N
x) L / 4N
y) L / 2N
z) 3L / 4N

ANSWER: Y -- L / 2N

94. Multiple Choice: The Michelson interferometer was designed to study the nature of:

w) water waves
x) sound waves
y) an "ether"
z) sunlight

ANSWER: Y -- AN "ETHER"

95. Multiple Choice: The Millikan experiment showed that electric charge was:

w) negative
x) quantized
y) positive
z) unmeasurable

ANSWER: X -- QUANTIZED

96. Multiple Choice: When a metal becomes a superconductor, there is a tremendous decrease in its:

w) total volume
x) electrical resistance
y) length
z) density

ANSWER: X -- ELECTRICAL RESISTANCE

97. Multiple Choice: An x-ray photon collides with a free electron, and the photon is scattered. During this collision there is conservation of:

w) momentum but not energy
x) neither momentum nor energy
y) energy but not momentum
z) both momentum and energy

ANSWER: Z -- BOTH MOMENTUM AND ENERGY

98. Multiple Choice: In the sun, helium is produced from hydrogen by:

w) radioactive decay
x) disintegration
y) fission
z) fusion

ANSWER: Z – FUSION

99. Multiple Choice: The half-life of an isotope of an element is 5 days. The mass of a 10 gram sample of this isotope remaining after 20 days is:

w) 0.312 grams
x) 0.625 grams
y) 1.25 grams
z) 2.50 grams

ANSWER: X -- 0.625 GRAMS

100. Multiple Choice: The idea that electrons revolved in orbits around the nucleus of an atom without radiating energy away from the atom was postulated by:

w) Thompson
x) Bohr
y) Rutherford
z) Einstein

ANSWER: X -- BOHR