



NATIONAL Science Bee

V/JV Physics National Championship Exam

Name _____

School _____

Grade _____

Email address _____

Instructions – Circle the correct answer or leave it blank. Correct answers are worth 2 points. Incorrect answers are worth –1 point. Questions left blank are worth 0 points.

- The path along which an object moves, which could be a straight line or curved is called?
 - Trajectory
 - Linear motion
 - Rotational motion
 - Visualizing motion
- An object that can be represented as a mass at a single point in space is called ?
 - Center of mass
 - A particle
 - Center of Gravity
 - A model
- An object starts at a positive position along the x-axis, then undergoes a negative displacement. The final position
 - Is positive
 - Is negative
 - Could be positive or negative
 - Is a single symbol
- The slope of the tangent line of a position-time graph is the?
 - Average velocity
 - Position in real time
 - Displacement
 - Instantaneous Velocity
- The area under the curve of a velocity-time graph is the ?
 - Displacement
 - Instantaneous velocity
 - Instantaneous Position
 - Acceleration
- If the acceleration vector points in the same direction as the velocity vector the object is ?
 - Slowing down
 - Speeding up
 - Moving at a constant speed
 - Moving along a curved path
- The slope of a velocity-time graph of an object in free-fall would be ?
 - Positively exponential
 - Negatively exponential
 - Positively constant
 - Negatively constant
- Which force is exerted on an object by a surface?
 - Normal force
 - Gravitational force
 - Weight
 - Tension
- An object sinks if it ?
 - Weighs less than the fluid it displaces
 - Weighs more than the fluid it displaces
 - Weighs the same as the fluid it displaces
 - Has neutral buoyancy
- Bernoulli's Principle is a statement
 - Of energy conservation
 - Of viscosity
 - Of gauge pressure
 - Of volume flow rate
- Which of the following has the highest specific metabolic rate calculated by specific heat
 - Elephant
 - Human
 - Mouse
 - Rat

12. Poiseuille's Equation
- Governs streamlines
 - Governs viscous flow through a tube
 - Governs compressibility of liquids
 - Buoyancy
13. The amplitude of a wave
- Is the distance from minimum to maximum displacement
 - A measure of the restoring force
 - Is the measure of oscillation
 - Is the distance from equilibrium to maximum
14. Oscillation about an equilibrium position with a linear restoring force is always
- Simple harmonic motion
 - The period of Oscillation
 - Additive
 - Accelerating
15. Wave speed on a string
- Increases with increasing linear density
 - Decreases with increasing linear density
 - Decreases with increasing tension
 - Is equal to the square root of linear density divided by tension
16. The intensity of a sound wave
- Increases with increasing area
 - Increases with decreasing power
 - Decreases with increasing area
 - Is directly related to area
17. According to the Doppler Effect, the frequency, as a sound moves toward an observer
- The observed frequency does not change
 - The observed frequency decreases
 - The wavelength increases
 - The wavelength decreases
18. Noise canceling headphones,
- Invert the wave caused by ambient sound
 - Decrease the intensity of incoming sound waves
 - Constructively add the ambient sound
19. Huygens' Principle says ?
- A bright central maximum of diameter is surrounded by secondary maxima
 - The wave front is tangent to all spherical wavelets
 - The wave front is the spreading of a wave after it passes through an opening
 - The central maximum of width is flanked by weaker secondary maxima
20. Which of the following is NOT increased by a machine?
- Work
 - Speed
 - Force
 - Torque
21. The smallest number of pulleys needed for an IMA of 5 is
- 3
 - 4
 - 5
 - 6
22. The mass of a nitrogen atom is 14u. The number of moles of molecular nitrogen (N₂) in 56 g of nitrogen is ?
- 64
 - 28
 - 4
 - 2
23. For fluid flow in a pipe, a Reynolds number less than 2000 means ?
- The fluid has turbulent flow
 - The fluid has low viscosity
 - The fluid flow is laminar
 - The fluid flow is upward
24. The sum of the currents that flow into a junction is equal to the sum of the currents that flow out of the junction is one of ?
- Kirchhoff's Rules
 - Coulomb's Laws
25. wave to the sound wave emitted by the headphone
- Constructively add sound wave emitted by both headphones

- C. Boyle's Laws
D. Faraday's Laws
25. When a source of energy is connected to a load, power transfer is maximum when both load and source have the same resistance. This is an example of ?
A. Internal resistance
B. Impedance matching
C. Potential resistance
D. Potential difference
26. With respect to an observer, the electric force between two charges appears altered when the charges are moving just as mass of an object moving is greater at rest is explained by ?
A. Tesla's theorem
B. Gauss' Law
C. Meitner's Postulate
D. Theory of relativity
27. The cause of the alternating current in the secondary coil of a transformer is an emf produced by ?
A. The varying electric field of the primary coil
B. The varying magnetic field of the secondary coil
C. The varying magnetic field of the primary coil
D. The voltage applied to the primary coil
28. The magnetic energy of a coil that carries a current I , does not depend on ?
A. The resistance of the coil
B. I
C. The presence of an iron core in the coil
D. The number of turns in the coil
29. The current and voltage cannot be exactly in phase in a circuit that contains?
A. Only resistance
B. Only inductance
C. Inductance and capacitance
D. Resistance, inductance and capacitance
30. Light rays from a point on an object that are reflected at different distances from the axis of a spherical mirror and do not converge to a single point is called ?
A. Total internal reflection
B. Image of meniscus
C. Spherical aberration
D. Linear magnification
31. When a spherical mirror forms a real image, the image relative to its object is always?
A. Larger
B. Inverted
C. Smaller
D. Erect
32. A magnification that is negative means the image is
A. Inverted
B. Erect
C. Smaller than the object
D. Larger than the object
33. A beam of light in which the electric fields of the waves are all in the same direction is
A. Unpolarized
B. Diffracted
C. Reflected
D. Polarized
34. The operation of the laser is based on which of the following?
A. Interference of matter waves
B. The Exclusion Principle
C. Induced emission of radiation
D. The Uncertainty Principle
35. Of the following transitions in a hydrogen atom, which one results in the absorption of the photon of highest frequency?
A. $n = 1$ to $n = 2$
B. $n = 2$ to $n = 1$
C. $n = 2$ to $n = 6$
D. $n = 6$ to $n = 2$
36. A semiconductor in which current is carried by the motion of holes, vacancies in the crystal's electron structure that behave as positive charges is ?
A. n-type
B. p-type
C. z-type
D. An energy band
37. A photon is given off by a light-emitting diode when ?
A. Two electrons collide

- B. A hole is created
 C. A hole is filled
 D. Two holes collide
38. A current in a n-type semiconductor involves the motion of ?
 A. Holes
 B. Positive atomic ions
 C. Negative atomic ions
 D. Electrons
39. Both nuclear fusion and fission reactions give off energy because?
 A. The binding energy per nucleon is most for nuclei of intermediate size
 B. They liberate neutrons
 C. The binding energy per nucleon is least for nuclei of intermediate size
 D. They liberate protons
40. During the decay of a radionuclide, its half-life ?
 A. Decreases
 B. Increases
 C. Does not change
 D. Any listed depending on nuclide
41. Terminal velocity depends on
 A. Mass, size, shape
 B. Mass, area, acceleration
 C. Mass, Normal Force, Air density
 D. Normal force, Air resistance, Shape
42. Ball 1 is dropped from a roof at the same time as Ball 2 is thrown horizontally. Ball 1
 A. Has the greater velocity when hits ground
 B. Has the lesser velocity when hits ground
 C. Reaches the ground first
 D. Reaches the ground last
43. A stone thrown upward has an acceleration that is?
 A. Smaller than that of stone thrown downward
 B. Greater than that of stone thrown downward
 C. Zero until it reaches the highest point in its path
 D. The same as that of stone thrown downward
44. Which Force is not acting on a person standing in an elevator?
 A. Normal force
 B. Weight
 C. Frictional force
 D. Tension
45. In Newton's Third Law of Motion, the action and reaction forces
 A. Act on the same object
 B. Act on different objects
 C. Do not have same magnitude or line of action
 D. Have the same magnitude but not the same line of action
46. 400 grams of salami weighs approximately?
 A. 3.9 N
 B. 0.041 N
 C. 3.9 kN
 D. 400 N
47. When 2 surfaces are in contact, the frictional force between them does NOT depend on?
 A. Normal force pressing one surface against the other
 B. Whether surfaces are relative motion or not
 C. The area of the surfaces in contact
 D. Use of lubricant or not
48. Relative to the force needed to keep a box moving at constant velocity, to start a box moving needs?
 A. Less force
 B. Depends on nature of surfaces in contact
 C. Same force
 D. More force
49. The rest energy of a body is ?
 A. The kinetic and potential energy of the body
 B. The energy it has by virtue of its mass alone
 C. The mass in addition to the kinetic and potential energy of the body
 D. The mass in addition to the potential

energy of the body only

50. When the vector sum of the external forces that act on a system equals zero,
- The total linear momentum is constant
 - The total linear momentum decreases
 - The total linear momentum increases
 - The total linear momentum is based on an open system
51. A rocket explodes in mid-air. How does this affect its total kinetic energy?
- Total kinetic energy is constant
 - Total kinetic energy is same as total momentum
 - Total kinetic energy increases
 - Total kinetic energy decreases
52. An airplane's velocity is doubled. What happens to its kinetic energy?
- Kinetic energy decreases due to increased drag
 - The kinetic energy increases fourfold
 - The kinetic energy doubles
 - Total kinetic energy is unchanged
53. The ratio between the relative velocity of recession after a collision between two bodies and their relative velocity of approach is
- Conservation of energy
 - Ratio of inelasticity
 - Elasticity
 - The coefficient of restitution
54. An elastic collision conserves?
- Both momentum and kinetic energy
 - Neither momentum or kinetic energy
 - Momentum but not kinetic energy
 - Kinetic energy but not momentum
55. An inelastic collision conserves?
- Both momentum and kinetic energy
 - Neither momentum or kinetic energy
 - Momentum but not kinetic energy
 - Kinetic energy but not momentum
56. The rotational analog of mass is a quantity called
- Moment of inertia
 - Torque
 - Rotational momentum
 - Angular velocity
57. A figure skater brings arms in close to the body to increase the spin velocity by ?
- Decreasing angular momentum
 - Decreasing the moment of inertia
 - Decreasing rotational friction
 - Increasing net torque
58. Why do helicopters have two propellers?
- To conserve angular force
 - To conserve potential energy
 - To decrease moment of inertia
 - To conserve angular momentum
59. A quarter of a circle contains?
- $1/4$ pi radians
 - $1/2$ pi radians
 - pi radians
 - 2 pi radians
60. Two disks roll down a ramp. One is solid and the other, identical but hollow. At bottom of ramp, the hollow disk's velocity is
- Less than the solid disk's
 - The same as the solid disk
 - Greater than the solid disk
 - Depends on the angle of the ramp
61. Two identical cylinders go down a ramp. Cylinder A rolls down, cylinder B slides without friction.
- A and B reach bottom together
 - A reaches the bottom first
 - B reaches the bottom first
 - Depends on the angle of the ramp
62. For a body to be in translational equilibrium?
- It moves with constant acceleration
 - The vector sum of forces is positive
 - The vector sum of forces is negative
 - The vector sum of forces is zero
63. Under what circumstances is it necessary to consider torques in analyzing equilibrium?
- When forces that act are concurrent
 - When forces that act are non concurrent
 - When net torque is zero
 - When object is in rotational equilibrium

64. An example of a cantilever is a ?
- Diving board
 - Bridge
 - Roof truss
 - Slide
65. A box of weight w is supported by two ropes. The magnitude of
- The tension in each rope must be $w/2$
 - The tension in each rope must be w
 - The vector sum of the tensions in both ropes must be w
 - The vector sum of the tensions in both ropes must be greater than w
66. The torques that act on an object in equilibrium have a vector sum of zero about
- one point only
 - one or more points
 - all points
 - not more than 2 points
67. The point about which torques are calculated when studying equilibrium of an object
- May be located anywhere
 - Must be located inside of the object
 - Must pass through one end of the object
 - Must pass through the center of gravity of the object
68. The ratio between the output force a machine exerts and the input force applied to it is ?
- Ideal Mechanical Advantage
 - Actual Mechanical Advantage
 - Efficiency
 - Chain hoist
69. The maximum stress that can be applied to a body without causing permanent deformation
- Modulus of elasticity
 - Stress
 - Elastic limit
 - Ultimate strength
70. The ratio between longitudinal stress and strain (how easily it can deform)
- Young's modulus
 - Bulk modulus
 - Shear modulus
 - Elongation
71. The stress on a wire that supports a load does not depend on ?
- The wire's diameter
 - Acceleration of gravity
 - The mass of the load
 - The wire's length
72. A load causes a wire to stretch by amount, s . If the same load is on a second wire but twice as long and twice the diameter, it will stretch by ?
- $s/4$
 - $s/2$
 - s
 - $2s$
73. The amplitude of a simple harmonic oscillator is doubled. How does this affect the period?
- The period is unchanged
 - The period is twice as great
 - The period is one-half as great
 - The period slowly decreases
74. When an object in simple harmonic motion passes through its equilibrium position its velocity is
- Its maximum value
 - Zero
 - Half its maximum value
 - $1/4$ th its maximum value
75. Largely forgotten, this scientist not only discovered protactinium but despite being instrumental in the discovery of nuclear fission, was denied a Nobel Prize given to other collaborators.
- Otto Hahn
 - Marie Curie
 - Manne Siegbahn
 - Lise Meitner

Physics Science Answer Key:

- 1) A
- 2) B
- 3) C
- 4) D
- 5) A
- 6) B
- 7) D
- 8) A
- 9) B
- 10) A
- 11) C
- 12) B
- 13) D
- 14) A
- 15) B
- 16) C
- 17) D
- 18) A
- 19) B
- 20) A
- 21) B
- 22) D
- 23) C
- 24) A
- 25) B
- 26) D
- 27) C
- 28) A
- 29) B
- 30) C
- 31) B
- 32) A
- 33) D
- 34) C
- 35) A
- 36) B
- 37) C
- 38) D
- 39) A
- 40) C
- 41) A
- 42) B
- 43) D
- 44) C
- 45) B
- 46) A
- 47) C
- 48) D
- 49) B
- 50) A
- 51) C
- 52) B
- 53) D
- 54) A
- 55) C
- 56) A
- 57) B
- 58) D
- 59) B
- 60) A
- 61) C
- 62) D
- 63) B
- 64) A
- 65) C
- 66) D
- 67) D
- 68) B
- 69) C
- 70) A
- 71) D
- 72) B
- 73) C
- 74) A
- 75) D