Test: Physics NCE

Question 1 of 75

Newton’s Second law of quantum mechanics is an equation named after what scientist who devised a thought experiment involving a hidden cat that is “both dead and alive”?

- **A)** Niels Bohr
- **B)** Erwin Schroedinger
- **C)** Arnold Sommerfeld
- **D)** Albert Einstein

Question 2 of 75

Halving the distance between two massive objects increases the gravitational force between the objects by what factor?

- **A)** 8
- **B)** 3
- **C)** 2
- **D)** 4

Question 3 of 75

The SI unit of power is named for which scientist, who developed an early steam engine?

- **A)** James Prescott Joule
- **B)** James Watt
- **C)** Thomas Newcomen
- **D)** Isaac Newton

Question 4 of 75

The Heisenberg uncertainty principle states that which two quantities cannot be simultaneously determined?

- **A)** momentum and position
- **B)** energy and angular momentum
- **C)** torque and velocity
- **D)** spin and time

Question 5 of 75

Which of the following is the rotational analogue of force?

- **A)** precession
- **B)** moment of inertia
- **C)** impulse
- **D)** torque

Question 6 of 75

What is the SI unit of frequency?

- **A)** seconds
- **B)** Amperes
- **C)** Joules
- **D)** Hertz

Question 7 of 75

For a particle with mass m and speed v, what quantity is given by mv^2?

- **A)** gravitational potential energy
- **B)** kinetic energy
- **C)** angular momentum
- **D)** linear momentum

Question 8 of 75

Which British scientist showed the wavelike nature of light in his namesake double slit experiment?

- **A)** Henry Cavendish
- **B)** Marie Curie
- **C)** Thomas Young
- **D)** Hans Christian Orsted

Question 9 of 75

Einstein showed that an object's rest energy is given by its rest mass times what constant?

- **A)** Boltzmann's constant, kb
- **B)** the speed of light, c
- **C)** Planck's constant, h
- **D)** the speed of light squared, c^2

Question 10 of 75

What one-dimensional objects name a complicated potential 'theory of everything' combining quantum mechanics and general relativity?

- **A)** strings
- **B)** curves
- **C)** bends
- **D)** lines

Question 11 of 75

What Caltech physicist won the Nobel Prize for his work on QED and developed namesake diagrams which depict photons as wavy lines?

- **A)** Richard Feynman
- **B)** Arthur Eddington
- **C)** Freeman Dyson
- **D)** Paul Dirac

Question 12 of 75

Gravity causes objects to accelerate at approximately how many meters per second squared on Earth?

- **A)** 10 m/s^2
- **B)** 25 m/s^2
- **C)** 15 m/s^2
- **D)** 20 m/s^2

Question 13 of 75

An applied magnetic field caused electrons to be split into two groups based on what quantum mechanical property in the Stern-Gerlach experiment?

- **A)** dipole moment
- **B)** charge
- **C)** spin
- **D)** velocity

Question 14 of 75

Chaos is exhibited by a doubled example of what device which Leon Foucault used to demonstrate the rotation of the Earth?

- **A)** wedge
- **B)** pulley
- **C)** pendulum
- **D)** screw

Question 15 of 75

Stress is measured in what unit, the SI unit of pressure?

- **A)** Webers
- **B)** Eotvos
- **C)** Pascals
- **D)** Newtons

Question 16 of 75

Newton’s cradle demonstrates the conservation of what quantity?

- **A)** linear momentum
- **B)** torque
- **C)** angular momentum
- **D)** force

Question 17 of 75

The Tsiolkovsky equation describes the motion of what kind of vehicle in terms of the exhaust velocity and mass of the fuel?

- **A)** rockets
- **B)** automobiles
- **C)** trains
- **D)** hot air balloons

Question 18 of 75

A difference in what intrinsic quantity between gold and silver led to Archimedes formulating his namesake buoyancy principle?

- **A)** volume
- **B)** mass
- **C)** specific heat
- **D)** density

Question 19 of 75

What Italian physicist used zinc and sulfuric acid to develop the first battery and names the SI unit of electrostatic potential?

- **A)** Alessandro Volta
- **B)** Luigi Galvani
- **C)** Enrico Fermi
- **D)** Nikola Tesla

Question 20 of 75

Dielectrics can be used to strengthen what circuit elements which typically use a set of parallel plates to store charge?

- **A)** rectifiers
- **B)** transformers
- **C)** capacitors
- **D)** resistors

Question 21 of 75

In Newtonian fluids, the strain rate is linearly proportional to stresses due to what quantity, a fluid's resistance to flow?

- **A)** vorticity
- **B)** viscosity
- **C)** shear
- **D)** drag

Question 22 of 75

Which of the following constants is equal to around about 6.6×10^{-34} Joule-seconds and serves as the constant of proportionality between a photon's energy and frequency?

- **A)** Boltzmann's constant
- **B)** Permittivity of free space
- **C)** Wien's constant
- **D)** Planck's constant

Question 23 of 75

The equation of state PV=nRT describes what model substances?

- **A)** ideal gases
- **B)** plasmas
- **C)** incompressible fluids
- **D)** superfluids

Question 24 of 75

Snell's Law governs which optical effect?

- **A)** dispersion
- **B)** reflection
- **C)** refraction
- **D)** diffraction

Question 25 of 75

According to Ohm's law, the voltage across a resistor is given by what quantity times resistance?

- **A)** charge
- **B)** inductance
- **C)** power
- **D)** current

Question 26 of 75

If a planet at radius R takes T hours to orbit the sun, how long would a planet at 4R take to orbit?

- **A)** T
- **B)** 8T
- **C)** T/2
- **D)** 16T

Question 27 of 75

What scientist coined the term 'radioactivity' and became the first and only woman to win the Nobel Prize twice?

- **A)** Chien-Shiung Wu
- **B)** Marie Curie
- **C)** Maria Goeppert Mayer
- **D)** Lise Meitner

Question 28 of 75

What is the value of absolute zero in Celsius?

- **A)** -195.79
- **B)** 0
- **C)** -273.15
- **D)** -459.67

Question 29 of 75

Up, down, strange, charm, top, and bottom are the six flavors of what class of elementary particles which make up baryons like protons and neutrons?

- **A)** mesons
- **B)** leptons
- **C)** electrons
- **D)** quarks

Question 30 of 75

Which of the following is not one of the modes of heat transfer?

- **A)** conduction
- **B)** radiation
- **C)** convection
- **D)** saltation

Question 31 of 75

The heat of a process at a given pressure equals the change in what thermodynamic potential symbolized H?

- **A)** entropy
- **B)** Helmholtz free energy
- **C)** enthalpy
- **D)** Gibbs free energy

Question 32 of 75

What quantity is defined as the derivative of velocity with respect to time?

- **A)** jerk
- **B)** force
- **C)** position
- **D)** acceleration

Question 33 of 75

According to Gauss' law of magnetism, the magnetic flux through any closed surface equals what value implying that magnetic monopoles do not exist?

- **A)** -0.083333333
- **B)** zero
- **C)** infinity
- **D)** one

Question 34 of 75

Interior magnetic fields are expelled due to the Meissner effect in what zero resistance materials described by BCS theory?

- **A)** superfluids
- **B)** Mott insulators
- **C)** superconductors
- **D)** topological insulators

Question 35 of 75

Which of these quantities are conserved during an inelastic collision?

- **A)** linear momentum
- **B)** none of the above
- **C)** kinetic energy
- **D)** all of the above

Question 36 of 75

What physicist explained the photoelectric effect and developed a set of 10 namesake field equations describing the general theory of relativity?

- **A)** Niels Bohr
- **B)** Albert Einstein
- **C)** Karl Schwarzschild
- **D)** Max Planck

Question 37 of 75

Energy is stored in magnetic fields by what circuit devices which exhibit simple harmonic oscillation when placed in series with a capacitor?

- **A)** batteries
- **B)** transistors
- **C)** inductors
- **D)** resistors

Question 38 of 75

What circuit device is symbolized by a set of uneven parallel lines?

- **A)** diode
- **B)** switch
- **C)** transformer
- **D)** battery

Question 39 of 75

Gluons mediate which fundamental force that is also described by quantum chromodynamics?

- **A)** electromagnetic force
- **B)** weak nuclear force
- **C)** gravitational force
- **D)** strong nuclear force

Question 40 of 75

Elastic materials obey what law, whose generalized form states that stress is linearly proportional to strain?

- **A)** Newton's third law
- **B)** Beer-Lambert law
- **C)** Hooke's law
- **D)** Bragg's law

Question 41 of 75

What physicist detected scattering of alpha particles off of gold foil, proving the existence of the atomic nucleus?

- **A)** Ernest Rutherford
- **B)** Arthur Holly Compton
- **C)** J. J. Thompson
- **D)** Otto Hahn

Question 42 of 75

Peter Higgs names a scalar example of what class of particles which have integer spin?

- **A)** fermions
- **B)** bosons
- **C)** neutrinos
- **D)** leptons

Question 43 of 75

In particle physics, photons are represented by what letter, which names a class of high energy electromagnetic radiation?

- **A)** beta
- **B)** alpha
- **C)** delta
- **D)** gamma

Question 44 of 75

By what factor does the period of a pendulum increase when the mass of the bob is doubled?

- **A)** the period does not change
- **B)** the period doubles
- **C)** the period is quadrupled
- **D)** the period is halved

Question 45 of 75

Kinetic friction is equal to the coefficient of friction multiplied by what quantity according to Amonton's first law?

- **A)** area of contact
- **B)** normal force
- **C)** sliding velocity
- **D)** relative roughness

Question 46 of 75

The Davisson-Germer experiment illustrated the paradoxical wavelike nature of what particles, thus confirming the de Broglie hypothesis?

- **A)** protons
- **B)** photons
- **C)** neutrinos
- **D)** electrons

Question 47 of 75

Ideal springs and pendulums exhibit what kind of motion?

- **A)** anharmonic oscillation
- **B)** simple harmonic oscillation
- **C)** coupled oscillation
- **D)** damped driven oscillation

Question 48 of 75

Which quantity undergoes dilation in reference frames with velocities approaching the speed of light?

- **A)** time
- **B)** mass
- **C)** temperature
- **D)** length

Question 49 of 75

Kirchoff's loop rule states that the sum of what quantity around any closed circuit equals zero?

- **A)** voltage
- **B)** resistance
- **C)** inductance
- **D)** current

Question 50 of 75

Which fictitious force causes deflections from straight trajectories in rotating reference frames?

- **A)** d'Alembert force
- **B)** centripetal force
- **C)** Euler force
- **D)** Coriolis force

Question 51 of 75

The angular momentum is defined by what operation on the distance from the axis and the applied force?

- **A)** vector sum
- **B)** dot product
- **C)** cross product
- **D)** outer product

Question 52 of 75

The moment of inertia of a solid sphere of mass M and radius R is given by which term?

- **A)** $2/3\ MR^2$
- **B)** $2/5\ MR^2$
- **C)** MR^2
- **D)** $1/2\ MR^2$

Question 53 of 75

The electric field outside a uniformly charged cylinder is directly proportional to what power of the distance from the axis?

- **A)** 2
- **B)** -1
- **C)** 0
- **D)** -2

Question 54 of 75

What French physicist names a law stating that the integral of the magnetic field around a closed loop equals the product of the permeability of free space and the enclosed current?

- **A)** Charles-Augustin de Coulomb
- **B)** Jean-Baptiste Biot
- **C)** Andre-Marie Ampere
- **D)** Blaise Pascal

Question 55 of 75

The theoretically most efficient heat engine consists of alternating isothermal and adiabatic steps and is named after what physicist?

- **A)** Otto Diesel
- **B)** Sadi Carnot
- **C)** Robert Stirling
- **D)** Nicolaus Otto

Question 56 of 75

For a thin lens, what quantity is equal to the harmonic mean of the distance to the object and the distance to the image according to the Lensmaker's equation?

- **A)** the height of the object
- **B)** the index of refraction
- **C)** the height of the image
- **D)** focal length

Question 57 of 75

Johannes Rydberg developed an empirical formula describing the energy levels of what model system from quantum mechanics?

- **A)** hydrogen atom
- **B)** infinite square well
- **C)** triangle well
- **D)** quantum harmonic oscillator

Question 58 of 75

An Atwood machine consists of two hanging masses and what simple machine?

- **A)** lever
- **B)** pulley
- **C)** wedge
- **D)** wheel and axle

Question 59 of 75

Atoms with odd numbers of electrons typically exhibit what form of magnetism meaning they align to the applied magnetic field?

- **A)** antiferromagnetism
- **B)** ferromagnetism
- **C)** paramagnetism
- **D)** diamagnetism

Question 60 of 75

Solutions to what nonlinear system of differential equations governing fluid mechanics is the subject of a Millennium Prize problem in mathematics?

- **A)** Stefan-Boltzmann equation
- **B)** Navier-Stokes equations
- **C)** Kelvin-Helmholtz equations
- **D)** Euler-Lagrange equations

Question 61 of 75

What quantity is defined as the sum of kinetic and potential energies and is used for its namesake ‘mechanics’?

- **A)** Liouvillian
- **B)** Hamiltonian
- **C)** Jacobian
- **D)** Lagrangian

Question 62 of 75

Which of the following forces is nonconservative?

- **A)** friction
- **B)** gravitational force
- **C)** electrostatic force
- **D)** spring force

Question 63 of 75

An interferometer named for what physicist includes a beamsplitter with mirrors at the ends?

- **A)** George Gamow
- **B)** Isidor Isaac Rabi
- **C)** Albert Michelson
- **D)** Otto Frisch

Question 64 of 75

Planck’s law, the Sakuma-Hattori equation and the Stefan-Boltzmann law describes what model from statistical mechanics?

- **A)** graybodies
- **B)** ideal gases
- **C)** ideal crystals
- **D)** blackbodies

Question 65 of 75

The del squared operator is named for what man?

- **A)** George Stokes
- **B)** Pierre-Simon Laplace
- **C)** Joseph-Louis Lagrange
- **D)** Jean le Rond d'Alembert

Question 66 of 75

A ‘disk’ named after what scientist describes the most focused spot of light that a perfect lens can make?

- **A)** George Biddell Airy
- **B)** Jacques Babinet
- **C)** Dominique-Francois-Jean Arago
- **D)** Simon Poisson

Question 67 of 75

The Saha and Vlasov equations are equations describing what class of substances modeled by magnetohydrodynamics?

- **A)** superfluids
- **B)** ferrofluids
- **C)** liquid crystals
- **D)** plasmas

Question 68 of 75

Vibrations in the Debye model of solids are quantized in terms of what quasiparticles?

- **A)** photons
- **B)** phonons
- **C)** holons
- **D)** rotons

Question 69 of 75

The square of what quantity describing the quantum state of a system gives the probability distribution of a particle's position?

- **A)** Hamiltonian
- **B)** wavefunction
- **C)** density matrix
- **D)** energy

Question 70 of 75

What quantity equal to internal energy minus temperature times entropy is also equal to Boltzmann's constant times temperature times the natural log of the partition function?

- **A)** Internal Energy
- **B)** Gibbs free energy
- **C)** Helmholtz free energy
- **D)** Work

Question 71 of 75

John Bardeen won the Nobel prize in physics for the development of the 'point contact' form of what class of devices which also come in 'bipolar junction' and 'field effect' types?

- **A)** transformers
- **B)** amplifiers
- **C)** transistors
- **D)** diodes

Question 72 of 75

The Reynolds number is defined as what quantity times a characteristic length over the kinematic viscosity?

- **A)** kinetic energy
- **B)** density
- **C)** fluid velocity
- **D)** vorticity

Question 73 of 75

According to Faraday's law of induction, the curl of the electric field equals the negative of the time derivative of what quantity?

- **A)** magnetic flux
- **B)** magnetic field
- **C)** current
- **D)** polarization

Question 74 of 75

What physicist names ‘boosts’ used to shift between reference frames and a ‘factor’ used in many calculations in special relativity?

- **A)** Llewellyn Thomas
- **B)** Hendrik Lorentz
- **C)** Galileo Galilei
- **D)** Henri Poincar

Question 75 of 75

Semiconductors possess relatively small ‘gaps’ named for what continuous ranges of energy levels which come in valence and conduction types?

- **A)** stripes
- **B)** belts
- **C)** bands
- **D)** spectra