PHYSICS

1. PHYSICS

Toss Up: Multiple Choice

A light ray passes through a prism , causing a dispersion of light. Which color will have the greatest angle of deviation?

W) Red

X) Yellow

Y) Green

Z) Blue

Toss Up Answer: Z

Bonus: Short Answer

Put the following electromagnetic waves in order of increasing wavelength: Microwaves, Ultraviolet, Gamma Rays, Radio Waves, Visible Light, Infrared, X-rays.

Bonus Answer: Gamma Rays, X-rays, Ultraviolet, Visible Light, Infrared, Microwaves, Radio Waves

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2. PHYSICS

Toss Up: Short Answer

A step-down transformer has a turns ratio less than

Bonus Answer: One

Bonus: Multiple Choice

By design, wires with the highest resistance are built into

W) Clocks

X) Toasters

Y) Telephones

Z) Stereo Speakers

Bonus Answer: X

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3. PHYSICS

Toss Up: Multiple Choice

The circuit breaker in a typical household light circuit is rated for how many amps?

W) 2

X) 20

Y) 200

Z) 2000

Toss Up Answer: X

Bonus: Short Answer

Most power lines carry high voltages. Before the electricity is fed into your home, it must be put through what device that lowers the voltage to 110 volts?

Bonus Answer: Transformer

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4. PHYSICS

Toss Up: Multiple Choice

Who did not have a unit of electrical measurement named after him?

W) Voltaire

X) Georg Ohm

Y) Andre Ampere

Z) Charles Coulomb

Toss Up Answer: W

Bonus: Short Answer

It converts electrical energy into electromagnetic radiation and vice versa. Name this device designed to transmit and receive radio waves.

Bonus Answer: Antenna

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5. PHYSICS

Toss Up: Short Answer

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

Bonus Answer: inertia

Bonus: Multiple Choice

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

W) speed

X) velocity

Y) acceleration

Z) W,X

Bonus Answer: Z

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6. PHYSICS

Toss Up: Short Answer

The speedometer in your car tells you what

Bonus Answer: instantaneous speed

Bonus: Short Answer

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, what is true about range and height of both objects?

Bonus Answer: A' will reach a smaller height and have a greater range than 'B'.

==========

7. PHYSICS

Toss Up: Multiple Choice

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

W) is constant until the projectile hits the ground.

X) always decreases with time until the projectile hits the ground.

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

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

Toss Up Answer: W

Bonus: Multiple Choice

n 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?

W) 1%

X) 1%

Y) 10%

Z) 0.30%

Bonus Answer: Z

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8. PHYSICS

Toss Up: Multiple Choice

How long is a meter stick?

W) 36 inches

X) 100 mm

Y) 10 cm

Z) 1 m

Toss Up Answer: Z

Bonus: Multiple Choice

Which combination of the following statements is wrong? I. A body can have a constant speed but a varying velocity. II. A body can have a constant velocity but a varying speed. III. A body can have a zero velocity and finite acceleration.

W) I

X) II

Y) III

Z) NONE

Bonus Answer: Z

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9. PHYSICS

Toss Up: Multiple Choice

The graphs of the two equations y = a x 2 + b x + c and y = A x 2 + B x + C, such that a and A have different signs and that the quantities b 2 - 4 a c and B 2 - 4 A C are both negative,

W) 1 intersections

X) 2 intersections

Y) None

Z) I do not know

Toss Up Answer: Z

Bonus: Multiple Choice

For x greater than or equal to zero and less than or equal to 2 pi, sin x and cos x are both decreasing on the intervals

W) (0 , pi/2)

X) (pi/2 , pi)

Y) (pi , 3 pi / 2)

Z) (3 pi / 2 , 2 pi)

Bonus Answer: X

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10. PHYSICS

Toss Up: Multiple Choice

Radiocarbon is produced in the atmosphere as a result of?

W) collision between fast neutrons and nitrogen nuclei present in the atmosphere

X) action of ultraviolet light from the sun on atmospheric oxygen
Y) action of solar radiations particularly cosmic rays on carbon dioxide present in the atmosphere
Z) lightning discharge in atmosphere

Toss Up Answer: W

Bonus: Multiple Choice

Nuclear sizes are expressed in a unit named
W) Fermi
X) angstrom
Y) newton
Z) Tesla

Bonus Answer: W

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11. PHYSICS

Toss Up: Short Answer

For the hydrogen atom, which series describes electron transitions to the N=1 orbit, the lowest energy electron orbit?

Bonus Answer: Lyman series

Bonus: Short Answer

Electric current may be expressed in which one of the following units?

Bonus Answer: coulombs/second

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12. PHYSICS

Toss Up: Short Answer

In the SI system of measure, what is the unit of capacitance?

Bonus Answer: FARAD

Bonus: Short Answer

How much work in joules is done by friction on a sled weighing 100 newtons during a 10 meter displacement? The coefficient of sliding friction is 0.1.

Bonus Answer: 100

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13. PHYSICS

Toss Up: Short Answer

An electric vehicle has two stages. If the first stage, the battery, has an efficiency of 90% and the second stage, the inverter, has an efficiency of 80%, calculate the approximate overall efficiency of the vehicle.

Bonus Answer: 72%

Bonus: Multiple Choice

Which of the following is congruent to (n + 1) modulus n?
W) 0
X) 1
Y) n-1
Z) n-2

Bonus Answer: W

==========

14. PHYSICS

Toss Up: Multiple Choice

Aaron, whose mass is 45 kilograms, is riding his 5.0 kilogram skateboard down the sidewalk with a constant speed of 6.0 meters per second when he rolls
across a 10.0 meter long patch of sand on the pavement. The sand provides force of friction of 6.0 newtons. What is Aaron's speed in meters per second as he emerges from the sand?

W) 0
X) 1.8
Y) 3.8
Z) 5.8

Toss Up Answer: Z

Bonus: Short Answer

Which of the following does NOT contain a scalar quantity? Force, energy, or acceleration?

Bonus Answer: Acceleration

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15. PHYSICS

Toss Up: Short Answer

In a totally inelastic collision, what happens to the two colliding
objects?

Bonus Answer: They STICK together!

Bonus: Short Answer

r For a uniformly rotating object, what do we call the rate of change
in the angle through which the object turns in one second?

Bonus Answer: ANGULAR VELOCITY

==========

16. PHYSICS

Toss Up: Multiple Choice

A Newton is equal to which of the following?

W) w) kilogram-meter per second
X) x) meter per second squared
Y) y) kilogram-meter per second squared
Z) z) kilogram per meter-second

Toss Up Answer: Y

Bonus: Short Answer

Work is what type of quantity?

Bonus Answer: Scalar quantity.

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17. PHYSICS

Toss Up: Short Answer

What is the German term for the energy released when high voltage electrons decelerate at impact with a metal and is also known as "breaking radiation"?

Bonus Answer: Bremsstrahlung

Bonus: Short Answer

Given that Planck's constant is 4*10^(-15) eV*s (READ AS: 4 times 10 to the power of negative 15 electron volt second), what is the maximum kinetic energy, in electron volts, of an electron released from a metal with work function of 1 eV when a photon of frequency of 300 terahertz strikes the metal's surface?

Bonus Answer: 0.2 electron volts

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18. PHYSICS

Toss Up: Multiple Choice

Two trucks are 50 kilometers apart and traveling toward each other. One automobile is moving at 60km/h and the other is moving at 40km/h mph. How long will it take for them meet?

W) 15 minutes
X) 20 minutes
Y) 24 minutes
Z) 30 minutes

Toss Up Answer: Z

Bonus: Short Answer

The position of a particle in meters is given by x(t) = 25t − 3t^3 (READ AS: 16 times t minus 3 times t cubed) , where the time t is in seconds. The particle is momentarily at rest at what time t rounded to the nearest hundredth?

Bonus Answer: 1.67 seconds, accept 1.67

==========

19. PHYSICS

Toss Up: Multiple Choice

If on a certain planet, acceleration due to gravity is -5 m/s^2, how long will a ball be in the air if thrown directly upward from the ground with a velocity of 10 m/s?

W) 2 seconds
X) 4 seconds
Y) 8 seconds
Z) 16 seconds

Toss Up Answer: X

Bonus: Multiple Choice

If Jim walks 10 meters north, then 5 meters southeast, then 5 meters northwest, then 5 meters south, what is his displacement?

W) 25 meters north
X) 15 meters north
Y) 5 meters north
Z) 5 meters south

Bonus Answer: Y

==========

20. PHYSICS

Toss Up: Multiple Choice

If an object is located at the focal point of a concave mirror, what type of image will form?

W) real, inverted
X) virtual, inverted
Y) real, upright
Z) Image will not exist

Toss Up Answer: Z

Bonus: Short Answer

Cone cells in the retina allow a human being to perceive color. What are the photoreceptor proteins found in cone cells called?

Bonus Answer: Photopsin

==========

21. PHYSICS

Toss Up: Multiple Choice

Which has the same units as joules?

W) Newton / meter

X) Pascal * meter^2

Y) Coulomb * volt

Z) Kilogram * meter / second^2

Toss Up Answer: Y

Bonus: Short Answer

What is the derived unit for Newton / meter^2?

Bonus Answer: Pascal

==========

22. PHYSICS

Toss Up: Short Answer

What is the third derivative of displacement with respect to time

Bonus Answer: Jerk

Bonus: Short Answer

What is the fourth derivative of displacement with respect to time

Bonus Answer: jounce

==========

23. PHYSICS

Toss Up: Multiple Choice

What is the Zeroth Law of Thermodynamics?

W) Energy cannot be created or destroyed in an isolated system.

X) Absolute Zero is the lowest temperature that is theoretically possible.

Y) If two systems are at the same time in thermal equilibrium with a third system, they are in thermal equilibrium with each other.

Z) The entropy of any isolated system always increases.

Toss Up Answer: Y

Bonus: Short Answer

If the actual vapor density is 5.8 g/m^3 and the saturation vapor density is 10 g/m^3, then what is the relative humidity?

Bonus Answer: 58%

==========

24. PHYSICS

Toss Up: Short Answer

A 12-N horizontal force is applied to a 40-N box resting on a rough horizontal floor. If the static coefficient of friction is 0.5 and the kinetic coefficient of friction is 0.4, the magnitude of the frictional force on the box is:

Bonus Answer: 12

Bonus: Multiple Choice

What is the coefficient of static friction between the ground and the object if it object is moving in a horizontal circle

with a speed of 20 m/s around a radius of 50 m? Assume that g = 10 m/s^2 (READ AS: meters per second squared)?
W) 0.3
X) 0.5
Y) 0.8
Z) 0.9

Bonus Answer: Y

==========

25. PHYSICS

Toss Up: Multiple Choice

A 2-kg object is moving to the right at 3m/s. A 4-N force is applied to the left of the object and then removed after the object has traveled an additional 5m. The work done by this force is:
W) 20 joules
X) 15 joules
Y) 13 joules
Z) -20 joules

Toss Up Answer: Z

Bonus: Short Answer

A 20kg dog initially runs at 10 m/s. What is the dog's final speed if 3000 joules of work is done on it?

Bonus Answer: 20

==========

26. PHYSICS

Toss Up: Multiple Choice

Block A, with a mass of 4 kg, is moving with a speed of 3.0m/s while block B, with a mass of 8 kg, is moving in the opposite direction with a speed of 3.0m/s. The center of mass of the two block-system is moving with a velocity of:
W) 1.0 m/s in the same direction as B
X) 1.3 m/s in the same direction as A
Y) 4.0 m/s in the same direction as B
Z) 6.0 m/s in the same direction as A

Toss Up Answer: W

Bonus: Multiple Choice

A 60kg hunter gets a rope around a 300kg polar bear. They are stationary, 12m apart, on frictionless level ice. When the hunter pulls the polar bear to him, the polar bear will move:
W) 0.5 m
X) 2 m
Y) 4 m
Z) 7m

Bonus Answer: X

==========

27. PHYSICS

Toss Up: Multiple Choice

What is the normal force on an object that is accelerating at 2 m/s^2 upwards if the object is 10 kg? (Use 10 m/s^2 for gravity and neglect other forces)
W) 80
X) 100
Y) 120

Z) 20

Toss Up Answer: Y

Bonus: Short Answer

If a projectile is launched 30 degrees above the horizontal at a velocity of 40 m/s, how long does it take for it to reach the ground? (Use 10 m/s^2 for gravity and neglect other forces)

Bonus Answer: 4 seconds

==========

28. PHYSICS

Toss Up: Multiple Choice

A hose has a diameter of 2 inches and its nozzle is 0.2 inches in radius. If water flows at 4 m/s in the hose, then how fast will it leave the nozzle?

W) 4 m/s

X) 1 m/s

Y) 100 m/s

Z) 200 m/s

Toss Up Answer: Y

Bonus: Short Answer

To measure moderately low pressures, oil with a density of 8.5 × 10^2 kg/m^3 (READ AS: 8.5 times 10 to the -2 kilogram per cubic meter) is used in place of mercury in a barometer. If the height of the oil column changes by 1.0mm, find the change in the pressure, assuming g = 10 m/s.

Bonus Answer: 8.5 Pa

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29. PHYSICS

Toss Up: Short Answer

If an object attached to one end of a spring makes 20 complete oscillations in 2*PI s, what is its angular frequency?

Bonus Answer: 20 rad/s

Bonus: Multiple Choice

A 1-kg object attached to a spring whose spring constant is 400N/m executes simple harmonic motion. If its maximum speed is 5.0m/s, find the amplitude of its oscillation.

W) 0.1

X) 0.25 m

Y) 0.45

Z) 0.75

Bonus Answer: X

==========

30. PHYSICS

Toss Up: Multiple Choice

A wave's equation is given as y = 0.1 sin(3x+10t) (READ AS: y equals 0.1 times sine of open parentheses 3x plus 10t close parentheses). What is the angular wave number?

W) 0.3

X) 1

Y) 10

Z) 3

Toss Up Answer: Z

Bonus: Short Answer

An EM wave has a magnetic field with an amplitude of 200 Teslas. What is the amplitude of the wave's electric field in N/c (READ AS: newtons per coulomb)?

Bonus Answer: 6 * 10^10 N/c

==========

31. PHYSICS

Toss Up: Multiple Choice

The sound intensity 3.0m from a point source is 22 W/m^2 (READ AS: 25 watts per meter squared). The power output of the source is:

W) 53

X) 396π

Y) 168

Z) 300π

Toss Up Answer: X

Bonus: Short Answer

A string has length L and mass M. If its fundamental frequency is f, find its tension in terms of L, M and f.

Bonus Answer: 4LMf^2 (READ AS: 4 times L times M times f squared)

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32. PHYSICS

Toss Up: Short Answer

The coefficient of linear expansion of a certain steel is 0.000034 per C◦ (READ AS: celsius degree). What is the exact coefficient of volume expansion, in (C◦) ^ (−1) (READ AS: celsius degree to the negative 1)?

Bonus Answer: 0.000102 (DO NOT ACCEPT APPROXIMATIONS)

Bonus: Multiple Choice

The energy given off as heat by 300 g of an alloy as it cools through 50C◦(READ AS: 50 celsius degree) raises the temperature of 300 g of water from 30◦C (READ AS: 30 degrees celsius) to 40◦ C. The specific heat of the alloy (in cal/g · C◦) is:

W) 0.0015

X) 0.1

Y) 0.2

Z) 1

Bonus Answer: Y

==========

33. PHYSICS

Toss Up: Short Answer

An educated guess or explanation for an observation or experimental result. Not yet fully accepted as fact is what?

Bonus Answer: Hypothesis

Bonus: Short Answer

A systematic methodology for gathering, organizing and applying knowledge is?

Bonus Answer: A scientific method

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34. PHYSICS

Toss Up: Short Answer

What is energy measured in?

Bonus Answer: Joules

Bonus: Short Answer

What is the unit of charge?

Bonus Answer: Columbus

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35. PHYSICS

Toss Up: Multiple Choice

An electron is placed in a horizontally hollow cylindrical solenoid with the current moving clockwise around the solenoid. The electron is released from rest in the middle of the solenoid. What direction will the electron move in?

W) To the left

X) To the right

Y) Stays in the same place

Z) Oscillates between both ends

Toss Up Answer: X

Bonus: Multiple Choice

There are two charges, one with charge +2Q and one with charge -4Q a distance of 2 meters from each other. Assuming the universal charge constant is 1.6*10^-19, which of the following is the force of attraction felt by the two charges, rounded to one decimal place

W) 4.8*10^-19 C

X) 9.6*10^-19 C

Y) 2.4*10^-19 C

Z) 3.2*10^-19 C

Bonus Answer: Z

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36. PHYSICS

Toss Up: Multiple Choice

What type of radiation is both the most penetrating and the most effectively stopped if blocked by a hydrogen-rich material?

W) Alpha

X) Beta

Y) Gamma

Z) Neutron

Toss Up Answer: Z

Bonus: Multiple Choice

What type of radiation originates from the electron cloud?

W) Alpha

X) Beta

Y) X-Ray

Z) Gamma

Bonus Answer: Y

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37. PHYSICS

Toss Up: Short Answer

What law most directly states that the total of the electric flux out of a closed surface is equal to the charge enclosed divided by the permittivity?

Bonus Answer: Gauss's Law

Bonus: Short Answer

When a magnet is moved into a coil of wire, changing the magnetic field and magnetic flux through the coil, a voltage will be generated in the coil according to which law?

Bonus Answer: Faraday's Law

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38. PHYSICS

Toss Up: Multiple Choice

Who first suggested that radiant energy could exist only in discrete quanta which were proportional to the frequency in order to explain the frequency distribution of blackbody radiation?

W) Isaac Newton

X) Max Planck

Y) Ernest Rutherford

Z) Paul Dirac

Toss Up Answer: X

Bonus: Short Answer

Later solved by Planck's quantum radiation formula, what asymptotic result of the classical Rayleigh-Jeans Law was the most troubling?

Bonus Answer: Ultraviolet Catastrophe

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39. PHYSICS

Toss Up: Multiple Choice

What is the relativistic mass of a particle with a rest mass of 8g traveling at a speed of .6c?

W) 4g

X) 8g

Y) 10g

Z) 12g

Toss Up Answer: Y

Bonus: Multiple Choice

What is the length of a 1 meter rod traveling on a spaceship going at .8c, as measured by an astronaut on the ship?

W) .8m

X) .6m

Y) 1m

Z) 1.25m

Bonus Answer: Y

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40. PHYSICS

Toss Up: Short Answer

If the sound intensity is 10,000 times the threshold of hearing then what is the intensity in decibels?

Bonus Answer: 40dB

Bonus: Short Answer

At what standard frequency would 60 decibels have a loudness of 60 phons?

Bonus Answer: 1000Hz

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41. PHYSICS

Toss Up: Multiple Choice

What is the S.I. unit for luminous intensity?

W) Lumen

X) Candela

Y) Newton

Z) Watts

Toss Up Answer: X

Bonus: Multiple Choice

For an isotropic source how many candelas equals 3 lumens?

W) 12π

X) 10π

Y) 4π

Z) 2π

Bonus Answer: W

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42. PHYSICS

Toss Up: Short Answer

A military cannon fires a boy into the air at an angle of 45° above the horizontal, reaching a max height y above his original launch height. The cannon is now aimed so that it fires straight up into the air at an angle of 90° to the horizontal. What is the maximum height reached by the same boy now? (let y represent height)

Bonus Answer: 2y

Bonus: Short Answer

a

Bonus Answer: a

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43. PHYSICS

Toss Up: Short Answer

If a rocket has a specific impulse of 800 seconds, what is its exhaust velocity, in m/s? Assume standard gravity to be 10 m/s^2.

Bonus Answer: Answer: 8000 m/s (also acceptable: 8 km/s). Exhaust velocity is the product of specific impulse as a unit of time and standard gravity.

Bonus: Short Answer

If an engine has a specific impulse of 500 seconds and a thrust of 10 kN, how long will it take the engine to burn 50 kg of fuel? Assume standard gravity to be 10 m/s^2.

Bonus Answer: Answer: 25 seconds.

Since Fthrust = Gstandard×Isp×R, where

Fthrust = instantaneous thrust of the engine (in newtons)

Gstandard = standard gravity (usually 9.81 m/s^2, but for simplicity we round to 10)

Isp = specific impulse of the engine in seconds

R = mass flow rate in kg/s

10000 = 10×500×R, so R = 2 kg/s

50kg/2kg/s = 25s

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44. PHYSICS

Toss Up: Short Answer

A car accelerates from rest at 4 (m/s)^2. What is the distance traveled by the car in 3 seconds?

Bonus Answer: 18 meters (m)

Bonus: Multiple Choice

A motor scooter travels east at a speed of 13 m/s. The driver then reverses direction and heads west at 17 m/s. What was the change in velocity of the scooter?

W) 13 m/s

X) 17 m/s

Y) 30 m/s

Z) 4 m/s

Bonus Answer: Y

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45. PHYSICS

Toss Up: Short Answer

A car with a mass of one ton collides with a truck with a mass of ten tons. Which applies the greatest force on the other, in Newtons?

Bonus Answer: They both apply an equal force.

Bonus: Short Answer

Which experiences greater acceleration in the collision from a car with a mass of one ton colliding with a truck with a mass of ten tons, and by how many times greater.

Bonus Answer: The car, it will accelerate ten times as much.

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46. PHYSICS

Toss Up: Short Answer

If the acceleration is always perpendicular to an object's velocity, what can be deduced about the object's motion?

Bonus Answer: It is circular motion.

Bonus: Short Answer

If the acceleration of an object is opposite its velocity, what can be said about the object's velocity over time? Assume that the direction of the velocity is positive.

Bonus Answer: It is decreasing.

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47. PHYSICS

Toss Up: Multiple Choice

The work done by a friction force is

W) always -

X) always 0

Y) either positive or negative depending upon the situation.

Z) always +

Toss Up Answer: W

Bonus: Multiple Choice

: As defined in physics, work is:

W) scalar quantity

X) always a positive quantity

Y) a vector quantity
Z) always 0

Bonus Answer: W

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48. PHYSICS

Toss Up: 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 accelerating to the right.
Z) Huh?

Toss Up Answer: X

Bonus: 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
X) 5
Y) 9
Z) 7

Bonus Answer: X

==========

49. PHYSICS

Toss Up: 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

Toss Up Answer: Z

Bonus: 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
Z)) kilogram per meter-second

Bonus Answer: Y

==========

50. PHYSICS

Toss Up: 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?

Bonus Answer: 1.8 meters

Bonus: 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?

Bonus Answer: 1.22 seconds

==========

51. PHYSICS

Toss Up: 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?

Bonus Answer: 2 meters per second^2

Bonus: 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?

Bonus Answer: 4000 J (joules)

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52. PHYSICS

Toss Up: 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?

Bonus Answer: 30 N (newton) seconds

Bonus: 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?

Bonus Answer: 4 meters per seconds

==========

53. PHYSICS

Toss Up: 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?

Bonus Answer: 6 meters/second up

Bonus: 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 0
Z) Constant!

Bonus Answer: Z

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54. PHYSICS

Toss Up: Multiple Choice

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?

W) 1 meter
X) 60 meters
Y) 6 meters
Z) 16 meters

Toss Up Answer: Y

Bonus: 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

Bonus Answer: X

==========

55. PHYSICS

Toss Up: 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 original force
X) 1/3 original force
Y) 1/9 original force
Z) unchanged

Toss Up Answer: Y

Bonus: Multiple Choice

In physics, a radian per second is a unit of:

W) angular displacement
X) angular velocity
Y) angular acceleration
Z) angular momentum

Bonus Answer: X

==========

56. PHYSICS

Toss Up: 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?

Bonus Answer: 2000 joules / 1960 joules (accept either)

Bonus: Short Answer

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

Bonus Answer: 4 Watts

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57. PHYSICS

Toss Up: Short Answer

What is the name of the first American physicist to win two Nobel prizes? (very random lol)

Bonus Answer: John Bardeen (can accept just last name?)

Bonus: Multiple Choice

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

W) constant
X) 0
Y) increasing
Z) decreasing

Bonus Answer: W

==========

58. PHYSICS

Toss Up: Short Answer

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

Bonus Answer: 200 Watts

Bonus: 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

Bonus Answer: Z

==========

59. PHYSICS

Toss Up: Multiple Choice

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

W) 150 watts
X) 200 watts
Y) 250 watts
Z) 2000 watts

Toss Up Answer: X

Bonus: 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?

Bonus Answer: 1000 J (joules)

==========

60. PHYSICS

Toss Up: 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

Toss Up Answer: Y

Bonus: 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?

Bonus Answer: 250 volts per meter

==========

61. PHYSICS

Toss Up: Multiple Choice

NMR spectroscopy is

W) diffraction

X) absorption

Y) radiation

Z) emission

Toss Up Answer: X

Bonus: Multiple Choice

NMR is based on

W) nuclear fission

X) charge of nucleus

Y) magnetically moment of the nucleus

Z) electrical moment of the nucleus

Bonus Answer: Y

==========

62. PHYSICS

Toss Up: Multiple Choice

What is the fundamental frequency, in Hz, for a string with a Tension of 250 N, a mass per length of .25 grams per meter, and a length of 50 cm?

W) 1200

X) 5000

Y) 1000

Z) 250

Toss Up Answer: Y

Bonus: Short Answer

Will a projectile fired at a 30 degree angle at 55 m/s clear a 25-meter fence located 50 meters away?

Bonus Answer: No (height at that point is ~23.5 m)

==========

63. PHYSICS

Toss Up: Multiple Choice

There is a 4kg block at rest. It spontaneously explodes into two pieces traveling in opposite directions. One piece weighing 1 kilogram travels to the left at 4 m/s. What direction and speed was the other block traveling in?

W) 4/3 m/s to the left

X) 3/4 m/s to the right

Y) 4/3 m/s to the right

Z) 4 m/s to the left

Toss Up Answer: Y

Bonus: Multiple Choice

Under small velocities, objects that collide do not conserve their total energy. However, under relativistic velocities, collisions always conserve their total energy. Why is this so?

W) Under relativistic velocities, mass and energy are interchangeable, and since mass can't be destroyed, neither can initial nor final energy.

X) Under small velocities, the frictional force during collision felt by two objects is large, whereas under relativistic velocities, the frictional force is negligible and energy is conserved.

Y) Under relativistic velocities, objects obtain relativistic masses which makes them gain more mass and makes up the lost energy in a regular collision.

Z) Under small velocities, particles lose parts of their masses while in motion, leading to a loss of energy after collision.

Bonus Answer: W

==========

64. PHYSICS

Toss Up: Multiple Choice

What is the magnitude of a vector 4 meters in the x direction, 1 meter in the y direction, and 8 meters in the z direction?

W) 7 meters

X) 9 meters

Y) 11 meters

Z) 13 meters

Toss Up Answer: X

Bonus: Short Answer

Unit X equals "sqrt(A / B)" and is in units "(Mass*Time) / Length^2". If A has units "Length / Time", what are the units of B?

Bonus Answer: Length^5 / (Mass^2 * Time^3)

==========

65. PHYSICS

Toss Up: Multiple Choice

Which of the following quantities are vector?

W) Work

X) Speed

Y) Torque

Z) Power

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following terms is NOT commonly used to represent a higher-order derivative of displacement?

W) Acceleration

X) Jounce

Y) Lock

Z) Spin

Bonus Answer: Z

==========

66. PHYSICS

Toss Up: Short Answer

A ball is thrown with an initial velocity of 10 meters per second off the top of a 30 foot building, at an angle 30 degrees above the horizontal. Assuming there is no air friction and the scenario occurs on Jupiter where objects have a gravitational acceleration of 25 meters per second squared, find the time it takes, in seconds, for the ball to reach ground level. Round to the nearest tenth.

Bonus Answer: 0.4

Bonus: Multiple Choice

A boy in freefall swings a ball tied to a string around in horizontal circles. Assuming no air friction, which of the following forces are NOT acting ball?

W) Centripetal Force

X) Centrifugal Force

Y) Gravitational Force

Z) Normal Force

Bonus Answer: Z

==========

67. PHYSICS

Toss Up: Multiple Choice

As defined in physics, speed is:

W) a vector quantity

X) always negative

Y) always zero

Z) always positive

Toss Up Answer: Z

Bonus: Multiple Choice

Electric current may be expressed in which one of the following units?

W) joules/coulomb

X) coulombs/second

Y) coulombs/volt

Z) ohms/second

Bonus Answer: X

==========

68. PHYSICS

Toss Up: Multiple Choice

Vectors A and B each have magnitude L. What is the cross product of these vectors if the angle between them when drawn with their tails at the same point is 60 degrees.

W) Zero
X) L/2
Y) L^2
Z) (L^2)/2

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following is true when a system is at equilibrium?

W) The object is at rest.
X) The object is not accelerating.
Y) The object is at constant velocity.
Z) Internal forces sum to zero.

Bonus Answer: X

==========

69. PHYSICS

Toss Up: Multiple Choice

A ball is thrown vertically up from the ground. Which of the following explains the ball's motion on its way up?

W) The ball is decelerating.
X) The ball's velocity is decreasing exponetially.
Y) The change in the ball's displacement is decreasing exponentially.
Z) The ball's velocity is constant.

Toss Up Answer: Y

Bonus: Multiple Choice

A ball is thrown horizontally at the same speed from the same height, one on the Earth and one on the Moon. Which of the following statements is/are true?

I. The horizontal distance traveled by the bullet is greater on the Moon.
II. The flight time is less for the bullet on the Earth.
III. The velocities of the bullets at impact are the same.

W) III only
X) I and II only
Y) II and III only
Z) I, II, and III

Bonus Answer: X

==========

70. PHYSICS

Toss Up: Multiple Choice

A vector extends 6 meters in the x direction and 2 root 3 meters in the y direction. The angle this vector makes with the positive x axis is:

W) 30 degrees
X) 60 degrees

Y) 90 degrees
Z) 180 degrees

Toss Up Answer: W

Bonus: Multiple Choice

A brick slides on a horizontal surface. Which of the following will increase the frictional force on it?
W) Increasing the surface of contact
X) Decreasing the surface of contact
Y) Increasing the mass of the brick
Z) Decreasing the mass of the brick

Bonus Answer: Y

==========

71. PHYSICS

Toss Up: Short Answer

A ball with a weight of 3.5 Newtons is thrown at an angle of 30 degrees above the horizontal with an initial speed of 16 meters per second. Give the magnitude and direction of the net force on the ball at its highest point.

Bonus Answer: 3.5 Newtons, downward

Bonus: Short Answer

A car is traveling at 15 meters per second on a horizontal road. The brakes are applied and the car skids to a stop in 4 seconds. Assuming gravitational acceleration is 10 meters per second squared, find the coefficient of kinetic friction between the tires and road. Round your answer to the nearest tenth.

Bonus Answer: 0.38

==========

72. PHYSICS

Toss Up: Multiple Choice

All electromagnetic waves have the same speed in:
W) Water
X) Air
Y) Glass
Z) Vacuum

Toss Up Answer: Z

Bonus: Short Answer

A man raises a massless string tied at the bottom to a 16N steel ball, with an upward acceleration of 2 meters per second squared. Find the tension in the string, to the nearest whole number of Newtons. Assume gravitational acceleration is 10 meters per second squared.

Bonus Answer: 19 Newtons

==========

73. PHYSICS

Toss Up: Multiple Choice

A beam of white light hits the sharp end of a glass prism and is broken up into monochromatic components. Which of the following phenomenon is this a direct example of?
W) Refraction
X) Dispersion
Y) Rarefaction
Z) Diffraction

Toss Up Answer: X

Bonus: Short Answer

A projectile whose mass is 9.4 kg is fired vertically upward. On its upward flight, an energy of 68 kJ is dissipated because of air resistance. How much higher would it have gone if the air resistance had been made negligible? Round to the nearest ten meters.

Bonus Answer: 740 m

==========

74. PHYSICS

Toss Up: Short Answer

What is the term for change in velocity per unit time?

Bonus Answer: acceleration

Bonus: Short Answer

What is the common term in physics for the product of mass times acceleration?

Bonus Answer: force

==========

75. PHYSICS

Toss Up: Multiple Choice

What is stated by Kirchhoff's First Law?

W) The description of the force interacting between static electrically charged particles.

X) The algebraic sum of currents in a network of conductors meeting at a point is zero.

Y) The algebraic sum of the products of the resistances of the conductors and the currents in them in a closed loop is equal to the total emf available in that loop.

Z) The net electric flux through any closed surface is equal to 1⁄ε times the net electric charge within that closed surface.

Toss Up Answer: X

Bonus: Multiple Choice

If two 4-Farad capacitors and one 6-Farad are connected in parallel, what is the equivalent capacitance three capacitors?

W) 14 Farads

X) 4.66 Farads

Y) 1.5 Farads

Z) 1 Farad

Bonus Answer: W

==========

76. PHYSICS

Toss Up: Multiple Choice

The driver of a car moving at a speed of 10 m/s sees a child and immediately applies brakes to bring the car to rest in 150 meters. If the combined mass of the car and the driver is 1200 kg, the magnitude of the retarding force on the vehicle is:

W) 300 N

X) 350 N

Y) 400 N

Z) 450 N

Toss Up Answer: Y

Bonus: Short Answer

A body is projected upwards with twice the escape velocity on Earth, 11.2 km/s. Ignoring the presence of other heavenly bodies, what is the speed of the body at infinity? Give your answer in km/s rounded to one decimal point.

Bonus Answer: 19.4 km/s

==========

77. PHYSICS

Toss Up: Multiple Choice

Suppose all the resistors in the world were only 10,000 Ohm resistors. What is the minimum number of resistors needed to make an equivalent resistance of 600 Ohms.

W) 8

X) 6

Y) 4

Z) 3

Toss Up Answer: Y

Bonus: Short Answer

Two wires of the same material and equal length are joined in parallel. If one of them has half the thickness of the other, and the thinner wire has a resistance of 8 Ohms, what is the resistance of the parallel combination?

Bonus Answer: 1.6 Ohms

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78. PHYSICS

Toss Up: Short Answer

A Carnot heat engine operates between 400K and 500 K. What is its efficiency?

Bonus Answer: 20%

Bonus: Multiple Choice

A Carnot heat engine and an irreversible heat engine both operate between the same high temperature and low temperature reservoirs. They absorb the same energy from the high temperature reservoir as heat. Which statement is true?

W) The irreversible engine does more work.

X) The Carnot engine transfers less energy to the low temperature reservoir as heat.

Y) The irreversible engine has the greater efficiency.

Z) The irreversible engine cannot absorb the same energy from the high temperature reservoir as heat without violating the second law of thermodynamics.

Bonus Answer: X

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79. PHYSICS

Toss Up: Multiple Choice

What kind of friction will act on a rolling, round object at an instant if the surface is horizontal and rough and no other force acts in the horizontal direction?

W) Static Friction

X) Kinetic Friction

Y) Rolling Friction

Z) No Friction

Toss Up Answer: Y

Bonus: Short Answer

If the acceleration due to gravity is 10 m/s^2, find the force required to move an object of mass 200 kilograms up an incline of 1 in 50 with an acceleration of 2 m/s^2 and a frictional force of 20 N.

Bonus Answer: 420 N

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80. PHYSICS

Toss Up: Multiple Choice

There are two small, thermally isolated rooms A and b. The heat capacitance of room A is 40 units of energy and room A contains 32 units of energy. The heat capacitance of room B is 100 units of energy and room B contains 50 units of energy. When the two rooms are thermally connected, in which direction will energy flow, on average?

W) Energy will not flow

X) Can't tell

Y) Room A to Room B

Z) Room B to Room A

Toss Up Answer: Y

Bonus: Short Answer

A piece of aluminium with mass 800 g is heated up to 1000 degrees C. Given the specific heat capacity of aluminium is 900 J/(kg K), calculate the amount of heat (in Joules) given out if the piece is cooled down to 200 degrees C.

Bonus Answer: 576,000 J

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81. PHYSICS

Toss Up: Multiple Choice

A 2 kg ball is dropped from 10m. Another 2 kg ball is thrown upwards at 5 m/s. What is the acceleration of the center of mass of these two balls?

W) 2g

X) g

Y) 5g

Z) 10g

Toss Up Answer: X

Bonus: Multiple Choice

Two astronauts are in gravity-free space. Astronaut A is 120 kg and Astronaut B is 90 kg. If A pushes B away, with B moving at 0.5 m/s, what is Astronaut A's final speed rounded to the tenth?

W) 0

X) 0.38

Y) 0.5

Z) 0.68

Bonus Answer: X

==========

82. PHYSICS

Toss Up: Multiple Choice

A metallic cylindrical conductor is used to produce some heat by applying a constant voltage between it's two ends. You want to double the heat released. Which of the following is the most appropriate thing to be done?

W) The length should be doubled

X) The radius should be doubled

Y) Both the length as well as the radius should be halved

Z) Both the length as well as the radius should be doubled

Toss Up Answer: Z

Bonus: Short Answer

A parallel plate capacitor of capacitance 10 micro F is charged to 50 micro C using a battery, and is then disconnected

from the circuit. How much energy in micro joules is required to pull apart the plates such that the distance between them is doubled?

Bonus Answer: 125

==========

83. PHYSICS

Toss Up: Short Answer

A Tesla is an SI derived unit that can be expressed as kg^a * C^b * s^c. What are the values of a, b and c?

Bonus Answer: 1, -1, -1

Bonus: Short Answer

A positron moves through a region in which the electric field is uniform in the x-direction and the magnetic field is uniform in the y-direction. What is the direction of the terminal velocity of the positron?

Bonus Answer: Positive z direction

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84. PHYSICS

Toss Up: Multiple Choice

Which of the following is the most correct statement of the equivalence principle?

W) General relativity is equivalent to Newtonian gravity under certain conditions

X) All kinds of energy are equivalent

Y) The effects of accelerating a frame are indistinguishable from gravitational forces

Z) The acceleration due to gravity is equivalent to GM/r under Newtonian conditions

Toss Up Answer: Y

Bonus: Short Answer

When a particle collides with its corresponding antiparticle, they annihilate, producing photons with energy equal to their rest mass energy. Imagine that you had 1 g of hydrogen and 1 g of anti-hydrogen. If the energy released when they collide is in the form [a x 10^k Joules], what's the value of k?

Bonus Answer: 14

==========

85. PHYSICS

Toss Up: Multiple Choice

What is the centripetal force if the mass of an object is 10 grams and its centripetal force is 10 m/s^2?

W) 100

X) 10

Y) 1

Z) 0.1

Toss Up Answer: Z

Bonus: Short Answer

A man pulls a 5 kg object with 100 Newton of force forward across a flat plain at constant speed. If the coefficient of friction between the ground and the object is 1.0, what is the magnitude of the acceleration of the object? Use 10 m/s^2 for gravity.

Bonus Answer: 10 m/s^2

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86. PHYSICS

Toss Up: Short Answer

At what angle should a projectile be launched from a horizontal surface to have the maximum range?

Bonus Answer: 45 degrees

Bonus: Short Answer

A mass of 8 kg is hanging vertically from the bottom of a spring with a spring constant of 10^3 N/m. To the nearest hundredths place, in meters, what is the displacement?

Bonus Answer: 0.08 meters

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87. PHYSICS

Toss Up: Multiple Choice

What type of damping provides the quickest approach to zero amplitude for a damped oscillator?

W) Hyperdamping

X) Overdamping

Y) Critical Damping

Z) Underdamping

Toss Up Answer: Y

Bonus: Short Answer

What is the damping coefficient equal to for a critically damped spring system with a spring constant of 1000 Newtons/meters and oscillating mass of 10 kg?

Bonus Answer: 10Hz [at critical damping the damping coefficient is equal to the undamped resonant frequency, which is equal to the sqrt(spring constant/mass)]

==========

88. PHYSICS

Toss Up: Multiple Choice

Which of the following is true about a light wave?

W) Its energy is directly proportional to its wavelength.

X) Its energy is directly proportional to its frequency.

Y) Its energy is directly proportional to its amplitude.

Z) Its energy is not related to any other of its properties.

Toss Up Answer: X

Bonus: Short Answer

Find the electrostatic force between two perfect spheres, both with charge 1 and are 1 meter apart from each other. Give your answer in scientific notation.

Bonus Answer: 8.99 × 10^9 N•m2/C2

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89. PHYSICS

Toss Up: Short Answer

Which greek letter is used to denote shear stress?

Bonus Answer: tao

Bonus: Short Answer

Which greek letter is sued to denote coefficient of viscosity?

Bonus Answer: mu

==========

90. PHYSICS

Toss Up: Short Answer

An octave is a music interval of what ratio of frequency?

Bonus Answer: 2:1

Bonus: Short Answer

From 440 Hertz to what Hertz would be one octave?

Bonus Answer: 880 Hertz

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91. PHYSICS

Toss Up: Multiple Choice

A 5 kg ball is ejected from a spring and it rolls 8m up a frictionless incline at 30 degrees before coming to a stop. Assuming that g = 10 m/s^2 (READ AS 10 meters per second squared) and that the spring constant is 100N/m, how far does the spring has to be compressed initially?

W) 1m

X) 2m

Y) 4m

Z) 6m

Toss Up Answer: X

Bonus: Short Answer

The potential energy of a 1kg particle is represented by U(x,y,z) = 2xy + 3z^2 (READ AS: U of x, y, z equals 2xy plus 3 z squared). What is the magnitude of the force acting on the particle at position (0,4,1)?

Bonus Answer: 10 N

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92. PHYSICS

Toss Up: Short Answer

An electron travels 45 degrees north of east in a magnetic field which points 45 degrees west of north. In what direction does the magnetic force acting on the electron points?

Bonus Answer: Down

Bonus: Short Answer

A 2C charge travels through a magnetic field B = 6i + 15j + 9k with velocity v = 2i + 5j + 3k. What is the magnetic force acting on the charge?

Bonus Answer: 0

==========

93. PHYSICS

Toss Up: Multiple Choice

An object oscillates with equation x = 2cos(5πt) (READ AS: x equals 2 times cosine of open parentheses 5 PI times t close parentheses). What is the frequency of the oscillation?

W) 0.5

X) 1

Y) 2.5

Z) 4

Toss Up Answer: Y

Bonus: Multiple Choice

An LC circuit consists of a 5 henry inductor and a 20 farad capacitor connected to a battery in a series circuit. What is the frequency of the oscillation of the current in the circuit?

W) 0.05/π (0.05/PI)

X) 0.1/π (0.1/PI)

Y) 2/π (2/PI)

Z) 3/π (3/PI)

Bonus Answer: W

==========

94. PHYSICS

Toss Up: Short Answer

A heat engine does positive work W as it absorbs energy Q_h (READ AS: Q sub h) from a heat reservoir and transfers energy Q_c (READ AS: Q sub c) to a cold reservoir. What is the efficiency of the heat engine in terms of Q_h, Q_c, and W?

Bonus Answer: W/Q_h

Bonus: Multiple Choice

For Christmas, Bobby Tables got a heater with a coefficient of performance of 10. If the heater transfers 50 kilojoules of heat into the room in 2 seconds, what is the power of the heater in kilowatts?

W) 1

X) 2.4

Y) 2.1

Z) 2.5

Bonus Answer: Z

==========

95. PHYSICS

Toss Up: Short Answer

Given a 5 meter length of gold wire with a radius of 0.05 meters with a resistivity of 2.2*10^-8, find the resistance in the wire.

Bonus Answer: 4.4*10^-5 ohms

Bonus: Multiple Choice

Given the following quantities chose the answer that contains only vector quantities.

W) Length, force, momentum

X) Momentum, temperature, work

Y) displacement, acceleration, velocity

Z) entropy, pressure, mass

Bonus Answer: Y

==========

96. PHYSICS

Toss Up: Short Answer

A flatbread truck is carrying a crate along a level road. The coefficient of static friction between the load and the bed is 0.4. The truck accelerates forward and the crate stays in its place on the truck bed. In what direction is the force that the bed exerts on the crate?

Bonus Answer: Forward

Bonus: Multiple Choice

James and John dive from an overhang into the lake below. James simply drops straight down from the edge. John takes a running start and jumps with an initial horizontal velocity of 25 m/s. Compare the time it takes each to reach the lake below.

W) Cannot be determined without knowing the mass of both James and John.

X) James and John will reach the surface of the lake at the same time.

Y) John reaches the lake first.

Z) James reaches the lake first.

Bonus Answer: X

==========

97. PHYSICS

Toss Up: Multiple Choice

For general projectile motion, the horizontal component of a projectile's acceleration

W) continuously increases

X) is zero

Y) remains a non-zero constant

Z) continuously decreases

Toss Up Answer: X

Bonus: Multiple Choice

If the acceleration of an object is directed parallel to the velocity vector,

W) the object is not moving

X) the object is turning

Y) the object is slowing down

Z) the object is speeding up

Bonus Answer: Z

==========

98. PHYSICS

Toss Up: Multiple Choice

Not all laws that hold in an inertial frame hold in a non-inertial frame. An obvious example is the law of inertia. Does the Work-Energy Theorem hold in a non-inertial frame?

W) It only holds in inertial frames.

X) It will not hold in a non-inertial frame unless there aren't any conservative forces at work.

Y) It will hold in a non-inertial frame unless there are non-conservative forces.

Z) It holds for any non-inertial frame.

Toss Up Answer: Z

Bonus: Short Answer

An object is launched on a horizontal surface with an initial speed of 20 m/s, so that it covers a distance of 5 meters in the time interval 4 sec to 5 sec. What is the coefficient of friction between the object and the horizontal surface? Assume gravitational acceleration is 10 m/s^2

Bonus Answer: 1/3

==========

99. PHYSICS

Toss Up: Multiple Choice

You decide to set off on a voyage to another star. To stop your muscles from atrophying, you want to generate artificial gravity by having your ship constantly accelerate at 1 g from your reference frame. Ignoring fuel requirements, is there a problem with generating artificial gravity this way over very long time frames?

W) Yes, this setup would not work to generate artificial gravity

X) Yes, 1 g isn't enough to prevent your muscles from atrophying

Y) No, this can be used indefinitely to generate artificial gravity

Z) Yes, eventually the ship would need to go faster than the speed of light, which is impossible

Toss Up Answer: Y

Bonus: Short Answer

A box of mass 3 kg is placed on the edge of a merry-go-round of radius 4 m. The coefficient of static friction between the box and the merry-go-round is 0.4. What is the square of the merry-go-round's speed at the moment the box slides off?

Bonus Answer: 12 (m/s)^2

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100. PHYSICS

Toss Up: Multiple Choice

When 236U fissions, the products might be which of the following?

W) Ba-146 (READ AS: barium 146), Kr-89 (READ AS: krypton 89), and a proton

X) Ba-146 (READ AS: barium 146), Kr-89 (READ AS: krypton 89), and a neutron

Y) Cs-148 (READ AS: cesium 148) and Br-85 (READ AS: barium 85)

Z) two uranium nuclei

Toss Up Answer: X

Bonus: Short Answer

In the proton-proton cycle, two hydrogen atoms initially react to form what 3 particles?

Bonus Answer: Deuterium, a positron, and an electron neutrino (ACCEPT neutrino)

==========

101. PHYSICS

Toss Up: Multiple Choice

An electrical current flows across an infinite rectilinear wire. If its intensity of is doubled, then the magnetic field at a generic point:

W) quadruples

X) doubles

Y) halves

Z) remains unchanged

Toss Up Answer: X

Bonus: Short Answer

The current I(t) flowing for a wire for t >= 0 is given by I(t) = 2^(-t). Find the total charge that will flow through the wire.

Bonus Answer: 1/(ln 2)

==========

102. PHYSICS

Toss Up: Multiple Choice

Light from a monochromatic lamp is shone upon a sheet of metal, and yet, the photoelectric effect is not observed. What change in the setup will most likely result in an observed photoelectric effect?

W) Increasing the brightness of the lamp

X) Moving the lamp closer to the sheet of metal

Y) Decreasing the wavelength of the light

Z) Increasing the surface area of the sheet of metal

Toss Up Answer: Y

Bonus: Short Answer

An electric current of 1 Ampere is flowing along an infinite horizontal wire in the x-axis. At x = 0 m the wire splits into a circle of radius 0.05 m and then comes back together at x = 4 m. What is the magnitude in Tesla of the magnetic field in the middle of this loop of wire?

Bonus Answer: 0

==========

103. PHYSICS

Toss Up: Short Answer

What's the stopping potential, in eV/C (READ AS: electron volts per coulomb) of a photoelectron ejected from a metal with work function of 1eV when the incident photon's energy is 3.5 eV?

Bonus Answer: 2.5 eV/C

Bonus: Multiple Choice

Two students conduct separate Compton scattering experiments with visible light and x-rays. The scattered radiation is observed at the same scattering angle. Which of the following statements about the observed results is true?

W) the x rays have the greater shift in wavelength and the greater change in photon energy

X) the two radiations have the same shift in wavelength and the visible light has the greater change in photon energy

Y) the two radiations have the same shift in wavelength and the same change in photon energy

Z) the two radiations have the same shift in wavelength and the x rays have the greater change in photon energy

Bonus Answer: Z

==========

104. PHYSICS

Toss Up: Multiple Choice

How many elements are in between the first two radioactive elements on the Periodic Table?

W) 15

X) 16

Y) 17

Z) 18

Toss Up Answer: Y

Bonus: Short Answer

What is the name for the line dividing the metals and the nonmetals on the periodic table?

Bonus Answer: Amphoteric line or semimetal line or metalloid line

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105. PHYSICS

Toss Up: Multiple Choice

What does Thomas Young's Double Slit Experiment demonstrate about light?

W) Light behaves like a particle

X) Light behaves like a wave

Y) The speed of light in a vacuum is 3.00x10^8 meters per second

Z) Light is related to electromagnetism

Toss Up Answer: X

Bonus: Short Answer

In a particular medium, light travels at a speed of 2.0x10^8 meters per second. What is the index of refraction of the medium?

Bonus Answer: 1.5

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106. PHYSICS

Toss Up: Multiple Choice

Diffraction plays an important role in which of the following phenomena?

W) The sun appearing as a disk to the naked eye

X) Light being bent through a glass prism

Y) Shouting through a megaphone

Z) A thin soap film displaying colors when light is incident on it

Toss Up Answer: Y

Bonus: Multiple Choice

A beam of light passes though one polarizing filter and through another filter rotated at 45 degrees compared to the first one. If the original intensity of the light was 100 W, what is the new intensity of the polarized light?

W) 50
X) 75
Y) 100
Z) 150

Bonus Answer: W

==========

107. PHYSICS

Toss Up: Short Answer

A plane mirror is in a vertical plane and is rotating about a vertical axis at 100 rpm. A horizontal beam of light is incident on the mirror. The reflected beam will rotate at:

Bonus Answer: 200 rpm (ACCEPT 200)

Bonus: Short Answer

The curvature of a concave spherical mirror is 50 cm^-1. How far away from the mirror does an object need to be placed as to not create an image?

Bonus Answer: 25 cm (ACCEPT 0.25m or equivalent forms)

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108. PHYSICS

Toss Up: Multiple Choice

Two objects stick together after they collide with each other. What is true about the collision?
W) The collision is elastic
X) The collision is completely inelastic
Y) The total momentum of the system changes
Z) The total kinetic energy of the system stays the same

Toss Up Answer: X

Bonus: Short Answer

An object moving at 10 meters per second relative to a surrounding fluid experiences a drag force of 20 newtons. If the object's speed increases to 20 meters per second, what is the drag force experienced by the object?

Bonus Answer: 80 newtons

==========

109. PHYSICS

Toss Up: Multiple Choice

If an object has a mass of 10 kg and a velocity of 1.5*10^8 m/s, what is its kinetic energy in terms of c?
W) 40(c^2)/3
X) (c^2)/3
Y) 10c/3
Z) 10(c^2)/3

Toss Up Answer: Z

Bonus: Short Answer

If an object has a kinetic energy of 6*10^16 joules and a velocity of .5c, what is its mass?

Bonus Answer: Answer: 2kg

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110. PHYSICS

Toss Up: Short Answer

Given the acceleration due to gravity as 10.0 meters per square second, what is the water pressure in pascals at the bottom of a pool that has a depth of 5 meters?

Bonus Answer: 50000 Pa

Bonus: Short Answer

A pendulum with a radius of 0.1 meters is released from rest at an angle of 30 degrees below the horizontal. Given the acceleration due to gravity as 10.0 meters per square second, what is the maximum speed of the pendulum assuming no energy is lost to friction?

Bonus Answer: 1 m/s

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111. PHYSICS

Toss Up: Multiple Choice

Water is flowing through a horizontal pipe. As the pipe becomes narrower, what is true about the speed and the pressure of the water?

W) Both the speed and the pressure increase

X) Both the speed and the pressure decrease

Y) The speed increases and the pressure decreases

Z) The speed decreases and the speed increases

Toss Up Answer: Y

Bonus: Short Answer

In a heat engine, hot steam at a temperature of 227 degrees Celsius does useful work before being released at a temperature of 127 degrees Celsius. What is the efficiency of the engine?

Bonus Answer: 20% or 0.2

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112. PHYSICS

Toss Up: Short Answer

Which type of transfer orbit from one circular orbit to another is the most energy-efficient?

Bonus Answer: Hohmann transfer orbit

Bonus: Multiple Choice

In which orbit are natural objects least common?

W) A planet's L1 point

X) A planet's L3 point

Y) A planet's L5 point

Z) A planet's L4 point

Bonus Answer: W

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113. PHYSICS

Toss Up: Short Answer

What are the fundamental forces of the Universe?

Bonus Answer: Gravitation, Electromagnetic, Weak, Strong

Bonus: Multiple Choice

The tau particle belongs to which class of particles?

W) Quarks

X) Hadrons

Y) Bosons

Z) Leptons

Bonus Answer: Z

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114. PHYSICS

Toss Up: Multiple Choice

In a hockey game, a 0.1 kg puck is slide on the ice at 40 m/s horizontally towards a goalie. If the goalie slides the puck back in the direction in which it came with a speed of 30 m/s, what is the impulse experienced by the puck?

W) 1 kgm/s
X) 7 kgm/s
Y) 3 kgm/s
Z) 120 kgm/s

Toss Up Answer: X

Bonus: Multiple Choice

A block sliding on a frictionless surface at 10 m/s hits a spring which returns the block at the same speed. If the block's mass is 5 kg, what is the impulse the block experiences?

W) 0.5 kgm/s
X) 50 kgm/s
Y) 2 kgm/s
Z) 100 kgm/s

Bonus Answer: Z

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115. PHYSICS

Toss Up: Short Answer

A ball with mass 0.2 kg is thrown at a wall with velocity 20 m/s and rebounds with a velocity of 15 m/s. What is the impulse of the net force imposed on the ball?

Bonus Answer: 7 kgm/s

Bonus: Short Answer

In a jousting game, a student of 60 kg with velocity 5 m/s is rolled towards a student of 30 kg at rest. When they collide, their poles conserve all of their kinetic energy as potential energy and redistribute it. What is the final velocity of the 30 kg student to the tenth place?

Bonus Answer: 6.6 m/s

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116. PHYSICS

Toss Up: Short Answer

In a food fight, a 0.1 kg apple is given a velocity of 10 m/s. Before reaching its target, the apple is traveling at 5 m/s. What is the impulse exerted on the apple by air resistance?

Bonus Answer: 0.5 kgm/s

Bonus: Short Answer

A 0.1 kg pinball is fired horizontally by a spring with a force constant of 40 N/m. If the spring is depressed 10 cm and the ball collides with a 0.3 kg ball elastically, what is the post collision velocity of the 0.3 kg ball?

Bonus Answer: 1 m/s

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117. PHYSICS

Toss Up: Short Answer

A bullet with mass 0.01 kg and a velocity of 300 m/s is aimed at a wood block on a table. If the mass of the block is 1 kg and the bullet is embedded in the wood block, what is the final velocity of the system?

Bonus Answer: 3 m/s

Bonus: Short Answer

A 0.400 kg soccer ball approaches a player horizontally with a speed of 15 m/s. The player illegally strikes the ball with her hand and causes it to move in the opposite direction with a speed of 22 m/s. What impulse was delivered to the ball by the player to the nearest whole number?

Bonus Answer: -15 kgm/s

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118. PHYSICS

Toss Up: Short Answer

If a 5000 kg truck is traveling at 30 m/s, how high must a ramp be to bring the truck to a complete stop?

Bonus Answer: 45 m

Bonus: Short Answer

A 1 kg radio controlled car is traveling at 10 m/s. When the car is 5 m from a cliff, the operator hits the brakes. How much force is required to stop the car?

Bonus Answer: 10 N

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119. PHYSICS

Toss Up: Short Answer

Just before hitting a nail, a 2 kg hammer is moving at 10 m/s. If the wood exerts a constant 180 N force on the nail, how far does the nail go?

Bonus Answer: 0.6 m

Bonus: Short Answer

What is the velocity of a particle after falling 10 m if its initial velocity is 10 m/s?

Bonus Answer: 10rad(3) m/s

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120. PHYSICS

Toss Up: Short Answer

A sports car dealer claims that his product will accelerate at a constant rate from rest to a speed of 90 km/hr in 8s. What is the acceleration of the car in m/s^2 to the nearest whole number?

Bonus Answer: 3 m/s^2

Bonus: Short Answer

A rock released at rest from the top of a tower hits the ground after falling for 2 s. What is the height of the tower if air resistance is negligible to the nearest whole number?

Bonus Answer: 20 m

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121. PHYSICS

Toss Up: Short Answer

A rock is thrown downward from the top of a tower with an initial speed of 12 m/s. If the rock hits the ground after 2 s, what is the speed of the rock as it hits the ground if air resistance is negligible to the nearest whole number?

Bonus Answer: 32 m/s

Bonus: Short Answer

Human reaction time is usually greater 0.10 s. If someone holds a ruler between your finger and thumb and releases it without warning, how far can you expect the ruler to fall before you catch in cm to the 10th place?

Bonus Answer: 4.9 cm

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122. PHYSICS

Toss Up: Short Answer

Given a fuel flow rate of 5 kg/s and a thrust of 20 kN, what is the exhaust velocity of the thruster? Assume standard gravity to be 10 m/s^2.

Bonus Answer: 4 km/s (also acceptable: 4000 m/s)

Bonus: Short Answer

If one of the engines of a single stage has a specific impulse of 40 seconds and a fuel flow rate of 2 kg/s, and the other engine has a specific impulse of 100 seconds and a fuel flow rate of 10 kg/s, what is the total thrust of the stage? Assume standard gravity to be 10 m/s^2.

Bonus Answer: 10800 N

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