PHYSICS

1. PHYSICS

Writer: Nicholas Adit

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

==========

2. PHYSICS

Writer: Shantanu Jha

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

==========

3. PHYSICS

Writer: Shantanu Jha

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

==========

4. PHYSICS

Writer: Shantanu Jha

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

==========

5. PHYSICS

Writer: Raafiul Hossain
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

==========

6. PHYSICS

Writer: Raafiul Hossain
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

Writer: Raafiul Hossain
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

==========

8. PHYSICS

Writer: Raafiul Hossain

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

==========

9. PHYSICS

Writer: Raafiul Hossain

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

==========

10. PHYSICS

Writer: Aaron Gee

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

==========

11. PHYSICS

Writer: Aaron Gee

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

==========

12. PHYSICS

Writer: Aaron Gee

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

==========

13. PHYSICS

Writer: Aaron Gee

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

Writer: Aaron Gee

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

==========

15. PHYSICS

Writer: Aaron Gee

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

Writer: Aaron Gee

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.

==========

17. PHYSICS

Writer: Charles Zhang
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

==========

18. PHYSICS

Writer: Charles Zhang
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

Writer: Ashneel Das
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

Writer: Kerwin Chen

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

Writer: Jessica Titensky

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

Writer: Jessica Titensky

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

Writer: Shantanu Jha

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

Writer: Charles Zhang

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

Writer: Charles Zhang

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

Writer: Charles Zhang

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

Writer: Jason Weng

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

Writer: Charles Zhang

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

==========

29. PHYSICS

Writer: Charles Zhang

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

Writer: Charles Zhang

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

Writer: Charles Zhang

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)

==========

32. PHYSICS

Writer: Charles Zhang

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

Writer: Raafiul Hossain

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

==========

34. PHYSICS

Writer: Raafiul Hossain

Toss Up: Short Answer

What is energy measured in?

Bonus Answer: Joules

Bonus: Short Answer

What is the unit of charge?

Bonus Answer: Columbus

==========

35. PHYSICS

Writer: Jan Wojcik

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

==========

36. PHYSICS

Writer: Shantanu Jha

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

==========

37. PHYSICS

Writer: Shantanu Jha

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

==========

38. PHYSICS

Writer: Shantanu Jha

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

==========

39. PHYSICS

Writer: Shantanu Jha
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

==========

40. PHYSICS

Writer: Shantanu Jha
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

==========

41. PHYSICS

Writer: Shantanu Jha
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

==========

42. PHYSICS

Writer: Aaron Gee

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

==========

43. PHYSICS

Writer: Yevgeniy Gorbachev

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

==========

44. PHYSICS

Writer: Ahmad Alnasser

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

==========

45. PHYSICS

Writer: Sean Vaysburd

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.

==========

46. PHYSICS

Writer: Sean Vaysburd

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.

==========

47. PHYSICS

Writer: Aaron Gee

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

==========

48. PHYSICS

Writer: Aaron Gee

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

Writer: Aaron Gee

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

Writer: Aaron Gee

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

Writer: Aaron Gee

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)

==========

52. PHYSICS

Writer: Aaron Gee

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

Writer: Aaron Gee

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

==========

54. PHYSICS

Writer: Aaron Gee

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

Writer: Aaron Gee

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

Writer: Aaron Gee

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

==========

57. PHYSICS

Writer: Aaron Gee

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

Writer: Aaron Gee

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

Writer: Aaron Gee

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

Writer: Aaron Gee

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

Writer: Jason Mohabir

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

Writer: George Papastefanou

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

Writer: Jan Wojcik

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

Writer: William Xiang

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

Writer: William Xiang

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

Writer: William Xiang

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

Writer: Shihab Karim

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

Writer: William Xiang

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

Writer: William Xiang

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

Writer: William Xiang

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

Writer: William Xiang

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

Writer: William Xiang

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

Writer: William Xiang
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

Writer: Henry Zheng
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

Writer: Shantanu Jha
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

Writer: Seiji Yawata

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

Writer: Seiji Yawata

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

==========

78. PHYSICS

Writer: Charles Zhang

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

==========

79. PHYSICS

Writer: Seiji Yawata

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

==========

80. PHYSICS

Writer: Seiji Yawata

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

==========

81. PHYSICS

Writer: Charles Zhang

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

Writer: George Zhou

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

Writer: Seiji Yawata

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

==========

84. PHYSICS

Writer: Seiji Yawata

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

Writer: Jason Weng
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

==========

86. PHYSICS

Writer: Banpreet Singh
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

==========

87. PHYSICS

Writer: Shantanu Jha
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

Writer: Hanna Yang

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

==========

89. PHYSICS

Writer: Kerwin Chen

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

Writer: Kerwin Chen

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

==========

91. PHYSICS

Writer: Charles Zhang

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

==========

92. PHYSICS

Writer: Charles Zhang

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

Writer: Charles Zhang

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

Writer: Charles Zhang

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

Writer: Andrew Chen (Senior)

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

Writer: Banpreet Singh

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

Writer: Banpreet Singh

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

Writer: Seiji Yawata

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

Writer: Seiji Yawata

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

==========

100. PHYSICS

Writer: Charles Zhang

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

Writer: Seiji Yawata

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

Writer: Seiji Yawata

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

Writer: Charles Zhang

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

Writer: Benjamin Avrahami

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

==========

105. PHYSICS

Writer: Brian Lim

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

==========

106. PHYSICS

Writer: Charles Zhang

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

Writer: Charles Zhang

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)

==========

108. PHYSICS

Writer: Brian Lim

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

Writer: Yevgeniy Gorbachev

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

==========

110. PHYSICS

Writer: Brian Lim

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

==========

111. PHYSICS

Writer: Brian Lim

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

==========

112. PHYSICS

Writer: Yevgeniy Gorbachev

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

==========

113. PHYSICS

Writer: Brian Lim

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

==========

114. PHYSICS

Writer: Prangon Ghose

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

==========

115. PHYSICS

Writer: Prangon Ghose

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

==========

116. PHYSICS

Writer: Prangon Ghose

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

==========

117. PHYSICS

Writer: Prangon Ghose

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

==========

118. PHYSICS

Writer: Prangon Ghose

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

==========

119. PHYSICS

Writer: Prangon Ghose

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

==========

120. PHYSICS

Writer: Prangon Ghose

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

==========

121. PHYSICS

Writer: Prangon Ghose

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

==========

122. PHYSICS

Writer: Yevgeniy Gorbachev

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

==========

123. PHYSICS

Writer: Elias Milborn

Toss Up: Short Answer

A train moving 35 meters per second emits a whistle with a frequency of 900 hertz. Assuming that the speed of sound in air is 350 meters per second, what is the frequency, in hertz, measured by a stationary observer in front of the train?

Bonus Answer: 1000

Bonus: Multiple Choice

Which of the following has the highest vapor pressure at STP?

W) mercury

X) ethyl alcohol

Y) methyl alcohol

Z) acetone

Bonus Answer: Z

==========

124. PHYSICS

Writer: Elias Milborn

Toss Up: Multiple Choice

When a resistor, inductor, and capacitor are connected in series to an AC generator, the current through the capacitor must be in phase with the voltage across which of the following?

W) The capacitor

X) The inductor

Y) The entire circuit

Z) The inductor

Toss Up Answer: Z

Bonus: Short Answer

Which lower case letter is commonly used to denote planck's constant?

Bonus Answer: h

==========

125. PHYSICS

Writer: Elias Milborn

Toss Up: Multiple Choice

As an object falls to the earth with air resistance present, what happens to the acceleration of the object?

W) It remains a constant 9.8 m/s^2

X) It increases from 0 to 9.8 m/s^2

Y) It remains at a constant 0 m/s^2

Z) It decreases from 9.8 to 0 m/s^2

Toss Up Answer: Z

Bonus: Multiple Choice

Mary and Joe are on a merry-go-round. Mary is seated near the center of rotation and Joe is on the outer edge. Which of the following BEST describes their motion?

W) Mary has a greater acceleration than Joe

X) Joe has a greater acceleration than Mary

Y) neither Joe nor Mary are accelerating

Z) both Mary and Joe have the same acceleration

Bonus Answer: X

==========

126. PHYSICS

Writer: Elias Milborn

Toss Up: Short Answer

A person standing on a scaffolding lowers an object with weight 250 newtons by means of a rope, at constant speed. If the weight of the ropes is negligible, what is the force in newtons that the person exerts on the rope?

Bonus Answer: 250

Bonus: Short Answer

Green light has a wavelength of 500 nanometers. What is its associated frequency in hertz?

Bonus Answer: 6x10^14

==========

127. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What kind of lens has a different optical power and focal length in two orientations perpendicular to each other?

W) Toric
X) Parabolic
Y) Cylindrical
Z) Ellipsoid

Toss Up Answer: W

Bonus: Multiple Choice

Einstein's Field Equations are a set of how many equations in his theory of general relativity?
W) 7
X) 9
Y) 10
Z) 11

Bonus Answer: Y

==========

128. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

In what branch of physics would you expect to find the worm-like chain model?
W) Wormhole Physics
X) Newtonian Physics
Y) Plasma Physics
Z) Polymer Physics

Toss Up Answer: Z

Bonus: Short Answer

By name or number, name which of the following muon decay can produce.
1. Electron
2. Muon Neutrino
3. Electron Neutrino
4. Positron

Bonus Answer: 1,3,4; Electron, Electron Neutrino, Positron

==========

129. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What German physicist developed the 2nd law of thermodynamics, showing that the universe's entropy always increases?
W) Wilhelm Röntgen
X) Rudolf Clausius
Y) Wilhelm Weber
Z) Hermann von Helmholtz

Toss Up Answer: X

Bonus: Multiple Choice

What German physicist, who died in 1855, formulated separate electrostatic and electrodynamical laws?
W) James Clerk Maxwell
X) Johann Gauss

Y) Frederick Beck
Z) Max von Laue

Bonus Answer: X

==========

130. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What is the magnitude of the magnetic force on a point charge with a charge of 1 Coulomb and velocity of 2 meters per second traveling perpendicular to a magnetic field of 2 Tesla?
W) -1 Newtons
X) -2 Newtons
Y) 2 Newtons
Z) 4 Newtons

Toss Up Answer: Z

Bonus: Short Answer

What is the name of the force that is the combination of electric and magnetic force on a point charge due to electromagnetic fields?

Bonus Answer: Lorentz Force

==========

131. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

What fuel is mostly used in a nuclear power-generation station?

Bonus Answer: Uranium-235 (Do not accept: Uranium or Uranium-238)

Bonus: Multiple Choice

Dark energy and dark matter comprise approximately how much of the known universe?
W) 50%
X) 75%
Y) 95%
Z) 99%

Bonus Answer: Y

==========

132. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What Irish physicist, living from 1805-1865, made important contributions to classical mechanics optics and algebra?
W) William Parsons
X) William Hamilton
Y) Francis Beaufort
Z) George Boole

Toss Up Answer: X

Bonus: Multiple Choice

What is generated by a Van de Graff generator?
W) Static Charge

X) Current
Y) Nuclear Decay
Z) Radiation

Bonus Answer: W

==========

133. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

A standard 1-kg mass is attached to a compressed spring and the spring is released. If the mass initially has an acceleration of 5.6m/s^2, the force of the spring has a magnitude of:
W) 0N
X) 2.8N
Y) 5.6N
Z) 11.2N

Toss Up Answer: Y

Bonus: Multiple Choice

A 42-kg man stands in an elevator that has a downward acceleration of 3.4m/s^2. The force exerted by him on the floor is about:
W) 12N
X) 270N
Y) 340N
Z) 412N

Bonus Answer: X

==========

134. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

A woman pushes a 25-kg shopping cart 10 meters along a frictionless horizontal surface. What is the total work exerted by the woman on the cart?

Bonus Answer: 0 Joules

Bonus: Multiple Choice

A 0.50kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. The total mechanical energy is 0.12J. The greatest extensions from this equilibrium length is:
W) 1.5 * 10^-3 m
X) 3.0 * 10^-3 m
Y) 0.039 m
Z) 0.054 m

Bonus Answer: Z

==========

135. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

Two particles interact by conservative forces. In addition, an external force acts on each particle. They complete round trips, ending at the points where they started. Which of the following must have the same values at the beginning and

tend of this trip?
W) the total kinetic energy of the two-particle system
X) the potential energy of the two-particle system
Y) the total linear momentum of the two-particle system
Z) the mechanical energy of the two-particle system

Toss Up Answer: X

Bonus: Multiple Choice

A force of 10 N holds an ideal spring with a 20 N/m spring constant in compression. The potential energy stored in the spring is:
W) 0.5J
X) 2.5J
Y) 5J
Z) 10J

Bonus Answer: X

==========

136. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Suppose that the fundamental dimensions are taken to be: force (F), velocity (V), and time (T). Find the dimensions of potential energy in simplest form.

Bonus Answer: FVT

Bonus: Multiple Choice

A projectile of mass 0.50kg is fired with an initial speed of 10 m/x at an angle of 60 degrees above the horizontal. The potential energy of the projectile-Earth system (relative potential energy when the projectile is at ground level) is:
W) 25 J
X) 18.75 J
Y) 12.5 J
Z) 6.25 J

Bonus Answer: X

==========

137. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Name all of the following that are NOT correct units for work: Joule, Newton*meter, Watt, ft*lb, Volt

Bonus Answer: Watt, Volt

Bonus: Multiple Choice

An 80-N crate slides with constant speed a distance of 5.0 m downward along a rough slope that makes an angle of 30 degrees with the horizontal. The work done by the force of gravity is:
W) -400 J
X) -200 J
Y) 200 J
Z) 400 J

Bonus Answer: Y

==========

138. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Name all of the following that are vector quantities: Weight, Distance, Velocity, Energy, Watt

Bonus Answer: Weight, Velocity

Bonus: Multiple Choice

A man wishes to pull a crate 15 m across a rough floor by exerting a force of 100 N. The coefficient of kinetic friction is 0.25. For the man to do the least work, the angle between the force and the horizontal should be

W) 0 degrees

X) 14 degrees

Y) 43 degrees

Z) 66 degrees

Bonus Answer: W

==========

139. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

Which of the following bodies has the largest kinetic energy?

W) Mass 3M and speed V

X) Mass 3M and speed 2V

Y) Mass 2M and speed 3V

Z) Mass M and speed 4V

Toss Up Answer: Y

Bonus: Multiple Choice

AN object is constrained by a cord to move in a circular path of radius 0.5m on a horizontal frictionless surface. The cord will break if its tension exceeds 16N. The maximum kinetic energy the object can have is:

W) 4J

X) 8J

Y) 17J

Z) 32J

Bonus Answer: W

==========

140. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Two trailers, X with mass 500kg and Y with mass 2000kg, are being pulled at the same speed. Find the ratio of the kinetic energy of Y to that of X in simplest terms.

Bonus Answer: 4:1 (or 4 to 1)

Bonus: Multiple Choice

Given a potential energy function U(x), the corresponding force F is in the positive x direction if:

W) U is positive

X) U is negative

Y) U is an increasing function of x

Z) U is a decreasing function of x

Bonus Answer: Z

==========

141. PHYSICS

Writer: Nicholas Adit

Toss Up: Short Answer

A baseball is thrown straight upward. What is the acceleration at the highest point?

Bonus Answer: 0

Bonus: Multiple Choice

A rock is dropped off a cliff and strikes the ground with an impact velocity of 30 m/s. How high was the cliff?

W) 15 m

X) 30 m

Y) 45 m

Z) 60 m

Bonus Answer: Y

==========

142. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

If all of the forces acting on an object balance so that the net force is zero, then

W) The object must be at rest

X) The object speed will decrease

Y) The object direction can change but it speed cannot

Z) None of the above

Toss Up Answer: Z

Bonus: Short Answer

A person who weighs 800 N steps onto a scale that is on the floor of an elevator car. If the elevator accelerates upward at a rate of 5 m/s2, what will the scale read (G = 10 m/s2)?

Bonus Answer: 1200 N

==========

143. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

A force F of strength 20 N acts on an object of mass 3 kg as it moves a distance of 4 m. If F is perpendicular to the 4 m displacement, the work it does is equal to

W) 0 J

X) 60 J

Y) 80 J

Z) 600 J

Toss Up Answer: W

Bonus: Short Answer

Under the influence of a force, an object of mass 4 kg accelerates from 3 m/s to 6 m/s in 8 s. How much work was done on the object during this time?

Bonus Answer: 54 J

==========

144. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

An object of mass 2 kg has a linear momentum of magnitude 6 kg • m/s. What is this object's kinetic energy?

W) 3 J

X) 6 J

Y) 9 J

Z) 12 J

Toss Up Answer: Y

Bonus: Short Answer

Two objects, one of mass 3 kg and moving with a speed of 2 m/s and the other of mass 5 kg and speed 2 m/s, move toward each other and collide head-on. If the collision is perfectly inelastic, find the speed of the objects after the collision.

Bonus Answer: 0.5 m/s

==========

145. PHYSICS

Writer: Shanjeed Ali

Toss Up: Short Answer

How many orbitals are there in the third electron shell?

Bonus Answer: 9

Bonus: Short Answer

Who discovered the neutron?

Bonus Answer: James Chadwick

==========

146. PHYSICS

Writer: Nicholas Adit

Toss Up: Short Answer

The mean distance from Saturn to the sun is 9 times greater than the mean distance from Earth to the sun. How long is a Saturn year?

Bonus Answer: 27 Earth years

Bonus: Short Answer

An object moves at constant speed in a circular path. True statements about the motion include which of the following?

I. The velocity is constant.

II. The acceleration is constant.

III. The net force on the object is zero since its speed is constant.

Bonus Answer: None of them (The vectors are changing)

==========

147. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

A sphere of charge +Q is fixed in position. A smaller sphere of charge +q is placed near the larger sphere and released from rest. The small sphere will move away from the large sphere with

W) decreasing velocity and acceleration

X) decreasing velocity and increasing acceleration.

Y) increasing velocity and decreasing acceleration.

Z) increasing velocity and increasing acceleration.

Toss Up Answer: Y

Bonus: Short Answer

If the distance between two positive point charges is tripled, then the strength of the electrostatic repulsion between them will decrease by a factor of

Bonus Answer: 9

==========

148. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

Negative charges are accelerated by electric fields toward points

W) at lower electric potentials

X) at higher electric potentials

Y) where the electric field is weaker

Z) where the electric field is stronger

Toss Up Answer: X

Bonus: Multiple Choice

The potential at point A in an electric field is 10V higher than at point B. If a negative charge, q = –2 C, is moved from point A to point B, then the potential energy of this charge will

W) decrease by 20 J

X) decrease by 5 J

Y) increase by 5 J

Z) increase by 20 J

Bonus Answer: Z

==========

149. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

For an ohmic conductor, doubling the voltage without changing the resistance will cause the current to

W) decrease by a factor of 2

X) decrease by a factor of 4

Y) increase by a factor of 4

Z) increase by a factor of 2

Toss Up Answer: Z

Bonus: Short Answer

If a 60-watt lightbulb operates at a voltage of 120 V, what is the resistance of the bulb?

Bonus Answer: 240 ohms

==========

150. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

A charge of mass m and charge q is moving in a circle of radius r and speed v due to a uniform magnetic field B. If the speed is doubled to 2v, what happens to the period, T ?

W) T increases by a factor of 2

X) T increases by a factor of 4

Y) T stays the same

Z) T decreases by a factor of 2

Toss Up Answer: Y

Bonus: Short Answer

A particle of charge –0.04 C is projected with speed 2 × 104 m/s into a uniform magnetic field, B, of strength 0.5 T. If the particle's velocity as it enters the field is perpendicular to B, what is the magnitude of the magnetic force on this particle?

Bonus Answer: 400 N

==========

151. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

What is the wavelength of a 5 Hz wave that travels with a speed of 10 m/s ?

W) 0.25 m

X) 0.5 m

Y) 1 m

Z) 2 m

Toss Up Answer: Z

Bonus: Short Answer

A string, fixed at both ends, supports a standing wave with a total of 4 nodes. If the length of the string is 6 m, what is the wavelength of the wave?

Bonus Answer: 4 m

==========

152. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Which of the following is NOT true?

W) the magnetic field associated with the current on a straight long wire is inversely proportional to the distance from the wire

X) Kirchhoff's first rule has to do with the accounting of total charges entering and leaving a junction per unit time

Y) Y) superconducting quantum interference devices, or SQUID's, are based on the Josephson Effect

Z) resistance and voltage are the two most common parameters used to characterize a resistor

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following is the strongest spectral line in the visible
region of the hydrogen spectrum

W) red Balmer line

X) orange Lyman line

Y) green Paschen line

Z) blue Brackett line

Bonus Answer: W

==========

153. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

If 1000 pounds is applied to a spring with spring constant of 100

pounds per inch on top of a hydraulic piston, how many pounds of force is transferred to the piston?
Bonus Answer: 1000

Bonus: Short Answer
If g = 9.8 meters per second squared, to the first decimal place and in
newtons, how many newtons of force are required to keep a 500 kilogram table of granite moving across a horizontal surface at constant speed if there is a kinetic frictional coefficient of 0.10 between the surface and the table?
Bonus Answer: 490 N

==========

154. PHYSICS

Writer: Aaron Gee
Toss Up: Multiple Choice
If the atomic mass of carbon-12 is exactly 12 atomic mass units,
why is the atomic mass of carbon not exactly 12 when listed on the Periodic Table?
W) mass deficit
X) neutrons are not the same mass as protons
Y) it adds mass of electrons
Z) the presence in nature of about 1.1% carbon-13
Toss Up Answer: Z

Bonus: Short Answer
If 2500 pounds is applied to a spring with spring constant of 100
pounds per inch on top of a hydraulic piston, how many pounds of force is transferred to the piston:
Bonus Answer: 2500

==========

155. PHYSICS

Writer: Aaron Gee
Toss Up: Short Answer
How many nodes are there in the first overtone in a standing wave of
a vibrating guitar string?
Bonus Answer: 3

Bonus: Short Answer
If g = 9.8 meters per second squared, to the first decimal place and in
newtons, how many newtons of force are required to keep a 450 kilogram slab of granite moving across a horizontal surface at constant speed if there is a kinetic frictional coefficient of 0.20 between the surface and the slab?
Bonus Answer: 882 N

==========

156. PHYSICS

Writer: Aaron Gee
Toss Up: Multiple Choice
e Often some of the strongest spectral lines in cold interstellar gas are
produced by
W) neutral lithium
X) ionized iron
Y) carbon and iron
Z) calcium and sodium
Toss Up Answer: Z

Bonus: Short Answer

The cosmic background radiation discovered by Penzias and Wilson closely matches the radiation from a black body with what temperature Kelvin, to the nearest whole number?

Bonus Answer: 3

==========

157. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

The process in which an atom reradiates a photon after interacting
with an incident photon of the same energy is called:
W) Cooleo Theorem
X) the Cherenkov effect
Y) Bragg's Law
Z) Thomson scattering

Toss Up Answer: Z

Bonus: Multiple Choice

A protanomalous person has decreased sensitivity of the red cones
in his or her eyes. Which of the following color pairs will this person have difficulty distinguishing between:
W) black and yellow
X) blue green
Y) purple blue
Z) red and yellow

Bonus Answer: Y

==========

158. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

In a compound gearing arrangement where a 40-tooth gear drives
an 80-tooth gear which is directly connected to a 50-tooth gear that drives a 100-tooth gear, the total reduction is a factor of:
W) 2
X) 6
Y) 4
Z) 21

Toss Up Answer: Y

Bonus: Multiple Choice

Elastic deformation is BEST described as ...
W) the linear portion of a stress/strain curve
X) 99% elongation
Y) stregnth of a material
Z) deformation

Bonus Answer: W

==========

159. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What specific type of semiconductor is produced by adding phosphorus to silicon?

Bonus Answer: N-Type

Bonus: Short Answer

How many turns are in the secondary coil of a transformer that has a primary coil with 20,000 turns and is designed to step down 12,000 volts AC to 120 volts AC?

Bonus Answer: 200

==========

160. PHYSICS

Writer: Aryan Bhatt

Toss Up: Short Answer

If the distance between two objects is halved and the mass of one of them is doubled, what happens to the gravitational force between them?

Bonus Answer: It is halved (prompt on decreases)

Bonus: Multiple Choice

Which of the following is NOT a factor that affects the force of gravity between them?

W) The distance between them

X) The mass of the more massive object

Y) The density of the less massive object

Z) The mass of the less massive object

Bonus Answer: Y

==========

161. PHYSICS

Writer: Brian Lim

Toss Up: Short Answer

When measured in meters, visible light has a wavelength with what order of magnitude?

Bonus Answer: 10^-7

Bonus: Multiple Choice

The indices of refraction for various materials are typically measured with what type of light?

W) Red light

X) Yellow light

Y) Green Light

Z) Blue Light

Bonus Answer: X

==========

162. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

What best describes the relationship between a planet's escape velocity and its radius and mass?

W) Escape velocity increases as radius increases or mass increases

X) Escape velocity increases as radius increases or mass decreases

Y) Escape velocity increases as radius decreases or mass increases

Z) Escape velocity increases as radius decreases or mass decreases

Toss Up Answer: Y

Bonus: Multiple Choice

In terms of the permittivity of free space, denoted as ε0[epsilon naught], and the permeability of free space, denoted as μ0[mu naught], which expression is equivalent to the speed of light?

W) ε0*μ0

X) 1/(ε0*μ0)

Y) ε0/μ0

Z) 1/sqrt(ε0*μ0)

Bonus Answer: Z

==========

163. PHYSICS

Writer: Brian Lim

Toss Up: Short Answer

What law of physics states that a planet orbiting a single star moves in an elliptical orbit?

Bonus Answer: Kepler's First Law [of Planetary Motion]

Bonus: Short Answer

If a charged particle enters a uniform magnetic field at an angle of 45 degrees to the field direction, what is the geometry of the path of the particle?

Bonus Answer: Helix [or helical]

==========

164. PHYSICS

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which statement describes a situation when polarization could not occur?

W) Light waves are reflected.

X) Light waves are scattered.

Y) Microwaves pass through a metal grid.

Z) Sound waves pass through a metal grid.

Toss Up Answer: Z

Bonus: Multiple Choice

An electromagnetic wave has a wavelength that is numerically of the same order of magnitude as the diameter of a nucleus.

In which region of the electromagnetic spectrum does the wave occur?

W) Gamma ray

X) X-ray

Y) Visible light

Z) Infra-red

Bonus Answer: W

==========

165. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What is the resulting electrical potential, in volts, when a charge of 12
coulombs is applied to a 1 farad capacitor?

Bonus Answer: 12 volts

Bonus: Short Answer

If 1000 pounds is applied to a spring with spring constant of 100
pounds per inch on top of a hydraulic piston, how many pounds of force is transferred to the piston?

Bonus Answer: 1,000

==========

166. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

Given that the specific heat capacity of water is 11 times that of copper, calculate the mass of copper at a temperature of 100 °C required to raise the temperature of 200 g of water from 20.0 °C to 24.0 °C, assuming no energy is lost to the surroundings.

Bonus Answer: 0.116 kg

Bonus: Short Answer

1 kg of water at a temperature of 45 °C is mixed with 1.5 kg of alcohol at 20 °C. Find the final temperature of the mixture.

Take the specific heat capacity of water to be 4200 J kg –1 K –1 and the specific heat capacity of alcohol to be 2400 J kg –1 K –1 . Assume no other exchange of heat occurs.

Bonus Answer: 33°C

==========

167. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Whose principle or law states that each point on a wavefront may be considered a new wave source?

W) Snell's Law
X) Huygen's principle
Y) Young's Law
Z) Hertz's Law

Toss Up Answer: X

Bonus: Multiple Choice

The wave nature of light is demonstrated by which of the following?
W) Diffraction
X) Color
Y) Length
Z) Speed of light

Bonus Answer: W

==========

168. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

The collision between a photon and a free electron was first explained by which of the following scientists?
W) Compton
X) Hertz

Y) Einstein
Z) Newton

Toss Up Answer: W

Bonus: Multiple Choice
The Tesla and the Gauss are units of measure of
W) magnetic fieild strength
X) conductance
Y) light
Z) electrical current

Bonus Answer: W

==========

169. PHYSICS

Writer: Aaron Gee

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

Bonus Answer: Plasma

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

Bonus Answer: Time

==========

170. PHYSICS

Writer: Aaron Gee

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

Bonus Answer: 1250 meters/second

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

Bonus Answer: 2 meters

==========

171. PHYSICS

Writer: Aaron Gee

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

Bonus Answer: 90 degrees

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

Bonus Answer: Electrons act like waves

==========

172. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

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

Bonus Answer: 8/3 or 2.66 meters in front of the mirror

Bonus: Multiple Choice

A standing wave is formed on a tightly stretched string. The distance between a node and an antinode is how many wavelengths?

W) 1/2
X) 1/4
Y) 1/8
Z) 1

Bonus Answer: X

==========

173. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

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

Bonus Answer: 2 meters

Bonus: Multiple Choice

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

W) quantized
X) random
Y) discontinuous
Z) nonexistant

Bonus Answer: W

==========

174. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

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

Bonus Answer: 5 times 10-2 Farads

Bonus: Short Answer

To convert a galvanometer to a voltmeter, you should add what to a series?

Bonus Answer: high resistance

==========

175. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

As a pendulum is raised to higher altitudes, its period?

Bonus Answer: Increases

Bonus: Short Answer

The SI unit of pressure is?

Bonus Answer: Pascal

==========

176. PHYSICS

Writer: Kerwin Chen

Toss Up: Multiple Choice

Which of the following accurately describes the setup of Young's double slit experiment?

W) single light source, monochromatic

X) multiple light sources, monochromatic

Y) single light source, polychromatic

Z) multiple light sources, polychromatic

Toss Up Answer: W

Bonus: Short Answer

Which scientist is famous for their single slit diffraction experiment?

Bonus Answer: Fraunhofer, Joseph Fraunhofer, Joseph von Fraunhofer

==========

177. PHYSICS

Writer: Kerwin Chen

Toss Up: Short Answer

What type of surface does diffuse reflection occur on?

Bonus Answer: rough

Bonus: Short Answer

What type of scattering is responsible for the blue color of our sky?

Bonus Answer: Rayleigh scattering

==========

178. PHYSICS

Writer: Kerwin Chen

Toss Up: Short Answer

What are substances that deforms continuously when subjected to shearing called?

Bonus Answer: fluids

Bonus: Short Answer

Which class of lasers is the most dangerous?

Bonus Answer: Class 4

==========

179. PHYSICS

Writer: Larry Wong

Toss Up: Short Answer

The acceleration due to gravity on the Earth's surface is

Bonus Answer: 9.8 m/s^2

Bonus: Multiple Choice

Which of the following quantities is a scalar?

W) acceleration

X) force

Y) speed

Z) velocity

Bonus Answer: Y

==========

180. PHYSICS

Writer: Ivan Zhang

Toss Up: Short Answer

What is the speed of light in km per second?

Bonus Answer: about 1.079 10^9 km per second

Bonus: Short Answer

What equation relates and connects the the concepts of mass and energy?

Bonus Answer: e = mc^2

==========

181. PHYSICS

Writer: Banpreet Singh

Toss Up: Multiple Choice

Work is a

W) vector

X) scaler

Y) cross product

Z) an imaginary number

Toss Up Answer: X

Bonus: Short Answer

What is the greek letter for angular velocity

Bonus Answer: Omega

==========

182. PHYSICS

Writer: Banpreet Singh

Toss Up: Short Answer

Since the specific gravity of lead is 11.35, it is how

many times as dense as water?

Bonus Answer: 11.35

Bonus: Short Answer

What Greek letter denotes angular acceleration?

Bonus Answer: alpha

==========

183. PHYSICS

Writer: Brian Lim

Toss Up: Short Answer

What is the charge of a muon?

Bonus Answer: -1 [or -1e]

Bonus: Multiple Choice

As an object falls freely, how does the energy of the object change?

W) kinetic energy and potential energy both increase

X) kinetic energy and potential energy both decrease

Y) kinetic energy increases while potential energy decreases
Z) kinetic energy decreases while potential energy increases

Bonus Answer: Y

==========

184. PHYSICS

Writer: Brian Lim

Toss Up: Short Answer

What is the term for the conditions at which a substance begins behaving like a supercritical fluid?

Bonus Answer: critical point

Bonus: Multiple Choice

What property can be used to determine the amount of energy of a photon?
W) speed
X) direction
Y) polarization
Z) frequency

Bonus Answer: Z

==========

185. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

For a solid sphere rotating about its center whose mass is uniformly distributed, what expression is equivalent to the moment of inertia?
W) mr^2
X) 1/2mr^2
Y) 2/3mr^2
Z) 2/5mr^2

Toss Up Answer: Z

Bonus: Multiple Choice

For a rod with uniformly distributed mass, what is the ratio between the moment of the inertia about its center to the moment of inertia about one of its ends?
W) 1/4
X) 1/2
Y) 2
Z) 4

Bonus Answer: W

==========

186. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

An object travels through a fluid. What is the relationship between drag force and speed?
W) linear relationship
X) square relationship
Y) exponential relationship
Z) no relationship

Toss Up Answer: X

Bonus: Multiple Choice

A person holding a heavy ball with outstretched arms spins in place while sitting in a chair. The person brings the ball closer. What happens to the angular velocity of the person?

W) it increases

X) it decreases

Y) it stays constant

Z) it increases and then decreases

Bonus Answer: W

==========

187. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

What best describes the index of refraction of air?

W) it is slightly greater than 0

X) it is slightly less than 0

Y) it is slightly greater than 1

Z) it is slightly less than 1

Toss Up Answer: Y

Bonus: Short Answer

the speed of light in a particular medium is 2.0x10^8 m/s. What is the index of refraction of the medium?

Bonus Answer: 1.5

==========

188. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

What type of light cannot be given off by a laser?

W) ultraviolet

X) red

Y) green

Z) white

Toss Up Answer: Z

Bonus: Short Answer

What is the term for the radiation of a perfectly opaque and non-reflective body?

Bonus Answer: blackbody radiation

==========

189. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

An object slides across a horizontal surface and eventually comes to a stop. What is true of the object?

W) its kinetic energy was converted to thermal energy

X) the energy related to the motion of the object was destroyed

Y) the kinetic energy of the object stayed constant

Z) the potential energy of the object increased

Toss Up Answer: W

Bonus: Short Answer

What unit is defined as the energy needed to raise the temperature of a gram of liquid water by 1 degree Celsius?

Bonus Answer: calorie

==========

190. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

Which of the following is a process used to produce an alternating current in an electric generator?

W) a loop of wire is spun in a magnetic field

X) a loop of wire is pushed in the direction of a magnetic field

Y) a loop of wire is pushed perpendicular to a magnetic field

Z) a magnet is pushed towards a wire

Toss Up Answer: W

Bonus: Short Answer

What is the SI unit for magnetic flux?

Bonus Answer: weber

==========

191. PHYSICS

Writer: Mohammed Jamil

Toss Up: Multiple Choice

A loaded freight car A with a mass of 14,000 kg moves at a constant velocity of 15 m/s on a horizontal railroad track and collides with an empty car B with a mass of 6,000 kg moving at 5 m/s. After the collision the cars stick to each other and moves like one object. What is the velocity of two cars after the collision?

W) 6 m/s

X) 8 m/s

Y) 10 m/s

Z) 12 m/s

Toss Up Answer: Z

Bonus: Multiple Choice

When two objects collide elastically the momentum is conserved. Which of the following is true about the kinetic energy during the collision?

W) The kinetic energy is lost

X) The kinetic energy is gained

Y) The kinetic energy is conserved

Z) The kinetic energy completely transforms into thermal energ

Bonus Answer: Y

==========

192. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A bullet travels through the air, it slows down due to air resistance. How does the bullet’s momentum change as a result?

Bonus Answer: The bullet’s momentum decreases as its speed decreases.

Bonus: Short Answer

How can a small force produce a large change in momentum ?

Bonus Answer: A small force can produce a large change in momentum if the force acts on an object for a long period of time.

==========

193. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A horse moves a sleigh 1.00 kilometer by applying a horizontal 2,000-newton force on its harness for 45 minutes. What is the power of the horse?

Bonus Answer: 741 watts

Bonus: Short Answer

A force of 100 newtons is used to move an object a distance of 15 meters with a power of 25 watts. Find the work done and the time it takes to do the work.

Bonus Answer: work = 1,500 joules; time = 60 seconds

==========

194. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A bulldozer does 30,000 joules of work to push another boulder a distance of 20 meters. How much force is applied to push the boulder?

Bonus Answer: 1,500 N

Bonus: Short Answer

A 450-newton gymnast jumps upward a distance of 0.50 meters to reach the uneven parallel bars. How much work,in joules, did she do before she even began her routine ?

Bonus Answer: 225

==========

195. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A conveyor-belt, horizontally, moves a 600Kg bag a distance of 100 meters through the airport.How much work was done?

Bonus Answer: No work was done

Bonus: Short Answer

A dryer has a power rating of 2500 watts. To dry a few towels this dryer uses 6,750,000 joules of energy. How long will it take to dry these towels, in minutes

Bonus Answer: 45 minutes

==========

196. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A 1-kilogram ball is thrown into the air with an initial velocity of 30 m/sec. How high in the air did it travel ?

Bonus Answer: 46 meters

Bonus: Short Answer

What is the velocity of an 500-kilogram elevator that has 4,000 joules of energy?

Bonus Answer: 4 m/sec

==========

197. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What was the first object created by people that produces a sonic boom (albeit a very small one)?

W) Bullet

X) Bullwhip

Y) Slingshot

Z) Jet Plane

Toss Up Answer: X

Bonus: Multiple Choice

What kind of semiconductors are essentially all pure semiconductor material?

W) p-type

X) n-type

Y) intrinsic

Z) extrinsic

Bonus Answer: Y

==========

198. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What French physicist, living from 1623-1662, discovered the basic principlesof pressures on fluids?

W) Andre Marie Ampere

X) Charles-Augustin de Coulomb

Y) Joseph-Louis Lagrange

Z) Blaise Pascal

Toss Up Answer: Z

Bonus: Multiple Choice

Supersymmetry is a proposed extension of space-time symmetry relating what 2 basic classes of elementary particles?

W) Bosons and Fermions

X) Hadrons and Leptons

Y) Leptons and Mesons

Z) Fermions and Mesons

Bonus Answer: W

==========

199. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What did Ernest Orlando Lawrence develop in 1932?

W) Nuclear Reactor

X) The Microwave

Y) Cyclotron

Z) X-Ray Machine

Toss Up Answer: Y

Bonus: Short Answer

What theory first appeared in a 1905 paper called "On the Electrodynamics of Moving Bodies"?

Bonus Answer: Special Theory of Relativity

==========

200. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Who discovered radioactivity in 1896?

W) Wilhelm Rontgen

X) Henri Becquerel

Y) Marie Curie

Z) Albert Einstein

Toss Up Answer: X

Bonus: Multiple Choice

What is made by joining an N-type and P-type semiconductor material?

W) Transistor

X) Diode

Y) Capacitor

Z) Collector

Bonus Answer: X

==========

201. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What quantity of a magnet determines the torque it will experience in an external magnetic field?

W) Multipole Expansion

X) Dipole Inversion

Y) Magnetic Moment

Z) Hysteresis Loop

Toss Up Answer: Y

Bonus: Multiple Choice

What Dutch physicist, living from 1626-1695, pioneered the use of the pendulum in clocks?

W) Willems Gravesande

X) Hans Christian Oersted

Y) Nicolas Hartsoeker

Z) Christiaan Huygens

Bonus Answer: Z

==========

202. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

Which of the 6 quarks is the lightest?

Bonus Answer: Up

Bonus: Multiple Choice

What is the "formal" SI unit of elementary particle spin?

W) joule-second

X) spin-h (planck constant)

Y) joule-plancktime

Z) spinor-second

Bonus Answer: W

==========

203. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What is studied in ballistics?

W) explosive impact of chemicals

X) speeds of atomic particles

Y) travel of sound

Z) motion of projectiles

Toss Up Answer: Z

Bonus: Multiple Choice

What is it called when all possible states of a system are represented, with each possible state corresponding to 1 unique point?

W) Boltzmann Set

X) Phase Space

Y) Poincare Space

Z) Configuration Space

Bonus Answer: X

==========

204. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Whose law defines the relationship between angle of incidence and of refraction?

W) Snell's

X) DeBroglie's

Y) Kepler's

Z) Carnot's

Toss Up Answer: W

Bonus: Short Answer

What are the names of Hydrogen's three isotopes?

Bonus Answer: Protium, Deuterium, Tritium (accept: Hydrogen, Deuterium, Tritium)

==========

205. PHYSICS

Writer: Ashneel Das

Toss Up: Short Answer

Given that the acceleration due to gravity on earth is 9.8 m/s, what is the velocity of a ball 1 second after it is dropped (neglect air resistance)?

Bonus Answer: 9.8 m/s

Bonus: Short Answer

If a ball is thrown directly upwards with a velocity of 49 m/s, after how many seconds will the ball be at the top of its path?

Bonus Answer: 5 seconds

==========

206. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

By name or number, which of these is a non-newtonian fluid?

1. Ketchup
2. Water
3. Custard
4. Toothpaste

Bonus Answer: 1,3,4

Bonus: Multiple Choice

What two parts comprise a semiconductor crystal?

W) Lattice and Symmetry

X) Motif and Basis

Y) Motif and Symmetry

Z) Basis and Lattice

Bonus Answer: Z

==========

207. PHYSICS

Writer: Ashneel Das

Toss Up: Multiple Choice

A car drives 3 blocks west and 4 blocks north. What is the total displacement of the car?

W) 7 blocks northwest

X) 5 blocks northwest

Y) 1 block northwest

Z) 4 blocks northwest

Toss Up Answer: X

Bonus: Short Answer

A cart has a mass of 3 kg and moves with a velocity of 2 m/s towards another cart with mass 3 kg. Find the velocity of the two carts after the first cart collides with the second.

Bonus Answer: 1 m/s

==========

208. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

What is the thrust of a rocket ejecting fuel at 200 kg/s and with an exhaust velocity of 1500 m/s?

W) 30000 newton meters

X) 60000 newton meters

Y) 90000 newton meters

Z) 300000 newton meters

Toss Up Answer: W

Bonus: Multiple Choice

A solid disk with a rotational inertia of 5 kg*m^2 (READ AS: kilogram meters squared) and a radius of 0.25 m rotates on a fixed axis perpendicular to the disk and through its center. If a force of 2 N is applied tangentially to the disk, what is the work done by the force after half of a revolution to the nearest tenth?

W) 0.4 J
X) 0.8 J
Y) 1.6 J
Z) 3.1 J

Bonus Answer: Y

==========

209. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

A heated 8 kg ring with a radius of 4m cools as it rotates, causing it to shrink to a radius of 2m. If it was initially rotating at 6 rad/s, what is it's final angular velocity?

Bonus Answer: 24 rad/s

Bonus: Short Answer

A 120-N child sits on a light swing and is pulled back and held with a horizontal force of 90 N. What is the magnitude of the tension force in each of the two supporting ropes?

Bonus Answer: 75 N

==========

210. PHYSICS

Writer: Aaron Gee

Toss Up: 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) 2400
X) 1000
Y) 3000
Z) 5000

Toss Up Answer: Y

Bonus: Multiple Choice

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?

W) 10
X) 6
Y) 1.8
Z) 2.8

Bonus Answer: Y

==========

211. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

Two forces have magnitudes of 11 newtons and 5 newtons. What's the highest value of their magnitude?

Bonus Answer: 16 N

Bonus: 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 m/s^2

==========

212. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

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

Bonus Answer: 200 Coloumbs

Bonus: Multiple Choice

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

W) 0
X) Infinity
Y) Nonexistant
Z) 1

Bonus Answer: W

==========

213. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

An infinitely long wire carries a current of three amps. How does the magnetic field outside the wire look like?

Bonus Answer: Circles the wire

Bonus: Short Answer

Iron is what type of magnetic material?

Bonus Answer: ferromagnetic

==========

214. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

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

Bonus Answer: Straight line

Bonus: Multiple Choice

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

W) A/d squared
X) A times d
Y) A divided by d
Z) d divided by A

Bonus Answer: Y

==========

215. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

To determine if a rigid body is in equilibrium the vector sum of the gravitational forces acting on the particles of the body can be replaced by a single force acting at which point?
W) the center of mass
X) the geometrical center
Y) the center of gravity
Z) a point on the boundary

Toss Up Answer: Y

Bonus: Short Answer

A uniform 120-N planck is supported by two forces acting at one end and at a point halfway to the planck center. What are the magnitudes of these two forces?

Bonus Answer: 80, 160

==========

216. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

A cube with 2-m sides and a bulk modulus of 4*10^5 N/m^2 (READ 4 times 10 to the sixth newton meters squared). When it's subjected to a pressure of 2*10^5 Pa, what is the resulting volume of the cube?
W) 0.5m^3
X) 2m^3
Y) 3m^3
Z) 4m^3

Toss Up Answer: Z

Bonus: Multiple Choice

A 4.0-m long steel beam with a cross-sectional area of 1.0 × 10^−2 m^2 and a Young’s modulus of 2.0 × 10^11 N/m^2 is wedged horizontally between two vertical walls. In order to wedge the beam, it is compressed by 0.020mm. If the coefficient of static friction between the beam and the walls is 0.70, what is the maximum mass (including its own) it can bear without slipping?
W) 700kg
X) 710kg
Y) 900kg
Z) 910kg

Bonus Answer: X

==========

217. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

The mass of the planet Yor'Ectum is 1/100 that of Earth and its radius is 1/4 that of Earth. If a person weighs 600N on Earth, what would he weigh on Yor'Rectum?

Bonus Answer: 96N

Bonus: Multiple Choice

The escape speed at the surface of Earth is approximately 8 km/s. What is the mass, in units of Earth's mass, of a planet with twice the radius of Earth for which the escape speed is twice that for Earth?

W) 2

X) 4

Y) 8

Z) 1/2

Bonus Answer: Y

==========

218. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

An object is dropped from an altitude of one Earth radius above Earth's surface. In terms of M, the mass of Earth, and R, Earth's radius, what is the speed of the object just before it hits Earth?

Bonus Answer: sqrt(GM/R) (READ AS: square root of GM over R)

Bonus: Short Answer

Two particles, each of mass m, are a distance d apart. If an external force brings a third particle, with mass 2m, from far away to a resting point midway between the two particles, what is the work done by this force?

Bonus Answer: −8Gm^2/d^2

==========

219. PHYSICS

Writer: Andrew Zheng

Toss Up: Multiple Choice

An artificial satellite orbiting Earth above North America releases a bomb. Neglecting air resistance, the bomb will do which one of the following?

W) strike North America at the instant of release

X) strike China at the instant of impact

Y) never strike Earth

Z) strike China at the instant of release

Toss Up Answer: Y

Bonus: Short Answer

In planetary motion the line from the star to the planet sweeps out equal areas in equal times. This is a direct consequence of which law?

Bonus Answer: law of conservation of angular momentum (DO NOT ACCEPT Kepler's Second Law)

==========

220. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

Assume that Earth is in circular orbit around the Sun with kinetic energy K and potential energy U, taken to be zero for infinite separation. What is the relationship between K and U?

Bonus Answer: K = -U/2 (accept equivalent forms)

Bonus: Multiple Choice

A planet is in circular orbit around the Sun. Its distance from the Sun is four times the average distance of Earth from the Sun. The period of this planet, in Earth years, is:

W) 4
X) 8
Y) 16
Z) 64

Bonus Answer: X

==========

221. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

If a wheel is turning at 3.0/PI rad/s, what is it's period?

W) 3.14
X) 6.58
Y) 8.73
Z) 9.67

Toss Up Answer: X

Bonus: Multiple Choice

What is the total energy of a block attached to a spring with spring constant of 50 N/m if the block's velocity corresponds to the equation, v(t) = 10sin(2t) (READ AS: v of t equals 10 times sin of quantity 2*t)?

W) 100 J
X) 125 J
Y) 250 J
Z) 500 J

Bonus Answer: X

==========

222. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

A wheel starts from rest and has an angular acceleration that is given by α(t) = (6 rad/s^4)t^2 (READ AS: 6 radians per seconds to the fourth times t squared). What is the angle the wheel turns through after time t?

W) [(1/8)t^4] rad
X) [(1/4)t^4] rad
Y) [(1/2)t^4] rad
Z) [t^4] rad

Toss Up Answer: Y

Bonus: Short Answer

String is wrapped around the periphery of a 5.0-cm radius cylinder, free to rotate on its axis. The string is pulled straight out at a constant rate of 10 cm/s and does not slip on the cylinder. As each small segment of string leaves the cylinder, what does its acceleration change by?

Bonus Answer: 0.2 m/s^2

==========

223. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

What is the unit of the quantity 1/(4PIe_o) (READ AS: 1 over 4 times Pi times epsilon naught)?

Bonus Answer: N*m^2/C^2 (READ AS: newton meters squared over coulomb squared)

Bonus: Short Answer

An time-varying electric field is given by (24t^2 N/C)*i + (30t N/C)*j + (16/t N/C) *k. What is its flux at time t=2 as it passes through a region in the y-z plane whose area is given by A(t)=2t?

Bonus Answer: 112 N/C

==========