As a 2.0-kg block travels around a 0.50-m radius circle it has an angular speed of 12 rad/s. The circle is parallel to the xy plane and is centered on the z axis, a distance of 0.75m from the origin. The z component of the angular momentum around the origin is:

- **6.0kg · m2/s**
- 9.0kg · m2/s
- 11 kg · m2/s
- 14 kg · m2/s

A net torque applied to a rigid object always tends to produce:

- linear acceleration
- rotational equilibrium
- **angular acceleration**
- rotational inertia

An object attached to one end of a spring makes 20 vibrations in 10 s. Its angular frequency is:

- 1.57 rad/s
- **2.0 rad/s**
- 6.3 rad/s

In simple harmonic motion, the restoring force must be proportional to the:

- amplitude
- frequency
- velocity

► **displacement**

Mercury is a convenient liquid to use in a barometer because:

► it is a metal

► it has a high boiling point

► it expands little with temperature

► **it has a high density**

The units of the electric field are:

► **J/m**

► J/(C·m)

► J/C

► J·C

A farad is the same as a

► **J/V**

► V/J

► C/V

► V/C

We desire to make an LC circuit that oscillates at 100 Hz using an inductance of 2.5H. We also need a capacitance of:

► 1 F

► 1mF

► 1 µF

► **100 µF**

The wavelength of red light is 700 nm. Its frequency is _____.

- 4.30 * 104 Hertz
- 4.30 * 103 Hertz
- **4.30 * 105 Hertz**
- 4.30 * 102 Hertz

Which of the following statements is NOT TRUE about electromagnetic waves?

- Electromagnetic waves satisfy the Maswell's Equation.
- Electromagnetic waves can not travel through space.
- The receptions of electromagnetic waves require an antenna.
- **The electromagnetic radiation from a burning candle is unpolarized.**

Radio waves and light waves are _____.

- Longitudinal waves
- Transverse waves
- **Electromagnetic and transverse both**
- Electromagnetic and longitudinal both

Wien's Law states that, *lmax* = _____ K.

- 2.90 * 10-3 Hertz
- 2.90 * 10-3 s
- 2.90 * 10-3 kg
- **2.90 * 10-3 m**

Interference of light is evidence that:

- the speed of light is very large

- light is a transverse wave
- **light is a wave phenomenon**
- light is electromagnetic in character

Fahrenheit and Kelvin scales agree numerically at a reading of:

- **-40**
- 0
- 273
- 574

According to the theory of relativity:

- **moving clocks run fast**
- energy is not conserved in high speed collisions
- the speed of light must be measured relative to the ether
- none of the above are true

Light from a stationary spaceship is observed, and then the spaceship moves directly away from the observer at high speed while still emitting the light. As a result, the light seen by the observer has:

- higher frequency and a longer wavelength than before
- **lower frequency and a shorter wavelength than before**
- higher frequency and a shorter wavelength than before
- lower frequency and a longer wavelength than before

How fast should you move away from a 6.0 × 1014 Hz light source to observe waves with a frequency of 4.0 × 1014 Hz?

- 20c
- **38c**
- 45c
- 51c

The quantum number n is most closely associated with what property of the electron in a hydrogen atom?

- **Energy**
- Orbital angular momentum
- Spin angular momentum
- Magnetic moment

The quantum number ms is most closely associated with what property of the electron in an atom?

- Magnitude of the orbital angular momentum
- **Energy**
- z component of the spin angular momentum
- z component of the orbital angular momentum

As the wavelength of a wave in a uniform medium increases, its speed will _____.

- Decrease
- Increase
- **Remain the same**
- None of these

The number of significant figures in 0.00150 is:

- 5
- 4
- 3
- 2

For a body to be in equilibrium under the combined action of several forces:

- All the forces must be applied at the same point
- all of the forces form pairs of equal and opposite forces
- any two of these forces must be balanced by a third force
- the sum of the torques about any point must equal zero

A bucket of water is pushed from left to right with increasing speed across a horizontal surface. Consider the pressure at two points at the same level in the water.

- It is the same
- It is higher at the point on the left
- It is higher at the point on the right
- At first it is higher at the point on the left but as the bucket speeds up it is lower there

An organ pipe with both ends open is 0.85m long. Assuming that the speed of sound is 340m/s, the frequency of the third harmonic of this pipe is:

- 200 Hz
- 300 Hz

- 400 Hz
- **600 Hz**

Capacitors C1 and C2 are connected in series. The equivalent capacitance is given by

- C1C2/(C1 + C2)
- (C1 + C2)/C1C2
- 1/(C1 + C2)
- C1/C2

If the potential difference across a resistor is doubled:

- only the current is doubled
- only the current is halved
- only the resistance is doubled
- only the resistance is halved

By using only two resistors, R1 and R2, a student is able to obtain resistances of 3 _, 4_, 12_, and 16 _. The values of R1 and R2 (in ohms) are:

- 3, 4
- 2, 12
- 3, 16
- 4, 12

Faraday's law states that an induced emf is proportional to:

- the rate of change of the electric field
- the rate of change of the magnetic flux

- the rate of change of the electric flux
- the rate of change of the magnetic field

A generator supplies 100V to the primary coil of a transformer. The primary has 50 turns and the secondary has 500 turns. The secondary voltage is:

- 1000V
- 500V
- 250V
- 100V

Which of the following electromagnetic radiations has photons with the greatest energy?

- blue light
- yellow light
- x rays
- radio waves

A virtual image is one:

- toward which light rays converge but do not pass through
- from which light rays diverge as they pass through
- toward which light rays converge and pass through
- from which light rays diverge but do not pass through

What is the unit of magnification factor?

- meter.Kelvin
- radian.Kelvin

- degree.Kelvin
- no units

During an adiabatic process an object does 100 J of work and its temperature decreases by 5K. During another process it does 25 J of work and its temperature decreases by 5 K. Its heat capacity for the second process is.

- 20 J/K
- 100 J/K
- 15 J/K
- 5 J/K

An ideal gas expands into a vacuum in a rigid vessel. As a result there is:

- a change in entropy
- a decrease of internal energy
- an increase of pressure
- a change in temperature

The Stern-Gerlach experiment makes use of:

- a strong uniform magnetic field
- a strong non-uniform magnetic field
- a strong uniform electric field
- a strong non-uniform electric field

A large collection of nuclei are undergoing alpha decay. The rate of decay at any instant is proportional to:

- the number of undecayed nuclei present at that instant

- the time since the decays started
- the time remaining before all have decayed
- the half-life of the decay

Consider Gauss's law: $E \cdot d A = q/0$. Which of the following is true?

- E must be the electric field due to the enclosed charge
- If q = 0, then E = 0 everywhere on the Gaussian surface
- **If the three particles inside have charges of +q, +q, and −2q, then the integral is zero**
- on the surface E is everywhere parallel to d A

A charged point particle is placed at the center of a spherical Gaussian surface. The electric flux ΦE is changed if:

- the sphere is replaced by a cube of the same volume
- the sphere is replaced by a cube of one-tenth the volume
- the point charge is moved off center (but still inside the original sphere)
- **the point charge is moved to just outside the sphere**

Choose the INCORRECT statement:

- Gauss' law can be derived from Coulomb's law
- Gauss' law states that the net number of lines crossing any closed surface in an outward direction is proportional to the net charge enclosed within the surface
- Coulomb's law can be derived from Gauss' law and symmetry

► **According to Gauss' law, if a closed surface encloses no charge, then the electric field must vanish everywhere on the surface**

The outer surface of the cardboard center of a paper towel roll:

► is a possible Gaussian surface

► cannot be a Gaussian surface because it encloses no charge

► cannot be a Gaussian surface since it is an insulator

► **cannot be a Gaussian surface because it is not a closed surface**

A physics instructor in an anteroom charges an electrostatic generator to 25 µC, then carries it into the lecture hall. The net electric flux in N · m2/C through the lecture hall walls is:

► 0

► 25 × 10−6

► 2.2 × 105

► **2.8 × 106**

A point particle with charge q is placed inside the cube but not at its center. The electric flux through any one side of the cube:

► is zero

► is q/0

► is q/60

► **cannot be computed using Gauss' law**

A particle with charge 5.0-µC is placed at the corner of a cube. The total electric flux in N · m2 /C through all sides of the cube is:

- ▶ 0
- ▶ 7.1 × 104
- ▶ 9.4 × 104
- ▶ **5.6 × 105**

Questions:

1. **Which weighs more, a liter of ice or a liter of water?**
2. **Will the current in a light bulb connected to a 220-V source be greater or less than when the same bulb is connected to 110-V source?**
3. **How is the wavelength of light related to its frequency?**
4. **We don't notice the de Broglie wavelength for a pitched baseball. Is this Because the wavelength is very large or because it is very small?**
5. **Does every magnet necessarily have a north and south pole? Explain**
6. **In a cool room, a metal or marble table top feels much colder to the touch than does a wood surface even though they are at the same temperature. Why?**
7. **If a water wave oscillates up and down three times each second and the distance between wave crests is 2 m, what is its frequency? What is its wavelength? What is its wave speed?**
8. **A transformer has N1 = 350 turns and N2 = 2 000 turns. If the input voltage is coil?**

9. **Why do astronomers looking at distant galaxies talk about looking backward in time?**
10. **Some distant astronomical objects, called quasars, are receding from us at half the speed of light (or greater). What is the speed of the light we receive from these quasars?**