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FINAL TERM EXAMINATION

Fall 2009

PHY101- Physics (Session - 1)

Question No: 1 (Marks: 1) - Please choose one

_____ 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
- ▶ 6.0kg · m²/s
- ▶ 9.0kg · m²/s
- ▶ 11 kg · m²/s
- ▶ 14 kg · m²/s

Question No: 2 (Marks: 1) - Please choose one

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

- ▶ rotational equilibrium

The magnitude of the *torque produced* by a force is defined as ... If we consider a *rigid body* rotating about a fixed axis

- ▶ linear acceleration
- ▶ rotational equilibrium
- ▶ angular acceleration
- ▶ rotational inertia

Question No: 3 (Marks: 1) - Please choose one

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

- ▶ 2.0 rad/s

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► 12.6 rad/s

► 1.57 rad/s

► 2.0 rad/s

► 6.3 rad/s

Angular Frequency is $\omega = \text{Thetta} / T$
 $20/10 = 2.0$

Question No: 4 (Marks: 1) - Please choose one

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

► displacement $f = -kx$

► amplitude

► frequency

► velocity

► displacement

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Question No: 5 (Marks: 1) - Please choose one

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

► it has a high density other liquids are lighter than mercury, they would require much longer columns.

► it is a metal

► it has a high boiling point

► it expands little with temperature

► it has a high density

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Question No: 6 (Marks: 1) - Please choose one

_____ The units of the electric field are:

► J/m

- J/m
- J/(C·m)
- J/C
- J·C

Question No: 7 (Marks: 1) - Please choose one

_____ A farad is the same as a

- J/V
- J/V
- V/J
- C/V
- V/C

Question No: 8 (Marks: 1) - Please choose one

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

- 100 μ F
- 1 F
- 1mF
- 1 μ F
- 100 μ F

Question No: 9 (Marks: 1) - Please choose one

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

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► 4.30×10^5 Hertz

► 4.30×10^4 Hertz

► 4.30×10^3 Hertz

► 4.30×10^5 Hertz

► 4.30×10^2 Hertz

Frequency = (speed) / (wavelength)

Wavelength = 700 nm

For speed of light, use 3×10^8 meters/sec

Frequency = $(3 \times 10^8) / (0.7 \times 10^{-6}) = 4.286 \times 10^{14}$ Hz = 4.286×10^5 GHz

Question No: 10 (Marks: 1) - Please choose one

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

► The electromagnetic radiation from a burning candle is unpolarized.

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► 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.

Question No: 11 (Marks: 1) - Please choose one

Radio waves and light waves are _____.

► Electromagnetic and transverse both

Both *radio waves* and *light* are electromagnetic transverse waves; their main difference is their frequency.

► Longitudinal waves

► Transverse waves

► Electromagnetic and transverse both

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► Electromagnetic and longitudinal both

Question No: 12 (Marks: 1) - Please choose one

Wien's Law states that, $\lambda_{max} =$ _____ K.

► $2.90 \times 10^{-3} \text{ m}$

Where exactly does the peak occur? Wien's Law states that $2.90 \times 10^{-3} \text{ m K}$. We can derive this in an advanced physics course, but for now you must take this as given.

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- $2.90 \times 10^{-3} \text{ Hertz}$
- $2.90 \times 10^{-3} \text{ s}$
- $2.90 \times 10^{-3} \text{ kg}$
- $2.90 \times 10^{-3} \text{ m}$

Question No: 13 (Marks: 1) - Please choose one

Interference of light is evidence that:

► light is a wave phenomenon

- the speed of light is very large
- light is a transverse wave
- light is a wave phenomenon
- light is electromagnetic in character

Question No: 14 (Marks: 1) - Please choose one

Fahrenheit and Kelvin scales agree numerically at a reading of:

► -40

- -40
- 0
- 273
- 574

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Question No: 15 (Marks: 1) - Please choose one

According to the theory of relativity:

► moving clocks run fast

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► 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

Question No: 16 (Marks: 1) - Please choose one

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:

► lower frequency and a shorter wavelength than before

► 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

Question No: 17 (Marks: 1) - Please choose one

How fast should you move away from a 6.0×10^{14} Hz light source to observe waves with a frequency of 4.0×10^{14} Hz?

► 38c

► 20c

► 38c

► 45c

► 51c

Question No: 18 (Marks: 1) - Please choose one

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

► Energy

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Answer:

(i) is the correct answer. If the principal quantum number is n , the energy of the electron is:

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

Question No: 19 (Marks: 1) - Please choose one

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

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

Question No: 20 (Marks: 1) - Please choose one

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

As the wavelength of a wave in a uniform medium increases, its speed will (C) remain the same, because speed is constant in a uniform medium.

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

Question No: 21 (Marks: 3)

_____ Two people are carrying a uniform wooden board that is 3.00 m long and weighs 160 N. If

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one person applies an upward force equal to 60 N at one end, at what point does the other person lift? Begin with a free-body diagram of the board.

ANSWER:

Forces in x direction = 0

Forces in Y = $F_1 + F_2 - W$

Given:

$L = 3.00 \text{ m}$ $F_1 = 60 \text{ N}$

$W = 160 \text{ N}$ $F_2 = ?$ and $x_2 = ?$

Sum of forces and torques = 0

Sum Force = $F_1 + F_2 - W = 0$

$60\text{N} + F_2 - 160 \text{ N} = 0$

$F_2 = 100 \text{ N}$

My pivot point is at F_2 .

Sum of torques = 0

Torque $F_1 = F_1(L - x_2)$

Torque $F_2 = 0$ b/c at pivot point

Torque $W = W(L/2 - x_2)$

$F_1L - F_1x_2 + (WL)/2 - Wx_2 = 0$

$(60)(3) - 60x_2 + (160 * 3)/2 - 160x_2 = 0$

$180 - 60x_2 + 240 - 160x_2 = 0$

$420 - 220x_2 = 0$

$x_2 = 1.9\text{m}$

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Question No: 22 (Marks: 3)

_____ If a charged particle moves in a straight line through some region of space, can you say that the magnetic field in that region is zero?

Question No: 23 (Marks: 3)

_____ You want to explore the shape of a certain molecule by scattering electrons of momentum p from a gas of the molecules and studying the deflection of the electrons. You will be able to see finer details in the molecules by (a) increasing p ; (b) decreasing p ; (c) not worrying what p is.

Question No: 24 (Marks: 3)

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A
vessel is filled with gas at some equilibrium pressure and temperature. Can all gas molecules in the vessel have the same speed?

Question No: 25 (Marks: 3)

What are the properties of wave function?

ANSWER:

Wave functions contain all the measurable information about the particles

Wave functions are continuous.

They allow energy calculations via schrodinger equation.

They establish the probability distribution in three dimensions.

They permit calculation of most probable values of given variables.

Question No: 26 (Marks: 5)

www.yugujranwala.com A
bike accelerates uniformly from rest to a speed of 7.10 m/s over a distance of 35.4 m. Determine the acceleration of the bike.

ANSWER:

$$2as = v_f^2 - v_i^2$$

$$2a(35.4) = (7.10)^2 - (0)^2$$

$$2a(35.4) = 50.41$$

$$A = .71 \text{ m/s}^2$$

Question No: 27 (Marks: 5)

A
flat loop of wire consisting of a single turn of cross-sectional area 8.00 cm^2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.500 T to 2.50 T in 1.00 s. What is the resulting induced current if the loop has a resistance of 2.00 Ω ?

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ANSWER:

$$E = (B_f - B_i) \cdot A / t = (2.5 - 0.5) \cdot 8 \cdot 10^{-4} / 1 = 1.6 \cdot 10^{-3} \text{ V}$$

$$I = E / R = 1.23 \text{ mA}$$

Question No: 28 (Marks: 5)

An ideal gas is contained in a vessel at 300 K. If the temperature is increased to 900 K, by what factor does each one of the following change? (a) The average kinetic energy of the molecules. (b) The rms molecular speed. (c) The average momentum change of one molecule in a collision with a wall. (d) The rate of collisions of molecules with walls. (e) The pressure of the gas.

Question No: 29 (Marks: 5)

Who discovered the nucleus? Write the experimental setup that he follows.

Ans:

Lord Rutherford discovered the nucleus. He carried out his famous experiment that showed the existence of a small but very heavy core of the atom. He arranged for a beam of alpha particles to strike gold atoms in a thin foil of gold. If the positive and negative charges in the atom were randomly distributed, all would go through without any deflection. But a lot of backscattering was seen, and some alphas were even deflected back in the direction of the incident beam. This was possible only if they were colliding with a very heavy object inside the atom.

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Question No: 30 (Marks: 5)

In an analogy between electric current and automobile traffic flow, what would correspond to charge? What would correspond to current?

Question No: 31 (Marks: 10)

(a) When can you expect a body to emit blackbody radiation?
(b) Which law is obeyed by Sun and other stars, briefly explain it.

(a) When can you expect a body to emit blackbody radiation?

Ans:

Waves are emitted when charges accelerate. Blackbody radiation occurs for exactly this reason as well. If a body is heated up, the electrons, atoms, and molecules which it contains undergo violent random motion. Light may emit by electrons in one atom and absorbed in another. Even an empty box will be filled with blackbody radiation because

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the sides of the box are made up of material that has charged constituents that radiate energy when they undergo acceleration during their random motion. A blackbody is both an ideal absorber and an ideal radiator. At high temperature, a body emits radiation of shorter wavelength. Temperature is inversely proportional to wavelength.

(b) Which law is obeyed by Sun and other stars, briefly explain it.

Ans:

The Sun and other stars obey Wien's Law since the gases they are composed of emit radiation that is in equilibrium with the other materials. Wien's law allows astronomers to determine the temperature of a star because the wavelength at which a star is brightest is related to its temperature.

