KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May, 2023

Marks Scored:

Level: B.Pharm.
Year : I

Course : PHYS 104
Semester : I

Exam. Roll No.:

Time: 30 mins.

F.M. : 20

30 APR 2023

Registration No.:

Date :

SECTION "A"
[20Q × 1 = 20 marks]

***Encircle the most appropriate answer.***

1. Work done against conservative force is equal to
   [a] change in kinetic energy [b] change in potential energy
   [c] change in mechanical energy [d] change in total energy

2. If a spring is stretched 2 cm by a suspended object having a mass of 0.55 kg, then the force constant of the spring is
   [a] 0.27 N/m [b] 2.7 N/m [c] 27 N/m [d] 270 N/m

3. The atoms of a diatomic molecule have masses $m_1$ and $m_2$. If $x_1$ and $x_2$ are their distances from the centre of mass, then
   [a] $\frac{x_1}{x_2} = \frac{m_1}{m_2}$ [b] $\frac{x_1}{x_2} = -\frac{m_1}{m_2}$ [c] $\frac{x_1}{x_2} = \frac{m_2}{m_1}$ [d] $\frac{x_1}{x_2} = -\frac{m_2}{m_1}$

4. A particle of mass $m$ moving with velocity $v$ makes head on elastic collision with another particle of same mass which is initially at rest. The velocity of first particle after collision is
   [a] 0 [b] $v$ [c] $-v$ [d] $2v$

5. A particle is vibrating in simple harmonic motion with amplitude of 4 cm. The displacement of the particle from equilibrium position when its energy is half kinetic and half potential is
   [a] 1cm [b] 2 cm [c] $\sqrt{2}$ cm [d] $2\sqrt{2}$ cm

6. A fluid flows through a tube of circular cross-section, which varies from point to point, but the flow is steady. If $v$ is the velocity of the fluid at a point, where the radius of curvature of tube is $R$, then at a different points along the length of tube
   [a] $\frac{v}{R} = \text{constant}$ [b] $vR = \text{constant}$
   [c] $vR^2 = \text{constant}$ [d] $v^2R = \text{constant}$

7. A spherical solid ball of mass 1 kg and radius 3 cm is rotating about an axis passing through its centre with an angular velocity of 50 rad/s. The kinetic energy of rotation is
   [a] 0.45 J [b] 1.125 J [c] 90 J [d] 4500 J

8. In $\beta-$decay
   [a] The parent and daughter nuclei have same number of protons
   [b] The daughter nucleus has one proton less than parent nucleus
   [c] The daughter nucleus has one proton more than parent nucleus
   [d] The daughter nucleus has one neutron more than parent nucleus

9. A Carnot engine is working between temperatures 300 K and 600 K has work output of 800 J/cycle. The amount of heat energy supplied from the source of engine in each cycle is
[a] 640 J [b] 800 J [c] 1600 J [d] 3200 J

10. For an adiabatic process involving an ideal gas having volume $V$ and temperature $T$, which of the following is constant? ($\gamma = C_P / C_V$)
[a] $TV$ [b] $TV^{\gamma}$ [c] $VT^{\gamma}$ [d] $TV^{\gamma-1}$

11. In nuclear fission large amount of energy is released because of
[a] the radioactivity of nucleus
[b] the total charge difference before and after the fission
[c] the total mass difference before and after the fission
[d] ejection of electrons from the atoms

12. In Newton's ring arrangement with air film in reflected light the diameter of nth ring is $D_n$. If the air film is replaced by liquid film of refractive index $\mu$. The diameter of nth fringe will become
[a] $\sqrt{\mu}$ times [b] $\mu$ times [c] $(1/\sqrt{\mu})$ times [d] $(1/\mu)$ time

13. Which of the following combinations of properties would be most desirable for a cooking pot?
[a] High specific heat and low conductivity
[b] Low specific heat and high conductivity
[c] High specific heat and high conductivity
[d] Low specific heat and low conductivity

14. When you look at a single slit diffraction pattern produced on a screen by light of a single wavelength, you see a bright central maximum and a number of maxima on either side, their intensity decreasing with distance from the central maximum. If the width of the slit is decreased
[a] the diffraction pattern shrinks in size
[b] the diffraction pattern increases in size
[c] it does not affect the size of the pattern
[d] the width of the central maximum increases

15. If $\mu_e$ and $\mu_o$ are the refractive indices of the crystal for E-ray and O-ray respectively. Then for positive crystal which of the following is correct?
[a] $\mu_e = \mu_o$ [b] $\mu_e < \mu_o$ [c] $\mu_e > \mu_o$ [d] $\mu_e \geq \mu_o$

***Fill in the blanks with most appropriate answer.***

16. The distance between the centre of suspension and centre of oscillation of a compound pendulum is equal to .....

17. The radius of gyration of a uniform circular disc of mass 1 kg and radius 50 cm about an axis through the centre of mass and perpendicular to its plane is .....

18. Indicator diagram in thermodynamic process is the graph between.....

19. A radioactive sample takes 8 hours to decay its $1/16^{th}$ part, its half-life is.....

20. The X-ray produced by the transition of electrons from M-shell to K-shell is called .....

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SECTION "B"
[5Q × 4 = 20 marks]

1. Define conservative force. Show that the resultant of conservative forces is equal to the negative gradient of potential energy.

2. A block of mass 3.57 kg is drawn at a constant speed a distance 4.06 m along a horizontal floor by rope exerting a constant force of magnitude 7.68 N making an angle 15° with the horizontal. Compute (a) the total work done on the block (c) the work done by the friction on the block.

**OR**

The radiation emitted by a star is 10,000 times more than that of the sun. If the surface temperature of the sun and the star is 6000 K and 2000 K respectively, then calculate the ratio of the radii of the star and the sun.

3. Distinguish between Fresnel and Fraunhoffer types of diffraction. Write a short note on diffraction grating.

4. Show that total angular momentum of the system of particles remains constant if the resultant torque acting on it is zero.

**OR**

Define specific heat capacities of gas. Prove the relation $C_p - C_v = R$ for one mole of an ideal gas.

5. With well labeled diagram describe the working principle of GM counter.

**OR**

State the law of radioactive decay. Deduce the relation $N = N_0\ e^{-\lambda t}$, where symbols have their usual meanings. Sketch a graph to illustrate radioactive decay.

SECTION "C"
[5Q × 7 = 35 Marks]

6. Obtain the Newton's second law of motion for a system of variable mass and hence establish the equation of rocket.

**OR**

Define compound pendulum and obtain its time period. Show that the point of suspension and point of oscillation are interchangeable. Also calculate minimum time period.

7. What do mean by laminar flow of fluid? Obtain the Poiseulle's formula for a viscous fluid flowing through a capillary tube of radius $R$.

8. Obtain an expression for intensity distribution in interference. Explain the interference phenomenon in thin film due to reflected light.

**OR**

Give the construction and theory of half wave and quarter wave plates. State and prove the Brewster's law.

9. Explain how Carnot's cycle is reversible. Show that the efficiency of Carnot cycle depends upon the temperature of source and the sink and is independent of the nature of working substance.

**OR**

What do you mean by Raman Effect? Give the quantum mechanical explanation of it. Write three characteristics of Raman Effect.

10. A gas molecule having a speed of 300 m/s collides elastically with another molecule of the same mass which is initially at rest. After collision the first molecule moves at an angle of $30^{\circ}$ to its initial direction. Find the speed of each molecule after collision and the angle made with the incident direction by the recoiling target molecule.

**OR**

In a Newton's-rings experiment, a plano-convex lens ($\mu = 1.52$) having radius 5 cm is placed on a flat plate as shown in Figure 1. When light of wavelength 650 nm is incident normally, 55 bright rings are observed, with the last one precisely on the edge of the lens. (i) What is the focal length of the lens? (ii) What is the radius $R$ of curvature of the convex surface of the lens?

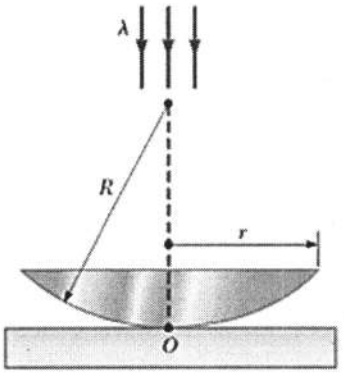


**Figure 1**