



South Asian Scholars Academy Secondary School
Birendranagar-03, Surkhet.

First Terminal Examination-2081

Grade: 12

Subject: Physics (1021)

FM : 50

Time: 2 hour

Attempt all the questions.

Group 'A'

[6 × 1 = 6]

Tick the Correct answer.

1. A body of moment of inertia I rotating about an axis has angular momentum L , the rotational kinetic energy of the body
(a) $\frac{1}{2}LI$ (b) $\frac{1}{2}LI^2$ (c) $\frac{1}{2}\frac{L^2}{I}$ (d) $2LI$
2. The surface tension of liquid with increase of temperature generally
(a) Increases (b) Remains constant (c) ☒ Decreases (d) Decreases up to 160° and then increases.
3. At a constant temperature, an ideal gas is compressed from 6.0 liters to 4.0 liters by a constant external pressure of 5.0 atm. How much work is done on the gas?
(a) ☒ + 10 liters atm (b) - 10 liters atm (c) + 30 liters atm (d) - 30 liters atm
4. A moving coil galvanometer carries a current I and the magnetic field is radial. The coil has N number of turns and an effective area A . the torque acting on the coil of a moving coil galvanometer is given by
(a) NA^2B^2I (b) $NAB I^2$ (c) ☒ $NABI$ (d) N^2ABI
5. Which combination of the metals in thermocouple gives the maximum thermo-emf in equal temperature difference at the two ends?
(a) Iron and copper (b) Antimony and bismuth (c) ☒ Zinc and iron (d) Antimony and copper
6. A photon of frequency f is incident on metal surface of threshold frequency f_0 . The maximum kinetic energy of emitted photoelectron is
(a) ☒ $h(f - f_0)$ (b) hf (c) hf_0 (d) $h(f + f_0)$

Group 'B'

[4 × 5 = 20]

Attempt any four the questions.

7. Answer the following questions,

- (a) Define angular momentum and write its SI unit. [1]
- (b) A ballet dancer can increase or decrease her spinning rate by using the principle of angular momentum. How? [2]



- (c) A disc of moment of inertia $5 \times 10^{-4} \text{ kg m}^2$ is rotating freely about the axis through its center at 60 rpm. Calculate the new revolution per minute if some wax of mass 0.01 kg is dropped gently on to the disc 0.06 m from the axis. [2]

'OR'

- (a) Define the term centre of buoyancy force and meta centre. Why should the meta centre lie above the centre of gravity of floating body? [2]

- (b) Explain the equation of continuity. [1]

- (c) Figure shows a liquid being pushed out of tube by pressing a piston. The area of cross section of the piston is 1.0 cm^2 and that of the tube at the outlet is 20 mm^2 . If the piston is pushed at a speed of 2 cm s^{-1} . What is the speed of the outgoing liquid? [2]



8. (a) What do you mean by Seebeck effect? [1]

- (a) Explain the variation of thermoelectric emf with temperature of junction. [2]

- (b) The thermo-emf E and the temperature of hot junction θ satisfy the relation $E = a\theta + b\theta^2$, where $a = 4.1 \times 10^{-5} \text{ V}(\text{°C})^{-1}$ and $b = -4.1 \times 10^{-8} \text{ V}(\text{°C})^{-2}$. If the cold junction temperature is 0°C , find the neutral temperature. [2]

9. (a) State and Explain Biot-Savart Law. [2]

- (b) Use this law to find the magnetic field due to an infinitely long straight current carrying conductor. [3]

10. Figure below shows the experimental setup of Millikan's oil drop experiment.

- (a) Find the expression for a charge of an oil drop of radius r moving with constant velocity v in a downward direction using a free body diagram. [2]

- (b) What will be the expression for the charge of an oil drop if the electric force is greater than its weight? [1]

- (c) Determine the electric field supplied when the electric force applied between the two horizontal plates just balances an oil drop with 4 electrons attached to it and mass of oil drop is $1.3 \times 10^{-14} \text{ kg}$. [2]



Group 'C'

$a = 67$

[3 × 8 = 24]

Attempt any three questions.

11. (a) Define simple harmonic motion.

[1]

(b) Suppose a particle of mass m is executing simple harmonic motion with angular speed, the displacement at any instant is y and r is maximum displacement of the vibration. For this vibration, kinetic energy is given by, $E_k = \frac{1}{2}m\omega^2(r^2 - y^2)$ and potential energy is given by, $U = \frac{1}{2}m\omega^2y^2$. Draw the nature of the energy versus displacement graph for E_k and U . Compare their variation with displacement. [2]

(c) Define free vibration and damped vibration with the help of their displacement-time graphs. [2]

(d) A spring of force constant k of 5 Nm^{-1} ($F = -kx$) is placed horizontally on a smooth table. One end of the spring is fixed and a mass X of 0.2 kg is attached to the free end. X is displaced a distance of 4 mm along the table and then released, calculate time period, maximum acceleration, maximum kinetic energy and maximum potential of the mass. [3]

'OR'

(a) Draw a PV diagram of petrol engine and explain its working based on the PV diagram. [3]

(b) Compare the efficiency of petrol engine with that of diesel engine based on their compression ratio. [2]

(c) A Carnot engine has 40% efficiency with a sink at 10°C . By how many degrees should the temperature of the source be increased in order to raise the efficiency to 65% ? [3]

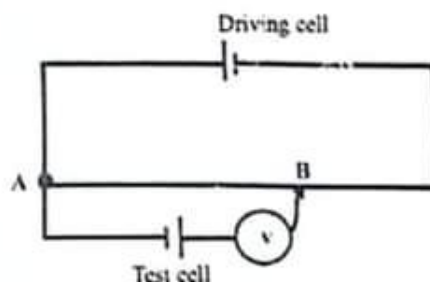
12. A student setup a circuit as shown in figure given below to measure the emf of a test cell

(a) Describe the principle of potentiometer. [2]

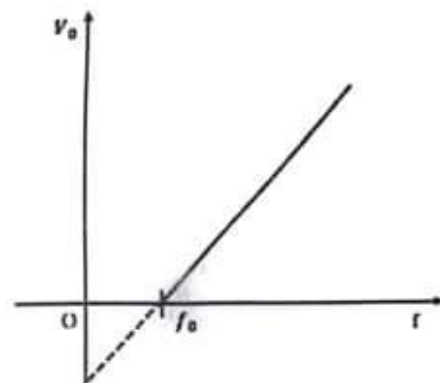
(b) Explain why he is unable to find a balance point and state the change he must in order to achieve the balance. [2]

(c) He obtained the balance point for the distance 37.5 cm using standard cell of emf 1.50 V and for the test cell, the balance distance AB was 25 cm . Calculate the emf of the test cell. [2]

(d) He could have used an ordinary voltmeter to measure the test cell directly. The student however argues that the above instrument is more precise than an ordinary voltmeter. Justify his logic. [2]



13. A graph between stopping potential (V_0) with the frequency (f) of incident radiation is shown in figure below. Answer the following questions.



- (a) Write the Einstein photoelectric equation in terms of stopping potential. [1]
- (b) How will you determine Planck's constant from the graph? [2]
- (c) What happens to the stopping potential if the frequency of incident photon increases gradually? Justify. [2]
- (d) Light of wavelength $6000 \text{ \AA}$ falls on a photosensitive plate of work function 1.9 eV . Find
 - (i) The energy of photon in eV.
 - (ii) Kinetic energy of the photoelectron emitted
 - (iii) Stopping potential. [3]

Best of Luck.



HERALD
SECONDARY SCHOOL
New Road, Thiruvananthapuram

First Term Examination -2081

Grade : XII

F.M. : 75

Subject : Physics (1021)

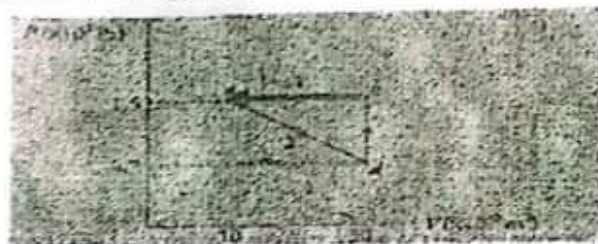
Time: 3 hrs.

Group A

Indicate the best alternative to the following questions

(11 × 1 = 11)

1. A disc of radius 2m and mass 100 gm rolls on a horizontal floor. Its center of mass has speed of 20cm/sec. How much work is needed to stop it?
a) 4J b) 3J c) 2J d) 1J
2. The graph between kinetic energy and displacement for a particle executing SHM is
(a) Straight line (b) Sine Curve (c) Parabolic (d) Elliptical
3. The equation of the wave is represented by $y = 10^{-4} \sin(100t - \frac{x}{10})$. The velocity of the wave will be
a) 100 m/sec b) 250 m/sec
c) 750 m/sec d) 1000m/sec
4. The work done during the cyclic process shown in figure is

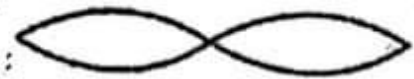


- (a) 2 J (b) 4 J (c) 8 J (d) 16 J
5. Thermo emf of a thermocouple changes sign at 600K. If the neutral temperature is 210°C, the temperature of cold junction is
a. 180K b. 117K c. 93°C d. 90°C
 6. At what temperature will the speed of sound be double of its value at 0°C?
(a) 819 °C (b) 919 °C (c) 1192 °C (d) 1092 °C
 7. Two resistance R and 2R are connected in series in an electrical circuit. The ration of heat in 2R to that in R is
(a) 1:2 (b) 1:4 (c) 2:1 (d) 4:1
 8. A charge of 2 C moving with velocity 0.5 m/sec at angle of 30° with the magnetic field of 4 T experience force of
(a) 1 N (b) 2 N (a) 0.5 N (a) 4 N
 9. With the increase in temperature the frequency of sound from an open organ pipe
(a) Increases (b) Decreases
(c) Remains constant (d) May increase or decrease
 10. The ratio of specific charge of proton to an alpha particles equals
(a) 4:1 (b) 1:1 (c) 1:2 (d) 2:1
 11. The mass of moving photon is
(a) Zero (b) $hc\lambda$ (c) $\frac{h}{c\lambda}$ (d) $\frac{hc}{\lambda}$

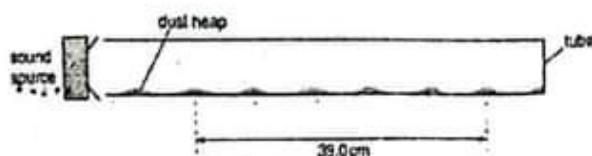
Group B

Answer the following questions

(2×5=10)

12. (a) Define radius of gyration. [1]
 (b) State principle of conservation of angular momentum. [2]
 (c) A disc of moment of inertia $5 \times 10^{-4} \text{ kg m}^2$ is rotating freely about an axis passing through the center at 40 rpm. Calculate the new rate of revolution per minute if some wax of mass 0.02 kg is dropped gently on to the disc 0.08 m from axis. [2]
13. (a) Define adiabatic process. [1]
 (b) Derive the expression for work done in Thermodynamical process. [2]
 (c) Using PV diagram explain how work done can be calculated in cyclic process. [2]
14. (a) Explain why charge particle entering normally into a magnetic field does not change its kinetic energy? [2]
 (b) A beam of electrons, moving with velocity 10^7 m/sec , enters midway between two horizontal parallel plates in the direction parallel to the plates which are 5 cm long and 2 cm apart and have a potential difference of V volts between them. Calculate V if the beam is deflected so that it just grazes the edge of the plate. (Assuming $\frac{e}{m} = 1.76 \times 10^{11} \text{ C/kg}$) [3]
15. (a) What do you mean by shunt? [1]
 (b) Describe its use converting a galvanometer into ammeter. [2]
 (c) A moving coil meter has a resistance of 25 ohm and indicates full scale deflection when a current of 4.0mA flows through it. How could this meter be converted to a milliammeter having a full scale deflection for a current of 50mA? [2]
16. (a) What do you mean by Seebeck effect? [1]
 (b) Graphically represent how thermoemf varies with temperature. [1]
 (c) For emf, $E = 10\theta - \frac{3}{100}\theta^2$, what would be the emf at neutral temperature? [1]
 (d) Define temperature of inversion. On what factors does it depend? [2]
17. The given figure shows the vibration of a stretched string of length, L 
 - (a) Which harmonics and overtone does it represent? [1]
 - (b) What is the frequency of this mode in terms of L. [2]
 - (c) If the tension on the string is increased 4 times, what will be the frequency of this mode? [2]

18. (a) The velocity of sound in a tube containing oxygen at 17°C and pressure 760 mm of Hg is 340 m/sec, what will be its velocity when the pressure is increased to 800 mm of Hg and oxygen is replaced by nitrogen at same temperature? [2]
- (b) Plot a graph to show the variation of the speed of sound in gas with its pressure at a constant temperature. [1]
- (c) When sound wave travels through air does the temperature at various point remain constant? Explain. [2]
19. (a) Define stationary wave. [1]
- (b) Explain how transverse wave differ from longitudinal wave. [2]
- (c) A glass tube closed at one end, has a fine dust sprinkled along its length. A sound source is placed near the open end of the tube as shown in figure. The frequency of the sound emitted by the source is varied and at one frequency, the dust forms small heap in the tube.



The frequency at which heaps are formed is 2.14 KHz. The distance between six heaps as shown in figure is 39 cm. Calculate speed of sound in the tube. [2]

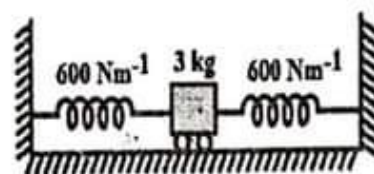
Group C

Answer the following questions:

(3×8=24)

19. (a) At what points is the energy entirely kinetic and potential in SHM? [1]
- (b) Derive the expression for time of vertical mass spring system. [3]

- (c) A trolley of mass 3 kg is connected to two identical rubber bands each of force constant ($k=600\text{N/m}$) as shown in figure. If the trolley is displaced from equilibrium position by 5 cm and released, what is the period of oscillation? [2]

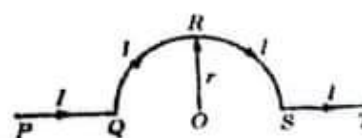


- (d) What is the maximum velocity with which the trolley moves? [2]

20. (a) State and explain Biot-Savart law. [2]

- (b) Use Biot-Savart law to find out the magnetic field at a center of current carrying circular loop. [2]

- (c) A long wire having a semi-circular loop of radius r carries a current I , as shown in Fig. Find the magnetic field due to entire wire at point O [3]



- (d) Write one limitations of Biot-savart law. [1]

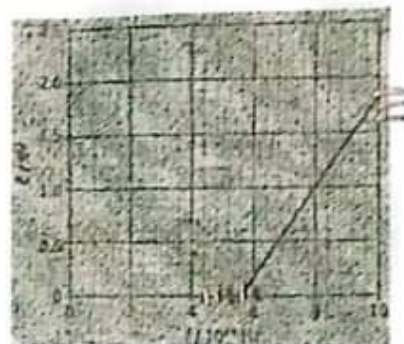
21. (a) In photoelectric effect

i. What is the effect on photocurrent if intensity is changed? [2]
(Represent graphically as well)

i. What is the effect if frequency of incident light is increased? Also plot the graph between stopping potential Vs photocurrent for light of two different frequencies. [1+1]

(b) The graph below shows the maximum kinetic energy of the emitted photoelectrons as the frequency of the incident radiation on a sodium plate is varied.

- i. From the graph determine the minimum frequency of incident radiation that can cause photoelectric effect [1]
- ii. Use the graph to calculate the value of the Plank constant in Js. [2]
- iii. Calculate the work function of the sodium. [1]





SUKUNA SECONDARY SCHOOL

Sundarharaincha-10, Morang

FIRST TERMINAL EXAMINATION-2081

Class: XII Science

Full Marks: 37.5

Subject: Physics

Time: 1.5 hr

Group 'A'

[5×1=5]

Rewrite the correct options of each question in your answer sheet.

1. The spokes are used in bicycle wheel to
(a) Increase frictional force (b) Decrease frictional force
(c) Increase moment of inertia (d) Decrease moment of inertia
2. The efficiency of Carnot engine working between steam point and ice point is about
(a) 16.8% (b) 26.8%
(c) 36.8% (d) 46.8%
3. The phase difference between two waves $y_1 = A \sin \omega t$ and $y_2 = A \cos \omega t$ is
(a) 0° C (b) π
(c) $\pi/2$ (d) $\pi/4$
4. Which of the following is not reversible?
(a) Seebeck effect (b) Peltier effect
(c) Joule's effect (d) Thomson's effect
5. In photoelectric effect, stopping potential depends on
(a) Frequency of incident light (b) nature of the emitter materials
(c) intensity of incident light (d) both (a) and (b)

Group "B"

[5×5=25]

1. The moment of inertia of a body about a given axis is the property under which, the body opposes any change in its state of rest or state of uniform rotations about that axis.
(a) Define the term radius of gyration. [1]
(b) Define the moment of inertia and prove the kinetic energy of a rotational body is $\frac{1}{2} I \omega^2$, where the symbols have their usual meanings. [2]
(c) State the principle of conservation of angular momentum. Write any two applications of it. [1+0.5+0.5]

2. The thermodynamic process is the change of thermodynamic variables in a system of different conditions.

(a) Derive an expression for work done by an ideal gas in an isothermal process. [2]

(b) Calculate the work done when one mole of perfect gas is compressed adiabatically. The initial pressure and volume of the gas are 10^5 Nm^{-2} and 6 liters respectively. The final volume of the gas is 2 liters. Molar heat capacity of the gas at constant volume is $\frac{3}{2}R$. [3]

Or,

(a) Why do Diesel engines need no spark plugs, whereas petrol engines need them? [2]

(b) Describe the working mechanism of a Diesel engine with the help of P-V diagrams. [3]

3. (a) Explosions on other planets are not heard on earth, why? [1]

(b) Write Newton's formula for the velocity of sound in air and explain why and how it was corrected by Laplace? [2]

(c) At what temperature, the velocity of sound in air is increased by 50% to that at 27°C ? [2]

4. (a) Define organ pipes. [1]

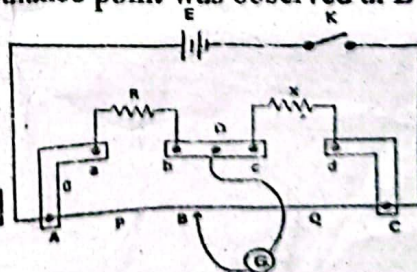
(b) Describe the various modes of vibration of the air column in closed organ pipes. [3]

(c) What is end correction? [1]

5. (a) State the principle of potentiometer. A potentiometer is also called a voltmeter of infinite resistance, why? [1+1]

(b) In the meter bridge experiment the balance point was observed at B point with $L = 35 \text{ cm}$.

(i) If the value of R be doubled of X and then interchanged. What would be the new position of balance point? [2]



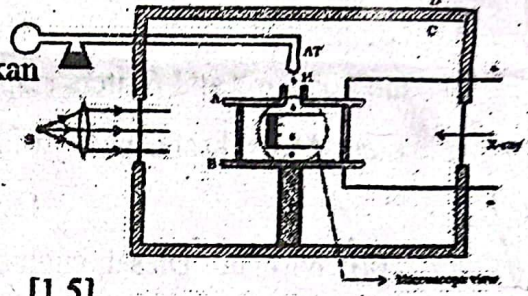
(ii) if the galvanometer and battery are interchanged at the balance position, how will the balance point get affected? [1]

Group "C"

[1×7.5 = 7.5]

1. (a) Figure represents the experimental arrangement for Millikan's oil drop experiments.

- i) For what purpose did Millikan use this apparatus? [1]
- ii) Why atomizer and x-ray are used? [2]
- iii) Why water drops cannot be used instead of oil? [1.5]
- iv) What would be the effect on Millikan's oil drop experiment of performing, it in vacuum? [1]
- (b) 400nm wavelength of light falls on a photo sensitive materials of work function 2.3 eV. Compute the maximum energy of photoelectrons. [2]



!!! GOOD LUCK !!!



MITHILA INSTITUTE OF TECHNOLOGY

Bishara Chowk, Janakpurdham - 4

Science Faculty

1st Terminal Examination - 2081

Class : XII

Physics

F.M.: 75

Time : 3 hrs.

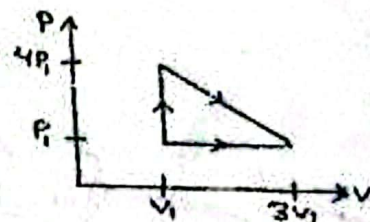
P.M.: 27

Candidates are required to give their answers in their own words as far as practicable. The figure in the margin indicate full marks.

[1x11=11]

MCQ.

- 1.a) The spokes are used in bicycle wheel to
i) increase frictional force ii) decrease frictional force
iii) decrease M.I. iv) increase M.I.
- b) A particle undergoes SHM having time period T. What is the time taken by it to move from mean position to half of amplitude?
i) $\frac{T}{2}$ ii) $\frac{T}{3}$ iii) $\frac{T}{6}$ iv) $\frac{T}{12}$
- c) The time period of body attached with spring
i) $t = 2\pi \sqrt{\frac{k}{m}}$ ii) $t = 2\pi \sqrt{\frac{m}{k}}$ iii) $t = \frac{1}{2\pi} \sqrt{\frac{k}{m}}$ iv) none
- d) In S.H.M, the kinetic energy is minimum at
i) mean position ii) Extreme end
iii) At $\frac{1}{4}$ th of amplitude from mean position iv) None
- e) An ideal gas is taken through series of changes represented in the diagram below. the net workdone by the gas at the end of the cycle is equal to
i) $P_1 V_1$ ii) $6P_1 V_1$
iii) $12P_1 V_1$ iv) $3P_1 V_1$
- f) When the door of a refrigerator is left open in a room, the temperature of the room
i) increase ii) decrease
iii) Remains same iv) first increases and then decreases
- g) The temperature of inversion of a thermocouple is 600°C and the neutral temperature is 310°C . What must be the temperature of cold junction?
i) 0°C ii) 10°C iii) 20°C iv) 30°C
- h) A charge of 2 coulomb is moving with velocity of 0.5 m/s at an angle of 30° in a magnetic field of 4T. What will be the magnetic force experienced by the charge?
i) 1N ii) 2N iii) 4N iv) 0.5N



- i) An electron is moving in an electric field of 3 million volts. What is the work done?
 i) $1.6 \times 10^{-19} \text{ J}$ ii) $4.8 \times 10^{-13} \text{ J}$
 iii) $4.8 \times 10^{-20} \text{ J}$ iv) $4.8 \times 10^{-19} \text{ J}$
- j) An electron enters in a magnetic field of 10^{-3} T normally with velocity of 10^6 m/s . The radius of path of electron is
 i) 11.4 cm ii) 11.4 mm iii) 5.7 cm iv) 5.7 mm
- k) The value of first excitation energy is
 i) 10.2 eV ii) 10.2 V iii) 12.09 eV iv) 12.09 V
- 2.a) The cap of a bottle can be easily opened with the help of the two fingers than with one finger. Why? [2]
- b) Derive moment of inertia of rod about an axis perpendicular to its plane and passing through its one end. [3]
- c) A computer disk drive is turned on starting from the rest and has constant angular acceleration.
 i) How long did it take to make the first complete rotation.
 ii) What is its angular acceleration? Given the disk took 0.75 sec for the drive to make its second complete revolution. [3]
- 3.a) A S.H.M is represented as $y = a \cos |wt + \phi|$. Find its acceleration. [2]
- b) What is second pendulum. [1]
- c) Show that motion of simple pendulum is S.H.M. Derive expression for time period of simple pendulum. [3+1]

Or,

- Define spring constant. Show that motion of body attached with spring in horizontal plane is S.H.M. Derive expression for time period. [1+2+1]
- d) Show that motion of body attached with helical spring is S.H.M. [3]
- e) A simple pendulum has period of 4.2 sec when the pendulum is shortened by 1m the period is 3.7 sec. Calculate acceleration due to gravity & length of pendulum. [3]
- a) State Wheatstone bridge principle and obtain balanced condition of it using Kirchoff's Laws. [3]
- b) How does thermo-emf change in a thermocouple when the temperature of hot junction is changed? [2]
- a) Explain, why do the gases have two specific heat capacities? [1]
- b) Show that $C_p - C_v = R$, where the symbols have their usual meanings. [3]
- c) An ideal gas has ratio of heat capacities $= \frac{5}{3}$ at 72°C is expanded adiabatically to eight times of its original volume. What is the approximate rise in temperature of the gas. [1]
- d) A Carnot engine working between 300K and 600K has a work output of 800J per cycle. What is the amount of heat energy supplied to the engine from source per cycle? [3]

CHHOREPATAN SECONDARY SCHOOL
First Term Examination - 2081

Grade: XII
Subject: Physics

Time: 3 hrs.

F.M.: 75

Group A

Write the best alternative to the following questions: (1 x 11 = 11)

1. Which of the following is a correct formula for calculating radius of gyration of a rotating object?

a. $K^2 = \frac{I}{m}$ b. $K = \frac{I}{m}$ c. $K = \frac{m}{I}$ d. $K = \left(\frac{I}{m}\right)^2$

2. In SHM, the particle velocity is maximum at

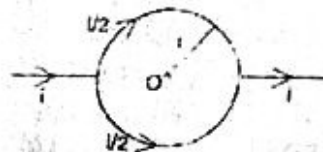
- a. extreme position b. mean position
 c. at a distance $A/2$ d. at a distance $A/4$

3. A constant torque of 1000 Nm turns a wheel of moment of inertia 200 Kg m^2 about its center. It's angular velocity after 3 second is

- a. 1 rad/s b. 5 rad/s c. 10 rad/s d. 15 rad/s

4. A straight conductor carrying a direct current 1 ampere is split in to a circular loop as shown in figure. Then the magnetic induction at the centre of the circular loop of radius r metre is

- a. 0 b. ∞
 c. $\frac{\mu_0 i}{2\pi r}$ d. $\frac{\mu_0 i}{2r}$



5. To send 10% of the main current through a moving coil galvanometer of resistance 99Ω , the shunt required is

- a. 9.9Ω b. 10Ω c. minimum but zero d. infinity

6. The terminal velocity of a droplet is 5cm/s. If 27 such droplets coalesce to form a big drop, the terminal velocity will be

- a. 5cm/s b. 15cm/s c. 45cm/s d. 135cm/s

7. A simple pendulum has a bob made of solid sphere of steel. If we replace it with a hollow sphere of same mass and same material, then time-period will

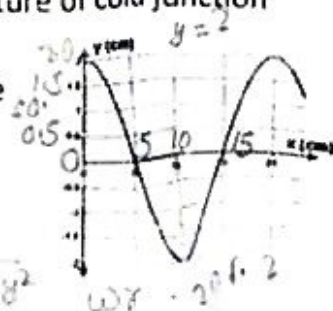
- a. increase b. decrease
 c. remains same d. become infinite

8. At neutral temperature, the thermoelectric power is

- a. zero b. maximum
 c. minimum d. dependent on temperature of cold junction

9. A wave of frequency 20 Hz is travelling along X direction. The displacement of particles of the medium is shown in figure. The speed of the wave in m/s is:

- a. 4 b. 5 c. 20 d. 400



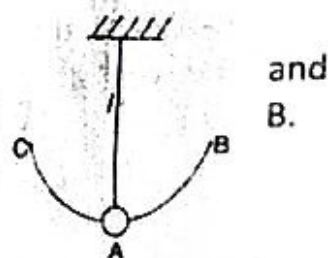
10. A cell of emf of 1.08V is balanced by 216cm length of a potentiometer. Find the length of the wire that would balance cell of emf 1.5V.
 a. 250cm b. 290cm c. 300cm d. 310cm
11. The parallel wires carrying current in opposite direction
 a. attracts b. repel
 c. first attracts and repel d. can't be predicted

Group 'B'

Give short answer to the following questions.

(8 × 5 = 40)

12. The figure alongside shows the motion of a simple pendulum.



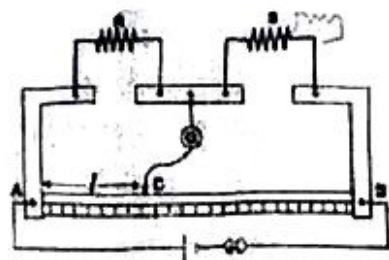
- a. Re-draw the figure showing different forces its components acting on the bob at position A and B. [1]
 b. Write any two characteristics of this type of motion. [2]
 c. Draw the nature of graph for T verses l and T² verses l. [2]
13. a. Define moment of inertia. On what factors does it depend? [2]
 b. The angular velocity of the earth around the sun increases when it comes closer to the sun. Why? [1]
 c. A bullet dancer spins at 1 revolution per second with her arms stretched. With her arms folded her moment of inertia about the axis of rotation decreases by 40%. Calculate the ratio of her initial K.E. of rotation to the final K.E of rotation. 3.5 [2]

OR

- a. If the angular momentum is conserved in a system, when moment of inertia is decreased. Will its rotational K.E be also conserved? Explain. [2]
 b. A disc of moment of inertia $5 \times 10^{-4} \text{ kgm}^2$ is rotating freely about the axis through its centre at 40rpm. Calculate the new revolution per minute if same wax of mass 0.02kg is dropped gently on to the disc 0.08m from the axis. [3]

14. A meter bridge circuit is shown in figure below:

- a. State the principle under which it works and mention its application. [1]
 b. In the figure, the null point is found at a distance of 60cm from A. If a resistance of 5Ω is connected in series with S, then null point occurs at 50cm from A.



(i) Determine the values of R and S. [3]

(ii) What will be the new balance point if 5Ω resistance is connected in series with R instead with S? [1]

15. a. Define viscosity. Discuss the effect of temperature on viscosity of liquid and gas. [2]

b. Sketch the velocity-time graph for a small spherical body moving through a viscous fluid. Explain the nature of graph. [2]

c. Which falls faster through atmosphere - big rain drop or small rain drop? Explain. [1]

16. a. What do you understand by shunt and multiplier? [1]

b. Why a voltmeter is always connected in parallel with load resistance? What happens in the circuit if voltmeter is connected in series? [2]

c. A galvanometer can bear maximum current of 25mA and has resistance 5Ω . Find the suitable resistance to convert it into. [2]

i. A voltmeter of range 0-2 volts

ii. An ammeter of range 0-10A

17. a. Explain what is meant by quantization of charge. [2]

b. In a Millikan's oil drop experiment, an oil drop of weight $1.5 \times 10^{-14} \text{ N}$ is held stationary between plates 10mm apart by applying a p.d. of 470V between the plates.

i. State the condition necessary for the drop to remain stationary. Also sketch the force acting on the oil drop. [1]

ii. Calculate the charge on the oil drop. [2]

OR

Electron is deviated in electric and magnetic fields.

a. What path does the electron follow in electric field? [1]

b. An electron passes through a space without deviation. Does it mean, there is no field? [2]

c. Is there any condition that an electron does not experience any force in magnetic field? [2]

18.

a. An airplane requires a long run on the ground before taking off. Explain why? [2]

b. State and prove Bernoulli's theorem for the flow of non-viscous fluids. [3]

19. a. What is thermoelectric effect. [1]

b. Explain the variation of thermo-emf with temperature. [3]

c. Write down the importance of thermoelectric effect. [1]

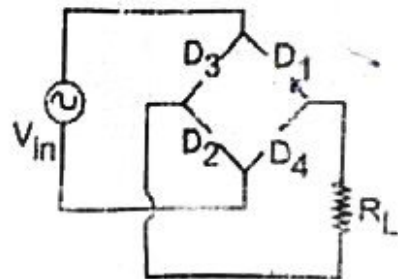
Group-C

Long questions.

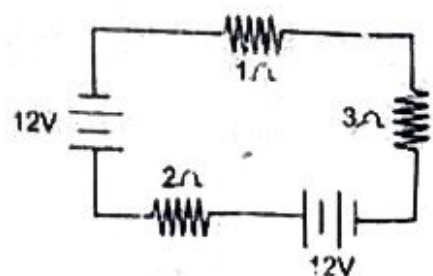
[3×8=24]

20. a. Write down the mathematical form of Biot-Savart's law. [1]
 b. A wire carrying current 'I' is bent in the form of a circle of radius 'a'. Using Biot-Savart's law, find the expression of the magnetic field at the centre of wire. [3]
 c. Plot a graph showing how the intensity of magnetic field at centre of circular wire varies with the radius of circle. [2]
 d. A copper wire 10m long is wound into a flat circle of 8cm diameter. If the current flowing through wire is 4.5A, what is the magnetic induction at the centre? [2]

21. a. Sketch the symbol of a p-n junction diode and indicate the polarity of its end. [1]
 b. Copy the outline of the diode bridge rectifier and complete it by adding diodes in the gaps. [1]
 c. Explain what will happen if one of the four diodes is damaged so that it stops conducting totally in any direction. Sketch a graph to show how the pd across the load R_L vary with time in this situation. [2]
 d. What do you mean by logic gate? [1]
 e. Draw the symbol of OR and NAND gate. [1]
 f. Make a truth table for AND and NOT gate. [2]



22. a. State and explain Kirchhoff's current and voltage law. [2]
 b. Write the principle of potentiometer [1]
 c. Explain how do you determine internal resistance of cell using potentiometer. [3]
 d. Determine the electric current that flows in the circuit as shown in the figure below. [2]



THE END



ST. XAVIER'S COLLEGE

Maitighar, Kathmandu

Grade: XII

First Terminal Examination - 2023

Subject: Physics (1021)

Time: 3 Hours

Full Marks: 75

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

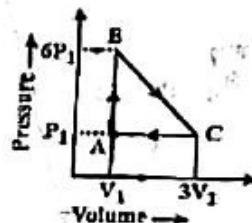
Attempt all the questions.

Group - 'A'

Rewrite the correct options of each question in your answer sheet.

[11x1=11]

- A particle undergoes SHM having time period T . What is time taken by it to move from mean position to half of amplitude?
a) $T/12$ b) $T/3$ c) $T/6$ d) $T/4$
- The rotational kinetic energy of a body is E and its moment of inertia is I , the angular momentum is
a) EI b) $2\sqrt{EI}$ c) E/I d) $\sqrt{2EI}$
- For a hollow cylinder and solid cylinder of the same mass and radius rolling without slipping on an inclined plane, which of these reaches the ground earlier
a) Hollow cylinder b) Solid cylinder c) both simultaneously d) can't say anything
- An ideal gas is taken through series of changes represented in diagram. The work done by the gas at the end of cycle is
a) $5P_1V_1$ b) P_1V_1 c) $10P_1V_1$ d) Zero
- What is the significance of the Clausius statement of second law of thermodynamics
a) Defines the maximum theoretical efficiency of a heat engine
b) State heat cannot spontaneously flow from colder body to hotter body
c) Describes the relationship between entropy and reversibility of a process
d) Describes the direction of spontaneous change in an isolated system.
- A charged particle moves through a uniform magnetic field perpendicular to it. The energy of the particle
a) Increases b) decreases c) remains constant d) First decreases and increases
- The radius of the path followed by a particle in a magnetic field is directly proportional to its
a) Charge b) magnetic field c) momentum d) kinetic energy
- To send 10% of the main current through a galvanometer of resistance $99\ \Omega$, the shunt required is
a) $11\ \Omega$ b) $9.9\ \Omega$ c) $10\ \Omega$ d) $9\ \Omega$
- Kirchhoff's second law is based on law of conservation of
a) Mass b) energy c) charge d) momentum
- In a meter bridge with standard resistance of $5\ \Omega$ in the left gap, the ratio of the balancing lengths of the bridge wire is 2:3. The unknown resistance is
a) $10/3\ \Omega$ b) $15\ \Omega$ c) $10\ \Omega$ d) $7.3\ \Omega$
- A current is flowing through a circular wire in clockwise direction. What will be the direction of magnetic field at the center of the circular wire?
a) Parallel to the plane of coil
b) Perpendicular to the plane of the coil away from the reader
c) Perpendicular to the plane of the coil towards the reader
d) At any angle



Group 'B'

Answer the following questions.

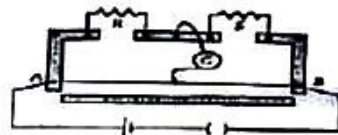
[8 x 5 = 40]

- a) The displacement y of a particle executing SHM is $y = r \sin \omega t$, where r is amplitude of vibration
i) Define Amplitude [1]
ii) Calculate the acceleration of the motion [2]
b) A particle executing SHM has a maximum velocity of 40 cm/s and maximum acceleration of 50 cm/sec^2 . Find the period of oscillation. [2]
- a) For a simple pendulum, show that the acceleration is directly proportional to the displacement of the bob from its mean position. [2]
b) A bob of mass 8 kg performs SHM of amplitude 30 cm . The restoring force is 60 N . Calculate i) Time period ii) The maximum acceleration iii) KE when displacement is 12 cm . [3]
- Angular speed of a rotating body is inversely proportional to its moment of inertia
a) Define moment of inertia. [1]
b) Explain why angular velocity of the Earth increases when it comes closer to the Sun in its orbit. [2]

1.2 x 1/2

10

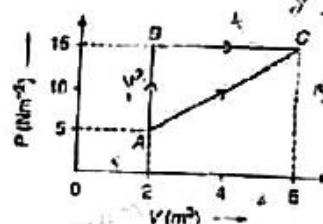
- c) If the Earth were to shrink suddenly, what would happen to the length of the day? Give reason. [2]
15. a) What is meant by entropy? Write the mathematical expression of entropy. [2]
 b) Can a room be cooled by leaving the door of an electric refrigerator open? Justify [1]
 c) Compare the efficiency of petrol engine with that of diesel engine based on their compression ratios. [2]
16. a) i) What do you mean by adiabatic process? [1]
 ii) Show that $C_p - C_v = R$, where symbols have their usual meaning. [2]
 b) A quantity of monoatomic gas at 27°C is compressed suddenly to $(8/27)^{\text{th}}$ parts of its initial volume. Find the change in temperature assuming $\gamma = 5/3$ [2]
17. (a) Draw the wheat stone bridge circuit and write the expression for balance condition of it. [2]
 b) In Meter Bridge shown below, the null point is found at a distance of 60.0 cm from A. If now a resistance of 5 ohm is connected in series with S, the null point occurs at 50 cm. Determine the values of R and S [3]
18. a) Discuss the torque produced on a rectangular current carrying coil placed in uniform magnetic field. [3]
 b) A positive charge of $1.5\mu\text{C}$ is moving with a speed of $2 \times 10^6 \text{ ms}^{-1}$ along positive X-axis. A magnetic field, $B = (0.2\hat{j} + 0.4\hat{k})$ tesla acts in space. Find the magnetic force acting on the charge. [2]
19. a) Write any two significance of Millikan's oil drop experiment [1]
 b) An electron and a proton having same initial velocity are projected in a uniform electric field whose path will be more curvature and why? [2]
 c) An electron moving with velocity $2 \times 10^7 \text{ m/s}$ describes a circle in a magnetic field of strength 0.02 T. If the specific charge e/m of electron is $1.76 \times 10^{11} \text{ C/kg}$, find the approximated diameter of the circular path? [2]



Group 'C'

Answer the following questions.

20. a) In figure an ideal gas changes its state from A to C by two paths ABC and AC [3 × 8 = 24]
 i) Find the path along which work done is least? [1]
 ii) The internal energy of gas at A is 10 J and amount heat supplied to change its state to C through the path AC is 200 J. Calculate the internal energy at C. [2]
 iii) The internal energy of gas at state B is 20 J. Find the amount of heat supplied to the gas to go from A to B [2]



- b) Derive an expression for the work done during the isothermal expansion of an ideal gas. [2]
21. a) Differentiate between super conductor and perfect conductor [2]
 b) State the principle of potentiometer. Draw a circuit diagram and write formula to determine the internal resistance of a cell using the potentiometer. [3]
 c) A potentiometer is 10 m long. It has a resistance of 20Ω . It is connected with a battery of 3V and a resistance of 10Ω . What is the potential gradient along the wire? [3]
22. a) A constant torque of 500 Nm turns a wheel about its center. The moment of inertia about this axis is 100 kg m^2 . Find the angular velocity gained in 4sec and KE gained after 20 revolutions. [1+2]

b) Figure below shows the experimental setup of Millikan's oil drop experiment. Find the expression for a charge of an oil drop of radius r moving with constant velocity v in a downward direction using a free body diagram. [2]

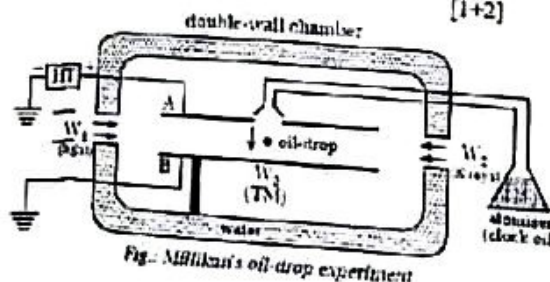


Fig. Millikan's oil drop experiment

- c) What will be the expression for the charge of an oil drop if the electric force is greater than its weight? [1]
 d) Determine the electric field supplied when the electric force applied between the two horizontal plates just balances an oil drop with 4 electrons attached to it and mass of oil drop is $1.3 \times 10^{-14} \text{ kg}$. [2]