

PHYSICS

TIME: 20 MINTUES

GROUP : FIRST *DGK-11-1-23* OBJECTIVE

MARKS : 17

NOTE : You have four choices for each objective type question as A , B , C and D . The choice which you think is correct; fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

QUESTION NO. 1

- 1 If the radius of a sphere  $r = 2.25 \pm 0.01$  cm then percentage uncertainty in  $r$  is  
(A) 0.2 % (B) 0.4 % (C) 0.1 % (D) 0.3 %
- 2 If we add the numbers 2.7543 , 4.10, 1.273, the rounded off answer will be  
(A) 8.1273 (B) 8.127 (C) 8.2 (D) 8.13
- 3 The minimum number of unequal vectors whose sum can be zero is  
(A) 1 (B) 2 (C) 3 (D) 4
- 4 The magnitude of resultant of two forces 6N and 8N acting at right angle to each other is  
(A) 10 N (B) 2 N (C) 14 N (D) 8 N
- 5 The horizontal range and maximum range of projectile are related as  
(A)  $R = R_{max} \sin \theta$  (B)  $R = R_{max} \sin 2 \theta$   
(C)  $R = R_{max} \sin^2 \theta$  (D)  $R = R_{max} \sin \theta \cos \theta$
- 6 A body is moving with uniform velocity. Its \_\_\_\_\_ changes  
(A) Speed (B) Acceleration (C) Direction of motion (D) Displacement
- 7 Escape velocity from the earth surface is  
(A)  $4.2 \text{ kms}^{-1}$  (B)  $7.5 \text{ kms}^{-1}$  (C)  $9.5 \text{ kms}^{-1}$  (D)  $11.2 \text{ kms}^{-1}$
- 8 Which of the following is correct  
(A)  $\vec{v} = \vec{r} \times \vec{\omega}$  (B)  $\vec{v} = \vec{\omega} \times \vec{r}$  (C)  $\vec{v} = \vec{r} \cdot \vec{\omega}$  (D)  $\vec{v} = \vec{\omega} \cdot \vec{r}$
- 9 The internal energy of 1 mole of an ideal gas depends on  
(A) Volume (B) Pressure (C) Temperature (D) Potential energy
- 10 The number of geo – stationary satellites to cover the whole earth is  
(A) 5 (B) 24 (C) 3 (D) 7
- 11 Cloud formation in the atmosphere is \_\_\_\_\_ process  
(A) Adiabatic (B) Isobaric (C) Isothermal (D) Isochoric
- 12 Terminal velocity is a \_\_\_\_\_ velocity  
(A) Constant maximum (B) Constant minimum (C) Variable (D) Instantaneous
- 13 Time period of simple pendulum at the centre of the earth will be  
(A) Zero (B) Infinite (C) Same as on the surface of the earth (D) Doubled
- 14 Maximum number of beats frequency that can be heard by a human is  
(A) 15 Hz (B) 20 Hz (C) 10 Hz (D) 8 Hz
- 15 Stationary waves are set up in an open organ pipe of length 2m. The wavelength of waves in first mode of vibration is  
(A) 4 m (B) 1 m (C) 8 m (D) 3 m
- 16 Light waves cannot be polarized by  
(A) Selective absorption (B) Reflection at large incidence angle  
(C) Interference of light (D) Scattering by air molecules.
- 17 Which of the following phenomena does not occur in sound waves ?  
(A) Diffraction (B) Polarization (C) Interference (D) Reflection

# 11<sup>th</sup> CLASS - 1<sup>st</sup> Annual 2023

**PHYSICS**

**GROUP : FIRST** *DGK-11-1-23*

**SUBJECTIVE**

**SECTION - I**

**TIME: 2.40 HOURS**

**MARKS : 68**

**QUESTION NO. 2 Write short answers of any Eight (8) parts of the following**

16

i	Differentiate between random and systematic error.
ii	What are two principal characteristics of an ideal standard ?
iii	Why do we find it useful to have two units for the amount of substance Kilogram and the mole?
iv	Show that the famous "Einstein equation" $E = mc^2$ is dimensionally consistent.
v	Prove that scalar product is commutative.
vi	Find the projection of $\vec{A} = 2\hat{i} - 8\hat{j} + \hat{k}$ in the direction of $\vec{B} = 3\hat{i} - \hat{j} - 12\hat{k}$
vii	Show that the sum and difference of two perpendicular vectors of equal lengths are also perpendicular and of the same length.
viii	Calculate the distance covered by a free falling body during first second of its motion.
ix	What are inertial and non inertial frame of references.
x	Explain the circumstances in which the velocity $V$ and acceleration $a$ of a car are (a) $V$ is zero but $a$ is not zero. (b) $a$ is zero but $V$ is not zero
xi	At what point or points in its path does a projectile have its minimum speed its maximum speed ?
xii	Explain how swing is produced in a fast moving cricket ball.

**QUESTION NO. 3 Write short answers of any Eight (8) parts of the following**

16

i	Calculate the work done in Kilo joules in lifting a mass of 10 kg (at a steady velocity) through a vertical height of 10 m.
ii	When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from ?
iii	Define term "Aquifer" .
iv	Show that orbital angular momentum $L_o = mv_o r$
v	Explain how many minimum numbers of geo-stationary satellites are required for global coverage of T.V transmission.
vi	Prove that $2 \text{ radian} = 114.6^\circ$
vii	Name two characteristics of simple harmonic motion.
viii	What is the total distance travelled by an object moving with S.H.M in a time equal to its period, if its amplitude is $A$ ?
ix	Define resonance and give its example.
x	Is it possible for two identical waves travelling in the same direction along a string to give rise a stationary wave.
xi	Why does sound travel faster in solids than in gasses ?
xii	What is condition for path difference in constructive interference and write its general equation ?

**QUESTION NO. 4 Write short answers of any Six (6) parts of the following**

12

i	State the Huygen's principle.
ii	How would you distinguish between un-polarized and plane-polarized lights ?
iii	An oil film spreading over a wet path shows colours. Explain how does it happen ?
iv	What is the function of a collimator in spectrometer ?
v	How would it be advantageous to use blue light with a compound microscope ?
vi	How can the efficiency of a practical heat engine be increased ?
vii	Why spark plug is not needed in a diesel engine ?
viii	Specific heat of a gas at constant pressure is greater than specific heat at constant volume why ?
ix	Does the entropy of a system increase or decrease due to friction ?

## SECTION - II

**NOTE : Attempt any three questions from this section (8 x 3 = 24)**

**(Part A = 5 marks & Part B = 3 marks)**

Q. No.5 (A)	Explain the scalar product with its characteristics and examples.
(B)	How large force is required to accelerate an electron ( $m = 9.1 \times 10^{-31} \text{ kg}$ ) from rest to a speed of $2.0 \times 10^7 \text{ ms}^{-1}$ through a distance of 5.0 cm.
Q. No.6 (A)	Define centripetal force and derive its formula $F_c = \frac{mv^2}{r}$
(B)	A football is thrown an angle of $30^\circ$ with respect to horizontal to throw a 40m pass, What must be the initial speed of the ball.
Q. No.7 (A)	State and explain equation of continuity.
(B)	What is the average translational kinetic energy of molecules in a gas at temperature $27^\circ\text{C}$ ?
Q. No.8 (A)	Discuss the effects of variations of pressure, density and temperature on the speed of sound in a gas. Also, derive the relation $V_t = V_o + 0.61 t$
(B)	A simple pendulum is 50.0 cm long. What will be its frequency of vibration at a place where $g = 9.8 \text{ ms}^{-2}$
Q. No.9 (A)	What is a spectrometer ? Explain its main parts.
(B)	A light is incident normally on a grating which has 2500 lines per centimeter. Compute the wave length of a spectral line for which the deviation in second order is $15.0^\circ$

## PHYSICS

GROUP : SECOND *OCR-11-2-23* OBJECTIVE

MARKS : 17

NOTE : You have four choices for each objective type question as A , B , C and D . The choice which you think is correct; fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

## QUESTION NO. 1

- 1 The expression for the time period of low flying satellite put into the orbit is  
(A)  $T = \frac{2\pi R}{g}$  (B)  $T = \frac{2\pi R}{g^2}$  (C)  $T = \frac{2\pi g}{R}$  (D)  $T = \frac{2\pi R}{v}$
- 2 The incompressible and non viscous fluid is called  
(A) Viscous fluid (B) Non ideal fluid (C) Real Fluid (D) Ideal fluid
- 3 The product of frequency and time period is equal to  
(A) 1 (B) 2 (C) 3 (D) 4
- 4 The portion of a wave below the mean level is called  
(A) Crest (B) Trough (C) Node (D) Anti - node
- 5 When an aero plane move towards air port, then its frequency received by radar  
(A) Decreases (B) Increases (C) Remain same (D) Become zero
- 6 Which of the following waves cannot be polarized  
(A) X - rays (B) radio waves (C) Ultra - violet waves (D) Sound waves
- 7 The magnifying power of a simple microscope is  
(A)  $M = 1 + \frac{f}{d}$  (B)  $M = 1 + \frac{d}{f}$  (C)  $M = 1 + \frac{1}{f}$  (D)  $M = 1 + df$
- 8 Charle's law can be written as mathematically  
(A)  $V \propto T$  (B)  $V \propto \frac{1}{T}$  (C)  $P \propto T$  (D)  $P \propto \frac{1}{T}$
- 9 The carnot cycle can be shown by  
(A) V - T graph (B) P - V graph (C) P - T graph (D) P - V - T graph
- 10 The unit of power in terms of base unit is  
(A)  $Kg ms^{-2}$  (B)  $Kg m^{-1}s^{-1}$  (C)  $Kg m^{-2}s^{-2}$  (D)  $Kg m^2s^{-3}$
- 11 Time taken by light to reach from sun to earth is  
(A) 1 min, 20 sec (B) 4 min, 20 sec (C) 8 min, 20 sec (D) 10 min, 20 sec
- 12  $\vec{r} = a\hat{i} + b\hat{j} + C\hat{k}$   
(A) Equal vector (B) Position vector (C) Unit vector (D) Negative vector
- 13 Torque has maximum value if angle between  $\vec{r}$  and  $\vec{F}$  is  
(A)  $30^\circ$  (B)  $90^\circ$  (C)  $45^\circ$  (D)  $60^\circ$
- 14 The time rate of change of displacement is called  
(A) Acceleration (B) Velocity (C) Speed (D) Average force
- 15 The relation  $I = \vec{F} \times \Delta t$  shows  
(A) Momentum (B) Power (C) Impulse (D) Work
- 16 The original source of energy of tides is  
(A) Earth (B) Sun (C) Moon (D) Star
- 17 Angular momentum of a body under a centripetal force is  
(A) Zero (B) Maximum (C) Minimum (D) Constant

## QUESTION NO. 2 Write short answers of any Eight (8) parts of the following

16

- i Add the given masses, in kg up to appropriate precision 2.189, 0.089, 11.8 and 5.32
- ii How many nano-seconds in one year ?
- iii Why do we find it useful to have two units for the amount of substance, the Kilogram and the mole ?
- iv Write the dimensions of (i) Pressure (ii) Density
- v Can the magnitude of a vector have a negative value ?
- vi Is it possible to add  $2\vec{A}$  into  $\vec{A}$  ? Explain
- vii Name the three conditions that could make  $A_1 \times A_2 = 0$
- viii At the highest point in the path of a projectile its speed is minimum, why? Explain it.
- ix Derive the relation for the height of a projectile.
- x Motion with constant velocity is a special case of motion with constant acceleration. Is this statement true? Discuss.
- xi Explain the circumstances in which the velocity ' $\vec{v}$ ' and acceleration ' $\vec{a}$ ' of a car are  
(i) Parallel (ii) Perpendicular to one another
- xii Two row boats moving parallel in the same direction are pulled towards each other. Explain.

## QUESTION NO. 3 Write short answers of any Eight (8) parts of the following

16

- i A person holds a bag of groceries while standing still, talking to a friend. A car is still while its engine is running. From the stand point of work, How are these two situations similar ?
- ii Calculate the work done in Kilojoules in lifting a mass of 10 kg (at a steady velocity) through a vertical height of 10 m.
- iii Define escape velocity. Does the escape velocity of a body depend upon its mass ?
- iv Calculate the rotational K.E of a disc and a hoop
- v Differentiate between tangential and angular velocity. If one of these is given for a wheel of known radius, how will you find the other ?
- vi What is meant by moment of inertia ? Explain its significance.
- vii Name the two characteristics of simple harmonic motion.
- viii Does frequency depend on amplitude for harmonic oscillators ? Explain.
- ix Explain briefly the example of an electrical resonance.
- x Find the temperature at which the velocity of sound in air is two times its velocity at  $10^\circ\text{C}$
- xi What features do longitudinal waves have in common with transverse waves ?
- xii Is it possible for two identical waves travelling in the same direction along a string to give rise to a stationary wave ? Explain.

## QUESTION NO. 4 Write short answers of any Six (6) parts of the following

16

- i Draw the experimental arrangement for observing Newton's ring.
- ii How would you manage to get more orders of spectra using a diffraction grating ?
- iii Why the Polaroid sunglasses are better than ordinary sunglasses ?
- iv Define near point and resolving power.
- v Why would it be advantageous to use blue light with a compound microscope ?
- vi What is heat engine ? Define efficiency.
- vii Explain bicycle pump as an example of 1<sup>st</sup> law of thermodynamics.
- viii Is it possible to convert internal energy into mechanical energy ? Explain with examples.
- ix A thermos flask containing milk as a system is shaken rapidly. Does the temperature of milk rise ?

## SECTION - II

NOTE : Attempt any three questions from this part (8 x 3 = 24) (Part A = 5 marks and Part B = 3 marks)

Q. No.5 (A)	Define absolute potential energy. Derive relation for absolute potential energy of body of mass 'm' at distance 'r' from the centre of earth.
(B)	Find the angle between the two Vectors $\vec{A} = 5\hat{i} + \hat{j}$ and $\vec{B} = 2\hat{i} + 4\hat{j}$
Q. No.6 (A)	What is projectile motion? Work out expressions for (i) Height (ii) Time of light
(B)	A gramophone record turntable accelerates from rest to an angular velocity of $45.0 \text{ rev min}^{-1}$ in 1.60 s. What is its average angular acceleration ?
Q. No.7 (A)	Derive a relation which shows that flow rate is a constant quantity in an ideal fluid.
(B)	A thermodynamic system undergoes a process in which its internal energy decreases by 300 J. If at the same time 120 J of work is done on the system, find the heat lost by the system.
Q. No.8 (A)	Define and explain the phenomenon of beats. How beats are graphically represented. Also mention the uses of beats.
(B)	A simple pendulum is 50.0 cm long. What will be its frequency of vibration at a place where $g = 9.8 \text{ ms}^{-2}$
Q. No.9 (A)	What is compound microscope ? Explain its working and derive the formula for its angular magnification
(B)	In a double slit experiment the second order maximum occurs at $\theta = 0.25^\circ$ . The wavelength is 650 nm. Determine the slit separation.

D

## PHYSICS

## GROUP : FIRST

TIME: 20 MINUTES

OBJECTIVE ~~OSK-9-22~~

MARKS: 17

NOTE: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

## QUESTION NO. 1

- |    |   |
|----|---|
| 1  | Number of colours used in process of colour printing to produce the entire range of colours are<br>(A) 4 (B) 5 (C) 6 (D) 7  |
| 2  | One femto is equal to<br>(A) $10^{-9}$ (B) $10^{-18}$ (C) $10^{-6}$ (D) $10^{-15}$  |
| 3  | Resultant of two perpendicular vectors of equal magnitude A is<br>(A) $A^2$ (B) A (C) $\sqrt{2} A$ (D) 2A   |
| 4  | If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = 4\hat{i} + 6\hat{j} - 2\hat{k}$ the angle between them will be<br>(A) $0^\circ$ (B) $45^\circ$ (C) $60^\circ$ (D) $90^\circ$                              |
| 5  | A bullet shot straight up, returns to its starting point in 10 sec, the initial speed was<br>(A) 10 m/sec (B) 49 m/sec (C) 24 m/sec (D) 98 m/sec  |
| 6  | Horizontal range is equal to 4 times of its maximum height only if angle of projection is<br>(A) $90^\circ$ (B) $45^\circ$ (C) $60^\circ$ (D) $30^\circ$  |
| 7  | When two protons are brought closer together, then<br>(A) K.E increases (B) P.E decreases (C) P.E increases (D) P.E remains same  |
| 8  | The time period of artificial satellite close to earth is given by<br>(A) $\frac{2\pi R}{V}$ (B) $2\pi RV$ (C) $\frac{2\pi V}{R}$ (D) $\frac{\pi R}{V}$   |
| 9  | If a body of mass 10 kg is allowed to fall freely, its weight becomes<br>(A) 10 N (B) 0 N (C) 100 N (D) 9.8 N   |
| 10 | A two (2) meter high tank is full of water. A hole appears at its middle. The speed of efflux will be<br>(A) $3.75 \text{ ms}^{-1}$ (B) $5.11 \text{ ms}^{-1}$ (C) $4.10 \text{ ms}^{-1}$ (D) $4.42 \text{ ms}^{-1}$  |
| 11 | The distance covered by a body in one complete vibration is 20 cm. What is the amplitude of the body<br>(A) 10 cm (B) 20 cm (C) 1 cm (D) 5 cm   |
| 12 | If the speed of sound in air at given pressure is 'V' then doubling the pressure, the new speed becomes<br>(A) 2 V (B) V (C) 3 V (D) 4 V  |
| 13 | A stretched string vibrates in n loops, its length in terms of wavelength is<br>(A) $\frac{n\lambda n}{2}$ (B) $(n+1)\frac{\lambda n}{2}$ (C) $(n + \frac{1}{2})\frac{\lambda n}{2}$ (D) $(n + \frac{1}{2})\lambda n$ |
| 14 | Which of the following phenomenon cannot produce colours with white light?<br>(A) Diffraction (B) Interference (C) Polarization (D) Dispersion  |
| 15 | An astronomical telescope has objective of focal length 100 cm and eyepiece of focal length 10 cm. Its magnifying power is<br>(A) 100 (B) 1000 (C) 10 (D) 1   |
| 16 | Change in entropy of reversible process is<br>(A) Positive (B) Maximum (C) Negative (D) Zero  |
| 17 | Isobaric process is one in which ..... remains constant<br>(A) Volume (B) Pressure (C) Temperature (D) Energy   |

QUESTION NO. 2 Write short answers of any Eight (8) parts of the following

D  
D.K-91-22

16

i	Define the terms , precision and accuracy
ii	Write the dimensions of (a) Pressure (b) Density
iii	How many seconds are in one year ? Calculate
iv	Differentiate in physical and non-physical quantities with examples
v	At what point or points in its path does a projectile have its minimum speed , its maximum speed ?
vi	Define impulse and show how it is related to linear momentum ?
vii	Why ballistic missiles are not useful for long range ?
viii	State second law of motion in terms of momentum
ix	A thermos flask containing milk as a system is shaken. Does the temperature of milk rise ?
x	Specific heat of gas at constant pressure is greater than specific heat at constant volume. Why ?
xi	Why entropy is called time arrow ?
xii	Can we say that first law of thermodynamics is law of conservation of energy ? Explain

QUESTION NO. 3 Write short answers of any Eight (8) parts of the following

16

i	What changes take place in a vector when it is multiplied by “ - 2 ” ?
ii	How the direction of the vector product of two vectors can be determined ? Explain
iii	Can a vector have rectangular component greater than the vector's magnitude ? Explain
iv	Define escape velocity. Does the escape velocity of a body depend upon its mass ?
v	In which case more work is done ? When a 50 kg bag of books lifted through 50 cm ; or when 50 kg crate is pushed through 2 m across the floor with force of 50 N ?
vi	Differentiate between renewable and non-renewable energy sources with examples
vii	Why does the coasting rotating system slow down as water drops into the beaker ?
viii	Why does a diver change his body positions before and after diving into the pool ?
ix	Calculate rotational K.E of solid circular disc and hoop
x	Can visible light produce interference fringes ? Explain
xi	What is meant by optically active crystals ? Give at least two examples
xii	Find the grating element of the diffraction grating containing 2000 lines/cm

QUESTION NO. 4 Write short answers of any Six (6) parts of the following

12

i	Write down the properties of an ideal fluid
ii	Does frequency depend on amplitude of harmonic oscillator ? Explain briefly
iii	Can we realize an ideal simple pendulum ? Explain
iv	What will be the time period and frequency of a simple pendulum at the centre of earth ?
v	What is the effect of pressure and density on speed of sound ?
vi	Discuss briefly the phase changes when the transverse wave is reflected by a rarer and denser medium
vii	Is it possible for two identical waves travelling in the same direction along a string to give rise to a stationary wave ?
viii	Write down the importance of collimator in spectrometer
ix	One can buy a cheap microscope for use of children. The image seen in such a microscope have coloured edges. Why is this so ?

SECTION-II

Note: Attempt any Three questions from this section

8 x 3 = 24

Q.5 (A)	Define and formulate absolute gravitational potential energy	5
(B)	Find the angle between two vectors $\vec{A} = 5\hat{i} + \hat{j}$ and $\vec{B} = 2\hat{i} + 4\hat{j}$	3
Q.6 (A)	State and prove law of conservation of linear momentum	5
(B)	A body of moment of inertia $I = 0.80 \text{ kg m}^2$ about a fixed axis , rotates with a constant angular velocity of $100 \text{ rad s}^{-1}$ . Calculate its angular momentum $L$ and the torque to sustain this motion	3
Q.7 (A)	State and prove Bernoulli's equation for ideal fluid	5
(B)	A pipe has length 1 m. Determine the frequency of fundamental and first two harmonics (a) if pipe is open at both ends (b) if pipe is closed at one end . (Speed of sound in air = $340 \text{ ms}^{-1}$ )	3
Q.8 (A)	Why simple pendulum is called simple. Also , derive a relation for its time period	5
(B)	Sodium light ( $\lambda = 589 \text{ nm}$ ) is incident normally on a grating having 3000 lines per centimeter. What is the highest order of the spectrum obtained with this grating ?	3
Q.9 (A)	What is Astronomical telescope ? Describe its construction and working. Also find its magnifying power	5
(B)	Calculate the entropy change when 1.0 kg ice at $0^\circ\text{C}$ melts into water at $0^\circ\text{C}$ . Latent heat of fusion of ice = $L_f = 3.36 \times 10^5 \text{ J kg}^{-1}$	3

D

## PHYSICS

## GROUP : SECOND

## OBJECTIVE

TIME: 20 MINUTES

MARKS: 17

NOTE: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

## QUESTION NO. 1

DGR-92-22

- 1 Which pair of physical quantity has the same dimension  
(A) Work and Power (B) Force and Torque (C) Momentum and Impulse (D) Torque and Power
- 2 The significant zero's in 0.04060 are  
(A) 4 (B) 3 (C) 6 (D) 2
- 3  $\hat{i} \cdot (\hat{j} \times \hat{k}) + \hat{j} \cdot (\hat{k} \times \hat{i}) =$   
(A) 1 (B) 2 (C) 0 (D) -1
- 4 If a force of 5 N is acting along x-axis, its component along x-axis is  
(A) 5 N (B) 0 N (C) 3 N (D) 4 N
- 5 The angle of projection for which max. height is equal to the horizontal range is  
(A) 45° (B) 67° (C) 76° (D) 56°
- 6 Rate of change of momentum of freely falling object is equal to  
(A) K.E (B) Momentum (C) Acceleration (D) Weight
- 7 When two protons are brought closer their ?  
(A) P.E increases (B) K.E increases (C) P.E Decreases (D) K.E Decreases
- 8 A body of mass 10 kg is falling freely, its weight appears  
(A) 98 N (B) 0 N (C) 10 N (D) 9.8 N
- 9 Rotational K.E of disc is  
(A)  $\frac{1}{2} mv^2$  (B)  $\frac{1}{4} IW^2$  (C)  $\frac{1}{4} mv^2$  (D)  $\frac{1}{8} mv^2$
- 10 Maximum drag force on a 1 kg falling sphere is  
(A) 9.8 N (B) 1 N (C) 98 N (D) 4.9 N
- 11 The distance covered by a body in one complete vibration is 20cm. What is the amplitude of vibration ?  
(A) 10 cm (B) 5 cm (C) 15 cm (D) 20 cm
- 12 The distance between 1<sup>st</sup> node and 4<sup>th</sup> anti node is  
(A)  $5 \lambda/4$  (B)  $3 \lambda/4$  (C)  $3 \lambda/2$  (D)  $7 \lambda/4$
- 13 Which quantity changes due to interference of sound waves of same frequency ?  
(A) Time period (B) Wave length (C) Amplitude (D) Frequency
- 14 In Michelson Interferometer, to shift bright to dark fringe, the mirror should be displaced by  
(A)  $\lambda/4$  (B)  $\lambda/2$  (C)  $\lambda/3$  (D)  $\lambda$
- 15 Light emitted from LED has wavelength  
(A) 1.3  $\mu\text{m}$  (B) 1.2  $\mu\text{m}$  (C) 1.4  $\mu\text{m}$  (D) 1.5  $\mu\text{m}$
- 16 For isothermal process  
(A)  $\Delta U = 0$  (B)  $Q = W$  (C)  $PV = \text{constant}$  (D) All of these
- 17 For diatomic gas  $C_v = 5/2 R$  then  $C_p$  will be  
(A)  $3/2 R$  (B)  $2/7 R$  (C)  $7/2 R$  (D)  $9/2 R$

QUESTION NO. 2 Write short answers of any Eight (8) parts of the following

D9K-92-22

16

- Why do we find it useful to have two units for the amount of a substance, the kilogram and the mole?
- The period of a simple pendulum is measured by a stop watch. What type of errors are possible in the time period?
- How can the uncertainty be calculated in timing experiments?
- Calculate how many seconds are there in one year?
- Differentiate between variable velocity and instantaneous velocity
- A 1500 kg car has its velocity reduced from  $20 \text{ ms}^{-1}$  to  $15 \text{ ms}^{-1}$ . How large was the average retarding force?
- Explain the circumstances in which velocity  $\vec{v}$  and acceleration  $\vec{a}$  of a car are
  - antiparallel
  - perpendicular to each other
- Motion with constant velocity is a special case of motion with constant acceleration. Is this statement true? Discuss
- Prove that absolute temperature of an ideal gas is directly proportional to average translational kinetic energy of gas molecules
- Give at least two examples of an adiabatic process
- Why does the pressure of a gas in a car tyre increase when it is driven through some distance?
- Is it possible to convert internal energy into mechanical energy? Explain with an example

QUESTION NO. 3 Write short answers of any Eight (8) parts of the following

16

- Write the rules to find direction  $\theta$  of the resultant in different quadrants
- If one of the rectangular components of a vector is not zero, can its magnitude be zero? Explain
- If all the components of the vectors  $\vec{A}_1$  and  $\vec{A}_2$  were reversed. How would this alter  $\vec{A}_1 \times \vec{A}_2$
- A disc without slipping rolls down a hill of height 10 m. If the disc starts from rest at the top of the hill. What is its speed at the bottom?
- Why microwaves are preferred in communication satellites?
- An object has 1 J of potential energy. What does it mean? Explain
- What is orbital velocity? Explain how it is related to orbital radius?
- A force  $F$  acts through a distance  $L$ . The force is then increased to  $3F$ , and then acts through a further distance  $2L$ . Draw the work diagram to scale
- When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this energy come from?
- Why Polaroid sunglasses are better than ordinary sunglasses?
- In Young's slits experiment, one of the slits is covered with blue filter and other with a red filter. What would be the pattern of light intensity on the screen?
- Define fringe spacing and write its formula

QUESTION NO. 4 Write short answers of any Six (6) parts of the following

12

- Define the term viscosity. Give its units
- Show that for horizontal mass spring system, elastic potential energy is given by  $P.E = \frac{1}{2} kx^2$ , where  $x$  is displacement
- Describe some common phenomena in which resonance plays an important role
- Given  $x = 0.5 \sin \frac{\pi}{8} t$ , Find the amplitude and frequency of the mass performing simple harmonic motion
- As a result of distant explosion, an observer senses a ground tremor and then hears the explosion. Explain the time difference.
- What features do longitudinal waves have common with transverse waves?
- What are the conditions on the path difference for constructive and destructive interference of two waves?
- What is the refractive index of the medium in which speed of light is  $2.75 \times 10^8 \text{ m/s}$ ?
- Explain the difference between angular magnification and resolving power of an optical instrument

## SECTION-II

Note: Attempt any Three questions from this section

8 x 3 = 24

- Q.5 (A) Define work and give its SI unit. How does it change with angle  $\theta$  between force and displacement. Discuss work done by variable force 5
- (B) Find the angle between the two vectors  $\vec{A} = 5\hat{i} + \hat{j}$  and  $\vec{B} = 2\hat{i} + 4\hat{j}$  3
- Q.6 (A) What procedure you suggest to produce artificial gravity. Derive a relation for the frequency of space station to produce artificial gravity. 5
- (B) A proton moving with speed of  $1.0 \times 10^7 \text{ m/s}$  passes through a 0.020 cm thick sheet of paper and emerges with a speed of  $2.0 \times 10^6 \text{ m/s}$ . Assuming uniform deceleration, find retardation and time taken to pass through the paper. 3
- Q.7 (A) State and explain Bernoulli's Equation 5
- (B) The wavelength of the signals from a radio transmitter is 1500 m and the frequency is 200 KHz. What is the wavelength for a transmitter operating at 1000 KHz and with what speed the radio waves travel? 3
- Q.8 (A) Prove that total energy remains conserved in mass spring system, Oscillating with SHM. 5
- (B) In a double slit experiment the second order maximum occur at  $\theta = 0.25^\circ$ . The wavelength is 650 nm. Determine the slit separation 3
- Q.9 (A) Define molar specific heat of a gas at constant pressure ( $C_p$ ) and at constant volume ( $C_v$ ). Also prove that  $C_p - C_v = R$  5
- (B) A glass light pipe in air will totally internally reflect a light ray if its angle of incidence is at least  $39^\circ$ . What is the minimum angle for total internal reflection if pipe is in water {Refractive index of water 1.33} 3

## PHYSICS

## GROUP : FIRST

D  
06K-91-21

## OBJECTIVE

TIME: 20 MINUTES

MARKS: 17

NOTE: You have four choices for each objective type question as A , B , C and D . The choice which you think is correct , fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

## QUESTION NO. 1

- |    |   |
|----|---|
| 1  | Acceleration of a pendulum of length $\ell = 1$ m and displacement of 5 cm having S.H.M is<br>(A) $0.29 \text{ m/s}^2$ (B) $0.19 \text{ m/s}^2$ (C) $0.69 \text{ m/s}^2$ (D) $0.49 \text{ m/s}^2$                               |
| 2  | If radius of droplet becomes half then its terminal velocity will be<br>(A) One fourth (B) Four times (C) Half (D) Double   |
| 3  | When both ends of organ pipe are open then the frequency of stationary waves of nth harmonic is given by<br>(A) $f_n = \frac{nv}{4\ell}$ (B) $f_n = \frac{v}{2n\ell}$ (C) $f_n = \frac{nv}{2\ell}$ (D) $f_n = \frac{2v}{n\ell}$ |
| 4  | The value of constant $\gamma$ for the mono-atomic gas is<br>(A) 1.67 (B) 1.40 (C) 1.29 (D) 2.45  |
| 5  | In youngs double slit experiment the position of bright fringe is given by<br>(A) $y = \frac{m\lambda d}{L}$ (B) $y = \frac{mLd}{\lambda}$ (C) $y = \frac{m\lambda}{Ld}$ (D) $y = \frac{m\lambda L}{d}$                         |
| 6  | In Michelson method time taken by the rotational mirror to rotate through an angle $\frac{2\pi}{8}$ (If f is the frequency of rotation) is<br>(A) $\frac{1}{4f}$ (B) $\frac{1}{2f}$ (C) $\frac{1}{8f}$ (D) $\frac{1}{6f}$       |
| 7  | Sadi Carnot described an ideal engine in<br>(A) 1640 (B) 1740 (C) 1940 (D) 1840   |
| 8  | A system does 600 J of work and at the same time internal energy increases by 320 J , The heat supplied is<br>(A) 200 J (B) 600 J (C) 280 J (D) 920 J   |
| 9  | The dimensions of volume flow rate of a fluid are<br>(A) $[LT^{-1}]$ (B) $[L^2T^{-2}]$ (C) $[L^3T^{-1}]$ (D) $[L^3T^{-2}]$  |
| 10 | Time taken by light to travel from sun to earth is<br>(A) 8 min 20 s (B) 1 min 20 s (C) 5 h 20 s (D) 4 h 20 s   |
| 11 | At what angle Dot product and Cross product have the same magnitude<br>(A) $0^\circ$ (B) $45^\circ$ (C) $30^\circ$ (D) $60^\circ$   |
| 12 | Magnitude of cross product of two perpendicular vectors is<br>(A) $\vec{A} \cdot \vec{B}$ (B) $AB \hat{n}$ (C) 0 (D) AB   |
| 13 | A 1500 kg has its velocity reduced from $20 \text{ ms}^{-1}$ to $15 \text{ ms}^{-1}$ in 3.0 sec. How large was the retarding force ?<br>(A) 500 N (B) 2500 N (C) 1500 N (D) 1000 N  |
| 14 | When a massive body of mass $m_1$ collides with lighter stationary body of mass $m_2$ , the velocity of massive body after collision will be<br>(A) $V_1' = 2V_1$ (B) $V_2' = V_1$ (C) $V_1' = V_1$ (D) $V_2' = 2V_2$           |
| 15 | Which one of the following is conservative force<br>(A) Electric force (B) Air resistance (C) Frictional force (D) Tension in string  |
| 16 | A hoop is rolled down on an inclined plane having height of 10 m. Its velocity at the bottom will be<br>(A) 4.91 m/sec (B) 9.89 m/sec (C) 28.31 m/sec (D) 31.31 m/sec   |
| 17 | Apparent weight of an object in a lift moving down with acceleration $a = g$ is<br>(A) $T = w + ma$ (B) $T = 0$ (C) $T = w$ (D) $T = \text{Infinity}$   |

**QUESTION NO. 2 Write short answers of any Eight (8) parts of the following**

16

- (1) Show that the expression  $V_f = V_i + at$  is dimensionally correct. Where  $V_i$  is the velocity at  $t = 0$ ,  $a$  is acceleration and  $V_f$  is the velocity at time  $t$
- (2) What are the rules for assessment of uncertainty in case of a power factor ?
- (3) Three students measured the length of a needle with a scale on which minimum divisions is 1 mm and recorded as (i) 0.2145 (ii) 0.21 m (iii) 0.214 m. which record is correct and why ?
- (4) Write the dimensions of (i) Force (ii) Velocity
- (5) The vector sum of three vectors give a zero resultant. What can be the orientation of the vectors ?
- (6) Define torque. Write its unit (7) What is the unit vector in the direction of the vector  $\vec{A} = 4\hat{i} + 3\hat{j}$
- (8) Does a moving object have impulse ? (9) Explain the difference between elastic and inelastic collision.
- (10) What is the effect on the speed of a fighter plane chasing another when it open fire ? What happen to the speed of pursued plane when it returns the fire ?
- (11) Define an Isolated system. Give example
- (12) Two row boats moving parallel in the same direction are pulled towards each other. Explain

**QUESTION NO. 3 Write short answers of any Eight (8) parts of the following**

16

- (1) Explain what do you understand the work done by Gravitational field ?
- (2) An object has one joule of potential energy. Explain what does its mean ?
- (3) When a rocket re-enters the atmosphere, its nose cone become very hot. Where does heat energy come from ?
- (4) Define the terms (a) Rotational Kinetic Energy (b) Orbital velocity
- (5) State the direction of the following vectors in simple situation ; angular velocity and angular momentum
- (6) Why does a diver change his body positions before and after diving in the pool ?
- (7) What should be the length of a simple pendulum whose period is 1.0 second at a place where  $g = 9.8 \text{ ms}^{-2}$  ?
- (8) Under what conditions does the addition of two simple harmonic motions produce a result, which is also simple harmonic ?
- (9) Describe two common phenomena in which resonance plays important role
- (10) What features do transverse periodic waves have common with longitudinal periodic waves ?
- (11) What is the effect of density on the speed of sound ? Explain
- (12) What happen when a jet plane like Concorde flies faster than the speed of sound ?

**QUESTION NO. 4 Write short answers of any Six (6) parts of the following**

12

- (1) Can visible light produce interference fringes ? Explain
- (2) Explain whether the Young's experiment is an experiment for studying interference or diffraction effect of light
- (3) Why the centre of the Newton's ring is dark ?
- (4) How convex lens is used as a magnifier ? What limits the magnification of an optical instrument ?
- (5) If a person was looking through a telescope at the full moon, how would the appearance of the moon be changed by covering half of the objective lens ?
- (6) Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why ?
- (7) What is meant by irreversible process ? Give its example
- (8) Calculate the work done during isothermal process ?
- (9) Draw PV-diagram which show four steps of Carnot engine

**SECTION-II**

**Note: Attempt any Three questions from this section**

8 x 3 = 24

- Q.5 (A) What is projectile motion ? Derive expressions for its height and range ? 5  
(B) Find the projection of  $\vec{A} = 2\hat{i} - 8\hat{j} + \hat{k}$  in the direction of the vector  $\vec{B} = 3\hat{i} - 4\hat{j} - 12\hat{k}$  3
- Q.6 (A) What is the effect of temperature on speed of sound ? Show that  $v_t = v_o + 0.61 t$  5  
(B) How large a force is required to accelerate an electron ( $m = 9.1 \times 10^{-31} \text{ kg}$ ) from rest to a speed of  $2 \times 10^7 \text{ ms}^{-1}$  through a distance of 10 cm. 3
- Q.7 (A) Derive Bernoulli's equation for a non-viscous, incompressible fluid which flows in a steady state manner 5  
(B) A 1000 kg car traveling with a speed of  $144 \text{ km h}^{-1}$  rounds a curve of radius 100 m. Find the necessary centripetal force 3
- Q.8 (A) Prove Law of Conservation of energy in SHM in mass spring system 5  
(B) Estimate the average speed of Nitrogen molecules in air under standard conditions of pressure and temperature. 3
- Q.9 (A) Define diffraction of light. Describe it through a diffraction grating to derive diffraction equation to determine wavelength of light. 5  
(B) An astronomical telescope having magnifying power 5.0 consists of two thin lenses 24 cm apart. Find focal lengths of the lenses 3

PHYSICS  
GROUP : SECOND

DGK-52-21  
OBJECTIVE

TIME: 20 MINUTES  
MARKS: 17

NOTE: You have four choices for each objective type question as A , B , C and D . The choice which you think is correct , fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

QUESTION NO. 1

- |    |   |
|----|---|
| 1  | When droplet of water has terminal velocity the acceleration is<br>(A) Maximum (B) Minimum (C) Zero (D) Constant  |
| 2  | If the mass of the bob of a pendulum is doubled then its time period is<br>(A) Halved (B) Doubled (C) Four times (D) Unchanged  |
| 3  | Speed of sound in lead at 20 °C is<br>(A) 1320 m/s (B) 1330 m/s (C) 1340 m/s (D) 1350 m/s   |
| 4  | It becomes difficult to recognize the beats when the difference between the frequencies of two sounds more than about<br>(A) 8 Hz (B) 10 Hz (C) 12 Hz (D) 6 Hz  |
| 5  | In Michelson interferometer by moving the mirror through a distance of $\lambda/4$ , the path difference changed by<br>(A) $\lambda/4$ (B) $\lambda/2$ (C) $\frac{3}{4}\lambda$ (D) $\lambda$                           |
| 6  | The unit of magnifying power of a lens are<br>(A) Watt (B) Joule (C) No unit (D) N - m  |
| 7  | The value of Boltzmann constant k is<br>(A) $1.38 \times 10^{-23} \text{ J K}^{-1}$ (B) $1.38 \times 10^{-25} \text{ J K}^{-1}$ (C) $1.38 \times 10^{-27} \text{ J K}^{-1}$ (D) $1.38 \times 10^{-29} \text{ J K}^{-1}$ |
| 8  | If one mole of an ideal gas is heated at constant volume then<br>(A) $Q_p = C_v \Delta T$ (B) $W = C_v \Delta T$ (C) $Q_v = C_p \Delta T$ (D) $\Delta U = C_v \Delta T$   |
| 9  | In order to reduce the uncertainty in finding time period of a vibrating body, it is advised to count<br>(A) Small number of swings (B) Large number of swings (C) Infinite number of swings<br>(D) Both A and C        |
| 10 | The dimensions of Einstein equation are $E = mc^2$<br>(A) $[MLT^{-2}]$ (B) $[ML^{-1}T^2]$ (C) $[ML^2T^{-2}]$ (D) $[ML^{-2}T^2]$   |
| 11 | The magnitude of a vector $\vec{v} = 3\hat{i} + 6\hat{j} + 2\hat{k}$<br>(A) 3 (B) 6 (C) 7 (D) 8   |
| 12 | When line of action of applied force passes through the axis of rotation , then the torque is<br>(A) Zero (B) 1 (C) Maximum (D) Minimum   |
| 13 | If a force of 20 N acts on a body for 5 seconds then the change in momentum will be<br>(A) 5 NS (B) 20 NS (C) 50 NS (D) 100 NS  |
| 14 | A typical rocket eject the burn gases at speed of over<br>(A) 400 m/s (B) 4000 m/s (C) 8000 m/s (D) 10,000 m/s  |
| 15 | Which one the following is non-conservative force<br>(A) Gravitational force (B) Electric force (C) Elastic spring force (D) Frictional force   |
| 16 | One radian is equal to<br>(A) $57.2^\circ$ (B) $57.3^\circ$ (C) $57.4^\circ$ (D) $57.7^\circ$   |
| 17 | The moment of inertia of solid disc or cylinder is<br>(A) $mr^2$ (B) $\frac{1}{2} mr^2$ (C) $\frac{1}{4} mr^2$ (D) $\frac{1}{2} m^2r$   |

**QUESTION NO. 2 Write short answers of any Eight (8) parts of the following** 16

- (1) Three students measured the length of a needle with a scale on which minimum divisions is 1 mm and recorded as (i) 0.2145 m (ii) 0.21 m (iii) 0.214 m. which record is correct and why ?
- (2) Find the dimensions and hence, the SI units of co-efficient of viscosity  $\eta$  in the Stoke's law  $F = 6 \pi \eta r v$
- (3) Check the correctness of the relation  $V = \sqrt{\frac{F \times l}{m}}$  dimensionally
- (4) Write the dimensions of (i) Force (ii) Acceleration
- (5) Define the terms (i) Unit vector (ii) Position vector
- (6) Suppose the sides of a closed polygon represent vector arranged head to tail. What is the sum of these vectors ?
- (7) What is the vector product of two vectors, give its two characteristics
- (8) Define projectile motion. Derive an expression for the time of flight
- (9) At what point or points in its path does a projectile have its minimum speed, its maximum speed ?
- (10) Define impulse and show how it is related to linear momentum
- (11) Find the velocities of two elastically colliding bodies when  $m_1 = m_2$  after collision
- (12) Explain the difference between laminar flow and turbulent flow

**QUESTION NO. 3 Write short answers of any Eight (8) parts of the following** 16

- (1) How can you find the work done by variable force by graphical method ?
- (2) What will be the velocity of the particle if its momentum and kinetic energy are equal in magnitudes ?
- (3) When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from ?
- (4) Prove that  $a_t = r\alpha$
- (5) What is meant by angular momentum ? Explain the law of conservation of angular momentum
- (6) When mud flies off the tyre of a moving bicycle, in what direction does it fly ? Explain
- (7) What is the distance travelled by an object moving with simple harmonic motion in a time equal to its period, if its amplitude is A ?
- (8) Does the acceleration of a simple harmonic oscillator remain constant during its motion ? Is acceleration ever zero ? Explain
- (9) If equation for simple harmonic motion is  $x = 10 \sin\left(\frac{\pi}{6}\right)t$ , then calculate the instantaneous displacement after 3 seconds
- (10) Explain why sound travels faster in warm air than in cold air
- (11) Write the characteristics of stationary waves (12) Explain the terms node and anti-node

**QUESTION NO. 4 Write short answers of any Six (6) parts of the following** 12

- (1) Can the mechanical energy be converted completely into heat energy ? If so give an example
- (2) Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why ?
- (3) Derive Boyle's law using kinetic theory of gases
- (4) A system absorbs 100 J heat at absolute temperature of 300 K. Calculate the change in entropy
- (5) If the magnifying glass has magnifying power 6 then find the focal length of convex lens
- (6) Explain the difference between angular magnification and resolving power of an optical instrument. What limits the magnification of an optical instrument ?
- (7) If 5000 lines/cm are ruled on a diffraction grating then find its grating element.
- (8) Under what conditions two or more sources of light behave as coherent sources ?
- (9) How would you manage to get more orders of spectra using a diffraction grating ?

**SECTION-II**

**Note: Attempt any Three questions from this section**

**8 x 3 = 24**

- Q.5 (A) Define projectile motion. If a projectile is fired in a direction angle  $\theta$  with the horizontal by velocity  $V_i$  then find the relations for (i) time of flight (ii) range of projectile 1+2+2
- (B) The magnitude of dot and cross product of two vectors are  $6\sqrt{3}$  and 6 respectively. Find the angle between the vectors 3
- Q.6 (A) Derive the relation for absolute potential energy to lift a body from certain position to infinity 5
- (B) An organ pipe has a length of 50 cm. Find the frequency of its fundamental note and next harmonic when it is open at both ends 3
- Q.7 (A) Define rotational kinetic energy, derive its relation. Also derive it for a disc and hoop 5
- (B) How large must be a heating duct if air moving at 3.0 m/s along, it can replenish the air in the room of 300 m<sup>3</sup> volume every 15 min. Assume air's density remains constant 3
- Q.8 (A) What is Carnot engine ? Discuss Carnot cycle. Also derive the relation for its % efficiency 5
- (B) A block of mass 4.0 kg is dropped from a height of 0.80 m on to a spring of spring constant  $k = 1960 \text{ Nm}^{-1}$ . Find the maximum distance through which the spring will be compressed. 3
- Q.9 (A) How compound microscope is formed ? Derive an expression for its total magnification 2+3
- (B) In a double slit experiment the second order maximum occurs at  $\theta = 0.25^\circ$ , the wave length is 650 nm. Determine slit separation 3