

OBJECTIVE

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 marks in that question.

QUESTION NO. 1

DGK-1-24

- 1 The minimum velocity necessary to put a satellite into orbit is :
(A) 7.1 Kms⁻¹ (B) 7.9 Kms⁻¹ (C) 7.4 Kms⁻¹ (D) 8.7 Kms⁻¹
- 2 Stoke's law holds for bodies having :
(A) Oblong shape (B) Rectangular shape (C) Spherical shape (D) All shapes
- 3 Product of time period and frequency is :
(A) Zero (B) π (C) 1 (D) 2
- 4 The value of 'r' for monoatomic gas is :
(A) 1.67 (B) 1.40 (C) 1.29 (D) 1.45
- 5 Laplace's formula for speed of sound is :
(A) $\sqrt{\gamma P/\rho}$ (B) $\sqrt{E/\rho}$ (C) $\sqrt{P/\rho}$ (D) $\gamma P/\rho$
- 6 The blue colour of sky is due to :
(A) Reflection (B) Diffraction (C) Scattering (D) Polarization
- 7 Magnifying power of astronomical Telescope is :
(A) f_e/f_o (B) f_o/f_e (C) $f_e f_o$ (D) $\frac{1}{f_e f_o}$
- 8 Heat is form of :
(A) Power (B) Momentum (C) Torque (D) Energy
- 9 Pascal is the unit of :
(A) Force (B) Pressure (C) Tension (D) Weight
- 10 SI unit of intensity of light is :
(A) Watt (B) Joule (C) Mole (D) Candela
- 11 1 giga is equal to :
(A) 10^3 (B) 10^{12} (C) 10^9 (D) 10^{18}
- 12 The magnitude of $\hat{i} \cdot (\hat{j} \times \hat{k})$ is :
(A) -1 (B) 0 (C) 1 (D) \hat{j}
- 13 If A_x and A_y are both negative, the resultant vector will lie in ----- quadrant.
(A) First (B) Second (C) Third (D) Fourth
- 14 A body having uniform acceleration of 10 ms^{-2} has a velocity of 100 ms^{-1} . In what time its velocity will be doubled ?
(A) 7 S (B) 14 S (C) 10 S (D) 16 S
- 15 The mass of an object is quantitative measure of its :
(A) Momentum (B) Inertia (C) Energy (D) Velocity
- 16 Work is negative when angle between \vec{F} and \vec{d} is :
(A) 0° (B) 90° (C) 180° (D) 45°
- 17 One revolution is equal to :
(A) $\frac{\pi}{2}$ rad (B) π rad (C) 2π rad (D) $\frac{\pi}{4}$ rad

SECTION-I

DGK-1-24

16

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

- i Does a dimensional analysis give any information on constant of proportionality that may appear in an algebraic expression? Explain.
- ii Give the drawbacks to use the period of a pendulum as a time standard.
- iii Find the uncertainty in the average value of these measurements 1.20, 1.22, 1.23, 1.19
- iv Find the distance between Moon and Earth where the travel time of light from Moon to Earth is 1 min 20 sec.
- v If one of the rectangular components of a vector is not zero. Can its magnitude be zero? Explain.
- vi Can a body rotate about its center of gravity under the action of its weight?
- vii If $F_1 = 3$ cm and $F_2 = 6$ cm. Let \vec{F}_1 is at angle 30° while \vec{F}_2 is lying at an angle of 120° w.r to X-axis respectively, then find their dot Product.
- viii What is the difference between uniform and variable velocity. Give S.I unit of acceleration.
- ix Why does a cricket player retrace his hands backward while catching?
- x At what point or points in its path does a projectile have its minimum speed, its maximum speed?
- xi When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from?
- xii Calculate the work done in Kilo joules in lifting a mass of 10 Kg through a vertical height of 10 m.

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

- i What are natural satellites and artificial satellites?
- ii Define angular displacement and write its unit.
- iii A disc and a hoop start moving down from the top of an inclined plane at the same time. Which one will be moving faster on reaching the bottom?
- iv Show that $S = r\theta$
- v Explain the difference between laminar flow and turbulent flow.
- vi Explain what do you understand by the term viscosity?
- vii Can we realize an ideal simple pendulum?
- viii What is meant by phase angle? Does it define angle between maximum displacement and the driving force?
- ix What is the total distance travelled by an object moving SHM in a time equal to its period, if its amplitude is A?
- x Explain the terms node and anti-node.
- xi Why does sound travel faster in solid than in gases?
- xii What are stationary waves? Explain.

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

- i How would you distinguish between un-polarized and plane-polarized lights?
- ii Can visible light produce interference fringes? Explain.
- iii Explain for which colour of light, the fringe spacing in double slit experiment will be maximum.
- iv Why would it be advantageous to use blue light with a compound microscope?
- v How the power is lost in optical fibre through dispersion? Explain.
- vi In a compound microscope magnification of objective and eyepiece are 5 and 50 respectively. What is the total magnification of microscope?
- vii Why does the pressure of a gas in a car tyre increase when it is driven through some distance?
- viii What happens to the temperature of the room, when an air conditioner is left running on a table in the middle of the room?
- ix How process of Human metabolism can be explained, by the first law of thermodynamics.

SECTION-II**Note: Attempt any Three questions from this section** 8 x 3 = 24

Q.5.(A)	What is vector product of two vectors? Why it is called cross product? Give its examples and write down its characteristics.	5
(B)	A truck weighing 2500 Kg and moving with velocity of 21 ms^{-1} collides with a stationary car weighing 1000 Kg. The truck and the car move together after the impact. Calculate their common velocity.	3
Q.6.(A)	What is gravitational field? Show that gravitational field is a conservative field.	5
(B)	An organ Pipe has a length of 50 cm. Find the frequency of its fundamental note and the next harmonic when it is open at both ends. (Speed of sound = 350 ms^{-1})	3
Q.7.(A)	What is moment of inertia. Discuss the moment of inertia of a rigid body.	5
(B)	A car of mass 1300 Kg is constructed using a frame supported by four springs. Each spring has a spring constant $20,000 \text{ Nm}^{-1}$. If two people riding in the car have a combined mass of 160 Kg. Find the frequency of vibration of the car, when it is driven over a pot hole in the road. Assume the weight is evenly distributed.	3
Q.8.(A)	State and explain Bernoulli's equation.	5
(B)	A mechanical engineer develops an engine. Working between 327°C and 27°C and claims to have an efficiency of 52%. Does he claim correctly? Explain.	3
Q.9.(A)	How does the magnification of an object is determined by using compound microscope?	5
(B)	Sodium light $\lambda = 589 \text{ nm}$ is incident normally on grating having 3000 lines per centimeter. What is the highest order of the spectrum obtained with this grating?	3

D



NOTE:



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QUESTION NO. 1

DGR-2-24

- 1 Open end of an organ pipe act as :
(A) Node (B) Antinode (C) Crest (D) Trough
- 2 The wavelength of X – rays is of the order of :
(A) 10^{-10} mm (B) 10^{-10} cm (C) 10^{-10} m (D) 10^{-10} dm
- 3 Optical fibre is covered for the protection with :
(A) Glass (B) Plastic jacket (C) Copper (D) Aluminum
- 4 The value of triple point of water is :
(A) 273.16°C (B) 273.16 F (C) 273.16 K (D) 273.16 K^{-1}
- 5 When hot and cold water are mixed, the entropy :
(A) Decreases (B) Increases (C) Remains constant (D) Zero
- 6 Unit used for the factor $\sqrt{\frac{l}{g}}$ may be :
(A) Meter (B) Second (C) Kilogram (D) Radian
- 7 Solid angle is :
(A) One dimensional (B) Two dimensional (C) Three dimensional (D) Four dimensional
- 8 If the magnitude of $\vec{A} \cdot \vec{B} = \frac{1}{2} AB$ then an angle between \vec{A} and \vec{B} is
(A) 30° (B) 45° (C) 60° (D) 90°
- 9 $\hat{i} \cdot (\hat{k} \times \hat{i})$ is equal to :
(A) 0 (B) 1 (C) \hat{i} (D) \hat{j}
- 10 Impulse has the same unit as that of :
(A) Force (B) Energy (C) Mass (D) Momentum
- 11 When an object moves with constant acceleration, the velocity – time graph is
(A) Parabola (B) Hyperbola (C) Straight line (D) Semi circle
- 12 1 Kilowatt is the unit of :
(A) Power (B) Work (C) Energy (D) Weight
- 13 The value of 'g' at the center of earth is :
(A) infinite (B) 2g (C) 3g (D) Zero
- 14 The expression for the angular momentum is :
(A) $\vec{L} = \vec{p} \cdot \vec{r}$ (B) $\vec{L} = -\vec{p} \cdot \vec{r}$ (C) $\vec{L} = \vec{r} \times \vec{p}$ (D) $\vec{L} = \vec{p} \times \vec{r}$
- 15 The diastolic pressure of a normal healthy person in torr is :
(A) 70 - 75 (B) 75 - 80 (C) 90 - 95 (D) 95 - 100
- 16 If time period of a simple pendulum is double, its length will be
(A) Eight times (B) Four times (C) Three times (D) Two times
- 17 The value of 'r' for diatomic gas is :
(A) 1.4 (B) 1.67 (C) 1.29 (D) 1.73



SECTION-I

QUESTION NO. 2 Write short answers to any Eight (8) of the following *DAK-2-24* 16

i	The length of a floor tile is 0.233 m while its breadth is 0.178 m. Find its area in significant figures.
ii	What is the difference between random error and systematic error ?
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	If force \vec{F} of magnitude 10 N makes an angle of 30° with y -axis then find its x -component.
vi	What does $\frac{\vec{A} \times \vec{B}}{AB \sin \theta}$ represent ?
vii	Can a vector have a component greater than the vector's magnitude
viii	If a squash ball comes back to its starting point after bouncing several times, then what would be its average velocity ?
ix	What is velocity time graph ?
x	Define impulse and show how it is related to linear momentum.
xi	A 60 kg man runs up a long flight of stairs in 40 sec. The vertical height of the stairs is 4.5 m. Calculate his power output in watts .
xii	What sort of energy is in the following (a) Compressed spring (b) A moving car

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

i	Describe what should be the minimum velocity, for a satellite to orbit close to the Earth around it.
ii	Show that orbital angular momentum $L_o = mvr$
iii	Show that how many minimum number of geostationary satellites are required for global coverage of T.V transmission.
iv	Orbital speed of a satellite is 7.9 Kms ⁻¹ . Calculate its period.
v	What are dimensions of AV , where 'A' is area and 'V' is velocity.
vi	A person is standing near a fast moving train. Is there any danger that he will fall towards it ?
vii	Why can we not realize an ideal simple pendulum ?
viii	Explain a relation between total energy, potential energy and kinetic energy of a body oscillating with SHM.
ix	Does frequency depend on amplitude for harmonic oscillator ?
x	Why does sound travel faster in solids than in gases ?
xi	How stationary waves are produced ?
xii	How do bats navigate food ?

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

i	An oil film spreading over a wet footpath shows colours.. Explain how does it happen ?
ii	What is the difference between " Spherical wave front " and " plane wavefront " ?
iii	What are the conditions to observe the interference of light waves ?
iv	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.
v	What will be the speed of light in water ? (refractive index of water is 1.33)
vi	One can buy a cheap microscope for use of children. The images seen in such a microscope have coloured edges. Why is this so ?
vii	Why the entropy of the system increases due to friction ?
viii	Why does the pressure of a gas in a car tyre increase when it is driven through some distance ?
ix	The oceans and our atmosphere contain large amount of heat energy but we cannot convert this energy into useful work. Why ?

SECTION-II

Note: Attempt any Three questions from this section

8 x 3 = 24

Q.5.(A)	Explain the addition of vector by rectangular components. Also write the main steps for addition.	5
(B)	A truck weighing 2500 Kg and moving with a velocity of 21 ms ⁻¹ collides with a stationary car weighing 1000 Kg. The truck and the car move together after the impact. Calculate their common velocity.	3
Q.6.(A)	What are stationary waves ? How they generate in an air column ?	5
(B)	A car of mass 800 kg at 54 km h ⁻¹ is brought to rest in 60 m. Find the average retarding force on the car. What has happened to its original kinetic energy ?	3
Q.7.(A)	How would you Differentiate real weight with apparent weight on the basis of frame of reference, also elaborate the reading of the scale as apparent weight in case of movement of lift.	2+1+1+1
(B)	A block of mass 4.0 Kg is dropped from a height of 0.80 m on to a spring of spring constant $K = 1960 \text{ N/m}$, find the maximum distance through which the spring will be compressed ?	3
Q.8.(A)	What is terminal velocity ? Show that terminal velocity of fog droplet is directly proportional to the square of its radius.	5
(B)	A heat engine performs 100 J of work and at the same time rejects 400 J of heat energy to the cold reservoirs. What is the efficiency of the engine ?	3
Q.9.(A)	Explain the diffraction of X-rays by crystal and derive Bragg's law. What are the uses of diffraction of X-rays ?	5
(B)	An astronomical telescope having magnifying power of 5 consists of two thin lenses 24 cm apart. Find the focal lengths of these lenses.	3

