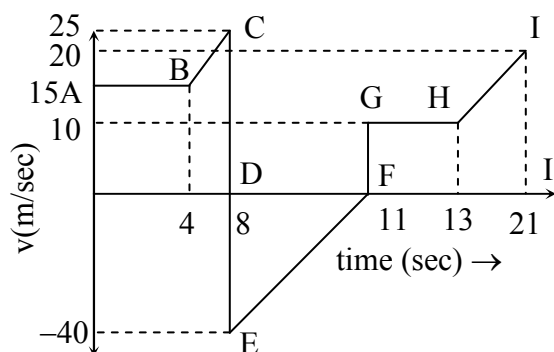


Part I (Mathematics)

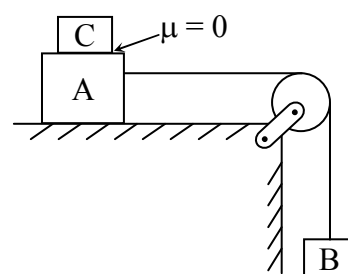
1. The number of diagonals of a polygon of m sides is :
(a) $\frac{m(m-1)}{2!}$ (b) $\frac{m(m-2)}{2!}$ (c) $\frac{m(m-3)}{2!}$ (d) $\frac{m(m-5)}{2!}$
2. The differential equation $\frac{dy}{dx} + Py = Qy^n$, $n > 2$ can be reduced to linear form by substituting:
(a) $z = y^{n-1}$ (b) $z = y^n$ (c) $z = y^{n+1}$ (d) $z = y^{1-n}$
3. A ray of light is coming along the line $y = b$ from the positive direction of x axis and strikes a concave mirror whose intersection with xy plane is a parabola $y^2 = 4ax$. If a and b are positive, then the equation of the reflected ray is :
(a) $y - 2at = \frac{2t}{t^2 + 1}(x - at^2)$ (b) $y - 2at = \frac{2t}{t^2 - 1}(x - at^2)$
(c) $y - 2at = \frac{-2t}{t^2 - 1}(x - at^2)$ (d) None of these
4. The sum of the first n terms of the series : $\frac{1}{2} + \frac{3}{4} + \frac{7}{8} + \frac{15}{16} + \dots$ is
(a) $2^n - n - 1$ (b) $1 - 2^{-n}$ (c) $n + 2^{-n} - 1$ (d) $2^n - 1$
5. $\lim_{x \rightarrow \infty} [x - \sqrt{x^2 + x}] =$
(a) $1/2$ (b) 1 (c) $-1/2$ (d) 0
6. If $x^2 - x + 1 = 0$ then value of x^{3n} is :
(a) $-1, 1$ (b) $1, 0$ (c) $-2, 2$ (d) $0, 2$
7. $\int \frac{dx}{\sin^6 x + \cos^6 x} =$
(a) $\tan^{-1}(\tan x - \cot x) + c$ (b) $-\tan^{-1}(-2 \cot 2x) + c$
(c) $\log(\tan x - \cot x) + c$ (d) $\log(\cot x - \tan x) + c$
8. In a group of boys, the number of arrangements of 4 boys is 12 times the number of arrangement of 2 boys. The number of boys in the group is :
(a) 10 (b) 8 (c) 6 (d) None of these
9. Equation of the diameter of the circle $x^2 + y^2 - 2x + 4y = 0$ which passes through the origin is :
(a) $x + 2y = 0$ (b) $2x + y = 0$ (c) $x + 3y = 0$ (d) $3x + y = 0$
10. A fair dice is tossed eight times. Probability that on the eighth throw, third six is observed is:
(a) ${}^8C_3 \cdot \frac{5^5}{6^8}$ (b) $\frac{{}^7C_2 \cdot 5^5}{6^8}$ (c) $\frac{{}^7C_2 \cdot 5^5}{6^7}$ (d) None of these

Part II (Physics)

1. In the velocity vs time graph given below, find the difference in distance and displacement of the body.



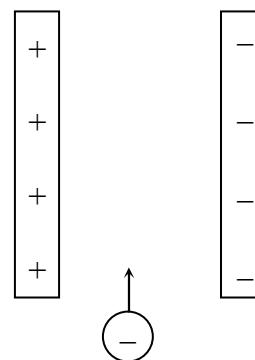
- (a) 40 m (b) 120 m (c) 60 m (d) can't be found
2. Two masses A and B of 10 kg and 5 kg respectively are connected with a string passing over a frictionless pulley fixed at the corner of a table as shown in fig. The coefficient of friction of A with the table is 0.2. The minimum mass of C that may be placed on A to prevent it from moving is equal to



- (a) 15 kg (b) 10 kg
(c) 5 kg (d) 0 kg
3. A satellite with time period $6\sqrt{2}$ hrs orbits the earth at a height $2.5 R$ from earth's surface. What is the height of a geostationary satellite from the surface of the earth. ($R \rightarrow$ radius of earth)

- (a) $7 R$ (b) $6 R$ (c) $5 R$ (d) $4 R$

4. A potential difference of 600 V is applied across the plates of a parallel plate capacitor being separated by 3 mm. An electron projected vertically parallel to the plates with a velocity 2×10^6 m/s moves undeflected between the plates. The magnitude of magnetic field in the region between the plates is

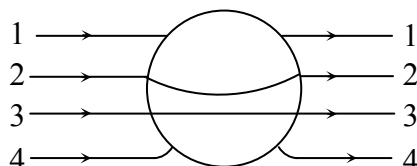


- (a) 0.1 T (b) 0.2 T
(c) 2×10^6 T (d) 600 T

5. A forced oscillator is acted upon by a force $F = f_0 \sin \omega t$. The amplitude of the oscillator is given by $\frac{55}{(2\omega^2 - 36\omega + 9)^{1/2}}$. What is resonant angular frequency ?

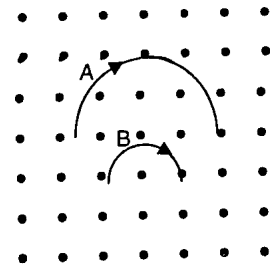
- (a) 2 units (b) 9 units (c) 18 units (d) 36 units

6. A metallic solid sphere is placed in a uniform electric field. The line of force follows the path shown in fig as



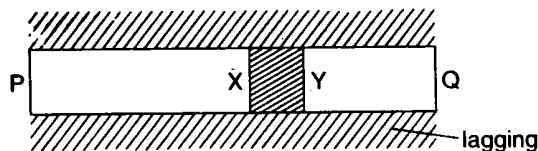
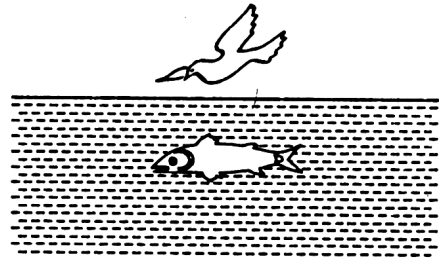
- (a) 1 (b) 2 (c) 3 (d) 4

7. Two particles 'A' and 'B' of masses m_A and m_B respectively and having the same charge are moving in a plane. A uniform magnetic field exists perpendicular to this plane. The speeds of the particles are v_A and v_B respectively and the trajectories are as shown in given Figure.



Then

- (a) $m_A v_A < m_B v_B$ (b) $m_A v_A > m_B v_B$
(c) $m_A < m_B$ and $v_A < v_B$ (d) $m_A = m_B$ and $v_A = v_B$
8. A fish is vertically below a flying bird moving vertically down towards water surface. The bird will appear to the fish to be
- (a) moving faster than its real speed and also away from the real distance
(b) moving faster than its real speed and nearer than its real distance
(c) moving slower than its real speed and also nearer than its real distance
(d) moving slower than its real speed and away from the real distance
9. In a silicon transistor, the base current is changed by $20\mu\text{A}$. This results in a change of 0.02 V in base to emitter voltage and a change of 2 mA in the collector current. The transistor is used as an amplifier with the load resistance of $5\text{ k}\Omega$. The AC current gain is
- (a) 0 (b) 1 (c) 100 (d) 10000
10. PQ is a fully-lagged metal bar, containing a section XY of a material of lower thermal conductivity. The thermal conductivities of the two materials are independent of temperature. Ends P and Q are maintained at different temperatures.



In the steady state, the temperature difference across XY would be independent of

- (a) the temperature difference between P and Q
(b) the metal of which the bar is made
(c) the thickness of the section XY
(d) the distance of the section XY from the end P

Part III (Chemistry)

- The optically active tartaric acid is named as D-(+)-tartaric acid because it has a positive :
 - Optical rotation and is derived from D-glucose
 - pH in organic solvent
 - Optical rotation and is derived from D-(+)-glyceraldehyde
 - Optical rotation when substituted by deuterium
- Which of the following carbonyl compound cannot be prepared by using Grignard's Reagent.
 - HCHO
 - CH₃CHO
 - CH₃COCH₃
 - C₂H₅COCH₃
- Number of isomers of C₄H₉Br is
 - 2
 - 3
 - 4
 - None of these
- When acetaldehyde reacts with aqueous Na₂CO₃ at 298K gives
 - Acetaldol
 - Diacetone alcohol
 - Ethanol
 - Propanol
- BrF₃ molecule has
 - Pyramidal shape
 - Tetrahedral shape
 - Bent-T-Shape
 - Trigonal bipyramidal shape
- A 2° alcohol (A) having the molecular formula C₅H₁₂O, on oxidation, gives a compound (B) with molecular formula C₅H₁₀O. Compound (B) give phenyl hydrazone derivative, but did not give haloform test and give negative Tollen's test. The structure of the compound (A) is
 - CH₃COCH₂CH₂CH₃
 - CH₃CHOHCH₂CH₂CH₃
 - CH₃CH₂COCH₂CH₃
 - CH₃CH₂CHOHCH₂CH₃
- In the extraction of aluminium, the function of cryolite is to :
 - lower the melting point of alumina
 - increase the melting point of alumina
 - remove impurities from alumina
 - minimize the anodic effect.
- Which one of the following is a shape selective catalyst ?
 - V₂O₅
 - Cr₂O₃
 - Hydrated zeolites
 - ZSM-5
- Heats of combustion of yellow phosphorous and red phosphorous are -9.91 kJ and -8.78 kJ respectively. The heat of transition of yellow to red phosphorous is
 - 18.69 kJ
 - + 1.13 kJ
 - + 18.69 kJ
 - 1.13 kJ
- Keeping in view the periodic law and the periodic table, suggest which of the following elements should have the maximum electronegativity character.
 - P
 - As
 - Bi
 - Sb

Part IV (English and Logical Reasoning)

Direction (1 & 2) : In the following questions, the sentences have been given in Active/Passive voice. From the given alternatives, choose the one which best expresses the given sentence in Passive/ Active voice.

1. He is said to be very rich.
(a) He said he is very rich. (b) People say he is very rich.
(c) He said it is very rich. (d) People say it is very rich.
2. Could you buy some stamps for me ?
(a) Stamps, should be bought for me.
(b) You are requested to buy some stamps for me.
(c) You are ordered to buy some stamps for me.
(d) Stamps could be bought for me.

Directions (3 & 4) : Select the pair out of the answer choices which has a similar relationships to that of the stem pair in the question.

3. WHISPER : SPEAK ::
(a) Listen : Bear (b) Request : Ask (c) Brush : Touch (d) Heat : Chill
4. TELEPHONE : RING ::
(a) Door : knock (b) Gate : open (c) Door : wood (d) Lock : key

