



Sri Chaitanya IIT Academy.,India.

A.P. T.S. KARNATAKA TAMILNADU MAHARASTRA DELHI RANCHI

A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Jr.Super60_STERLING BT

JEE-MAIN

Date: 26-10-2024

Time: 09:00AM to 12:00PM

WTM-16

Max. Marks: 300

IMPORTANT INSTRUCTION:

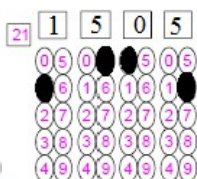
1. Immediately fill in the Admission number on this page of the Test Booklet with **Blue/Black Ball Point Pen** only.
2. The candidates should not write their Admission Number anywhere (except in the specified space) on the Test Booklet/ Answer Sheet.
3. The test is of **3 hours** duration%.
4. The Test Booklet consists of 90 questions. The maximum marks are **300**.
5. There are **three** parts in the question paper 1,2,3 consisting of **Physics, Chemistry** and **Mathematics** having **30 questions** in each subject and subject having **two sections**.
(I) Section –I contains 20 **multiple choice** questions with only one correct option.
Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

(II) Section-II contains 10 **Numerical Value Type** questions. Attempt any 5 questions only, if more than 5 questions attempted, First 5 attempted questions will be considered.

■ The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and if answer is from **10.5** and less than **11** round off is **11**).

To cancel any attempted question bubble on the question number box.

For example: To cancel attempted question 21. Bubble on 21 as shown below



Question Answered for Marking

Question Cancelled for Marking

Marking scheme: +4 for correct answer, 0 if **not attempt** and -1 in all other cases.

6. Use **Blue / Black Point Pen only** for writing particulars / marking responses on the Answer Sheet. **Use of pencil is strictly prohibited.**
7. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electron device etc, except the Identity Card inside the examination hall.
8. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
9. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Hall. **However, the candidate are allowed to take away this Test Booklet with them.**
10. **Do not fold of make any stray marks on the Answer Sheet**

Name of the Candidate (in Capital): _____

Admission Number:

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Candidate's Signature: _____ Invigilator's Signature: _____

**26-10-2024_Jr.Super60_STERLING BT_Jee-Main_WTM-16_Test Syllabus****PHYSICS**

: FLUID STATICS: Archimedes' Principle, Principle of Buoyancy, Buoyancy (Including effective 'g'), Laws of floatation, Basic Ideas of stable Equilibrium of floating Body, Problems in fluid Statics, FLUID STATICS: Basic Ideas of stable Equilibrium of floating Body, Problems in fluid Statics, Fluid Dynamics: General Characteristics of liquid flow, types of Fluid flow (Stream line and turbulent flow), Equation of Continuity, Bernoulli's theorem, Applications of Bernoulli's theorem: Velocity of efflux, horizontal range of the escaping liquid time of emptying of the vessel, Impact force of liquid, Venturimeter, Sprayer (or) atomizer, Narrowing water jet, Siphon, Pitot tube, Dynamic lift, Thrust on a rocket, Magnus effect.

CHEMISTRY

: ORGANIC CHEMISTRY: Allotropes of carbon, Hybridisation of carbon; Sigma and pi-bonds; Shapes of simple organic molecules, Purification and characterisation of organic compounds: Methods of purification, Detection of nitrogen, sulphur, phosphorus and halogens, Estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus., IUPAC NOMENCLATURE : Nomenclature of Hydrocarbons.

MATHEMATICS

: Applications of vectors to Geometry, Product of four vectors (Deleted pertaining to JEE Main but still in JEE ADV Syllabus & BIEAP), 3D-Geometry: Distance Formula, Section formula, Direction Ratios & Cosines of a line, Angle between two lines by using D.Cs and D.Rs



THE PERFECT HAT-TRICK WITH ALL-INDIA RANK 1
IN JEE MAIN 2023 JEE ADVANCED 2023 AND NEET 2023

**JEE MAIN
2023**SINGARAJU
VENKAT KOUNDINYA
SRI CHAITANYA
6th, 12th Class**300
300**
MARKS**RANK****1****JEE Advanced
2023**VAVILALA
DHIVILAS REDDY
SRI CHAITANYA
6th, 12th Class**341
360**
MARKS**RANK****1****NEET
2023**BORA VARUN
CHAKRAVARTHI
SRI CHAITANYA
6th, 12th Class**720
720**
MARKS**RANK****1**



PHYSICS

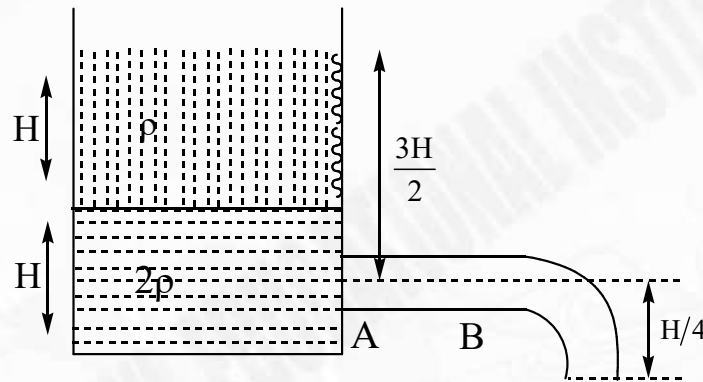
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(SINGLE CORRECT ANSWER TYPE)

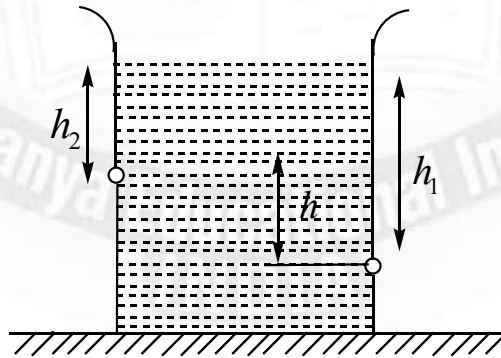
This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases.

1. Water flows out of a big tank along a horizontal tube AB of length L and radius R and bends at right angle at the other end as shown in the figure. Find moment of force exerted by water on the tube about the end A at the instant shown (Assume that the radius of the tube is small.)



- 1) $5\rho\pi R^2 gHL$ 2) $10\rho\pi R^2 gHL$ 3) $15\rho\pi R^2 gHL$ 4) none of the above
2. There are two identical small holes of area of cross-section 'a' on the opposite sides of a tank containing a liquid of density ρ . The difference in height between the holes is h . The tank is resting on a smooth horizontal surface. Horizontal force required to keep the tank in equilibrium is (at the shown instant)

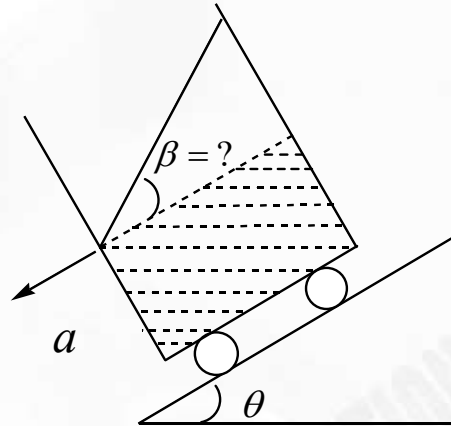


- 1) $\frac{2gh}{\rho Q}$ 2) $\frac{\rho gh}{a}$ 3) $2\rho agh$ 4) $gh\rho a$

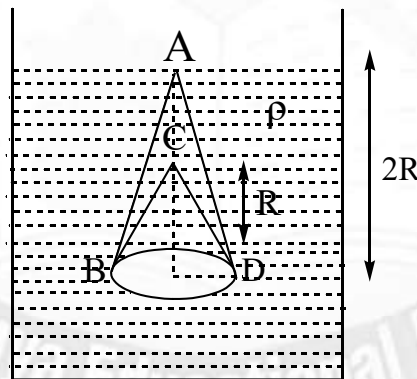




3. A container containing a liquid is moving down an incline plane with constant acceleration 'a'. The angle made by the water surface with the inclined plane is (take $a = 2g\sin\theta$)



- 1) 2θ 2) 0.5θ 3) θ 4) cannot say anything
4. A solid cone of uniform density and height $2R$ and base radius R has a conical portion scooped out from its base with the same base radius but height R as shown in the figure. The solid cone is floating in a liquid of density ρ with vertex A touching the fluid surface. If atmospheric pressure is P_0 , the buoyant force on the cone is

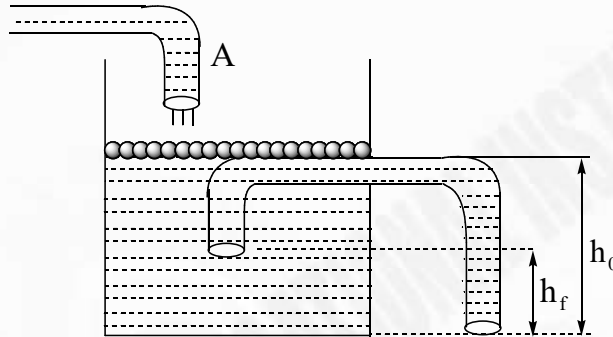


- 1) $\frac{\pi R^3 \rho g}{3} \left[2 + \frac{3P_0}{R\rho g} \right]$ 2) $\frac{\pi R^3 \rho g}{3} \left[5 + \frac{3P_0}{R\rho g} \right]$
- 3) $\frac{\pi R^3 \rho g}{3}$ 4) $\frac{\pi R^3 \rho g}{3} \left[4 + \frac{3P_0}{R\rho g} \right]$

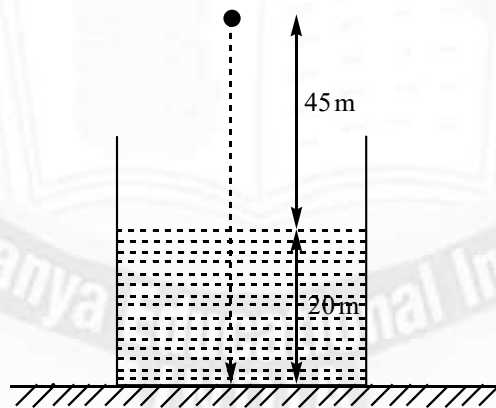




5. The ratio of masses of a cubical block of wood and a chunk of concrete is $3/5$ so that the combination just floats with entire volume submerged under water. If the specific gravity of wood is 0.5, then specific gravity of concrete will be
 1) 2.5 2) 25 3) 15 4) 3
6. In the figure shown, water flows into the open vessel through pipe A at a constant rate. The water can flow out of the vessel by pipe B. The maximum flow-rate of the water in pipe B is always more than that in pipe A. Final height of the water level in the vessel would be



- 1) h_0
 2) h_f
 3) Somewhere in-between h_0 and h_f
 4) The water level will keep oscillating in the vessel
7. A target object is placed at the bottom of a tank of depth 20 m, and filled with a liquid of density 500 gm/cc. Another object of density 100 gm/cc is dropped onto it, from a height of 45 m from the upper surface of the liquid. (Take $g=10 \text{ m/s}^2$). Choose incorrect statement.

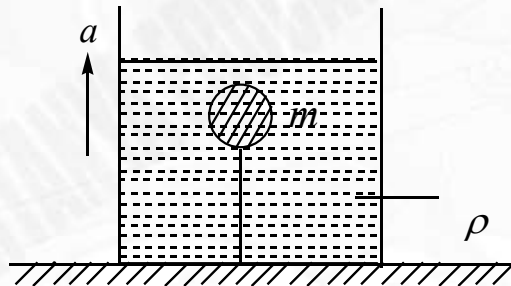


- 1) The second object does not collide with the target.
 2) The second object does collide with the target.
 3) The least separation between object and target is 8.75 m.
 4) The retardation of the object in the liquid is 40 ms^{-2} .

**JEE MAIN**
2023SINGARAJU
VEERAT KOONDINYA
AIR 100 (2023)
Sri Chaitanya
6th, 12th Class**300**
300
MARKS**RANK****1****JEE Advanced**
2023VAVILALA
CHIVILAS REDDY
AIR 100 (2023)
Sri Chaitanya
6th, 12th Class**341**
360
MARKS**RANK****1****NEET**
2023BORA VARUN
CHAKRAVARTHI
AIR 100 (2023)
Sri Chaitanya
6th, 12th Class**720**
720
MARKS**RANK****1**



8. A small body of density ρ is dropped from rest at a height h (from surface) on to a lake of density ρ' where $\rho < \rho'$. Which of the following statement or statements is or are correct if all dissipative effects are neglected? (Neglect viscosity)
- 1) The speed of the body just before entering the lake is $2gh$
 - 2) The body in the lake experiences downward acceleration equal to $\{(\rho/\rho')-1\}g$
 - 3) The maximum depth to which the body sinks in the lake is $h\rho/(-\rho + \rho')$
 - 4) The body does not come back to the surface of the lake
9. A wooden ball of mass m (density σ) is kept inside water (density $\rho > \sigma$) by the help of a massless string shown in the figure. One end of the string is fixed at the bottom of vessel. When the vessel containing the water is accelerated upwards with acceleration a as shown in the figure.



- 1) Tension in the string will increase 2) tension in the string will decrease
 - 3) Force of buoyancy will decrease 4) None
10. Along a streamline
- 1) The velocity of fluid particle remain constant
 - 2) The velocity of all fluid particles crossing a given position is constant
 - 3) The velocity of all fluid particles at a given instant is constant
 - 4) The speed of a fluid particle remains constant.
11. In the following figure is showing the flow of an ideal liquid through a horizontal pipe. Three tubs A, B, and C are connected to the pipe. The radii of the tubes A, B and C at the junction are respectively 2 cm, 1 cm and 2cm. It can be said that the :

**JEE MAIN**
2023SINGARAJU
VEERAT KOUNDINYA
AIR 1st Rank
Sri Chaitanya
60th-12th Class
300
300
MARKS

RANK

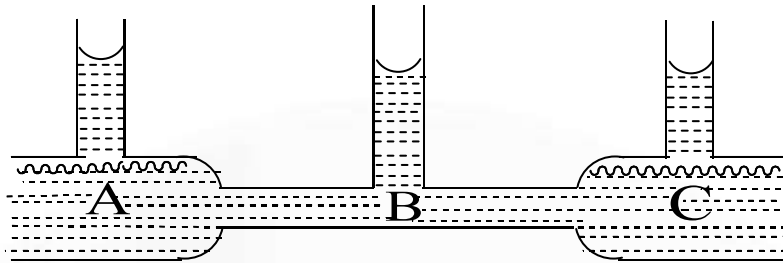
1**JEE Advanced**
2023VAVILALA
DRIVILAS REDDY
AIR 1st Rank
Sri Chaitanya
60th-12th Class
341
360
MARKS

RANK

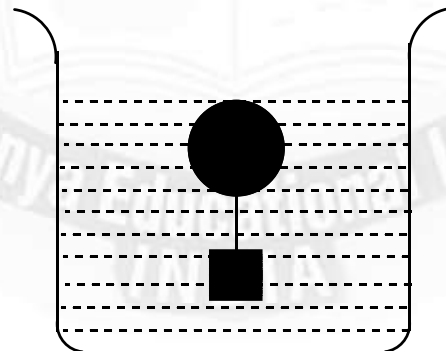
1**NEET**
2023BORA VARUN
CHAKRAVARTHI
AIR 1st Rank
Sri Chaitanya
60th-12th Class
720
720
MARKS

RANK

1



- 1) Height of the liquid in the tubes B and C is same
 - 2) Height of the liquid in the tubes A and B is the same
 - 3) Height of the liquid in all the three tubes is the same
 - 4) Height of the liquid in the tubes A and C is the same
12. Which one of the following cannot be explained on the basis of Bernoulli's theorem?
- 1) Blowing off of light roofs when strong winds blow
 - 2) Curved path followed by a spinning ball
 - 3) Working of an atomizer/ perfume bottle
 - 4) None
13. The rate of flow of glycerin of density ρ through conical section of a pipe, if the area of cross-sectional of its ends are A_1 and A_2 and pressure drop across its length be Δp , is given by ($A_1 > A_2$)
- 1) $A_1 A_2 \sqrt{\frac{\Delta P}{\rho(A_1^2 - A_2^2)}}$
 - 2) $A_1 A_2 \sqrt{\frac{2\Delta P}{\rho(A_1^2 - A_2^2)}}$
 - 3) $\sqrt{\frac{2\Delta P}{\rho(A_1^2 - A_2^2)}}$
 - 4) $A_1 A_2 \sqrt{\frac{2\Delta P}{3\rho(A_1^2 - A_2^2)}}$
14. A body floats in a liquid contained in a beaker. The whole system shown in figure is falling under gravity. The up thrust on the body due to liquid is:



- 1) Zero
- 2) equal to weight of liquid displaced
- 3) Equal to weight of the body in air
- 4) equal to weight of the immersed body

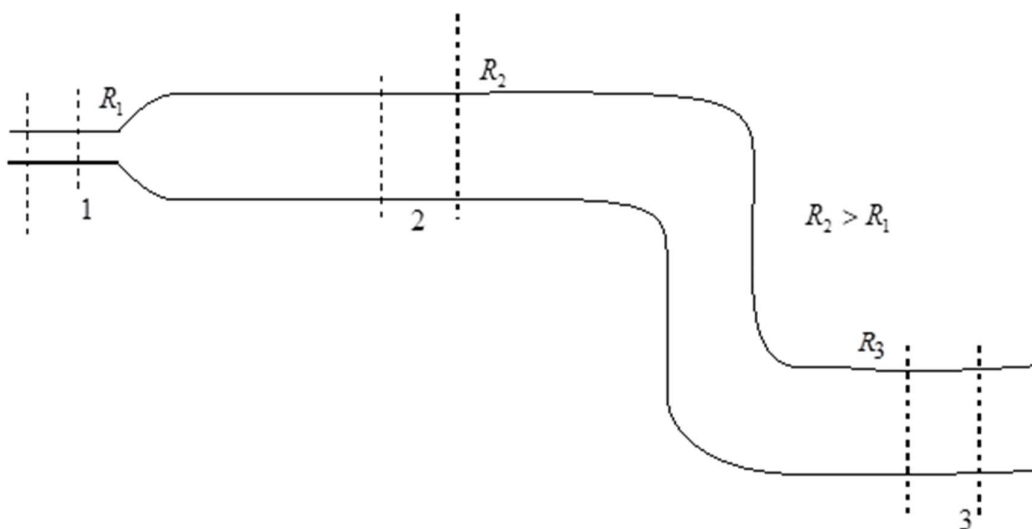
**JEE MAIN**
2023SINGARAJU
VEERAT KONDINYA
AIR 1 (JEE Main)
Sri Chaitanya
6th-12th Classes**300**
300
MARKS**RANK****1****JEE Advanced**
2023VAVILALA
CHIVILAS REDDY
AIR 1 (JEE Advanced)
Sri Chaitanya
6th-12th Classes**341**
360
MARKS**RANK****1****NEET**
2023BORA VARUN
CHAKRAVARTHI
AIR 1 (NEET)
Sri Chaitanya
6th-12th Classes**720**
720
MARKS**RANK****1**

15. In container having liquid

	Column-I		Column-II
A.	Pressure difference between two points is $\rho gh \rightarrow$ where h is vertical separation	P	Container is stationary
B.	Pressure difference between two points at the same horizontal level is zero	Q	Container is accelerating along horizontal direction
C.	Pressure difference between two points at the same horizontal level is non-zero	R	Container is falling freely.
D.	Pressure difference between two points separated by same vertical distance is zero	S	Container is accelerating in vertical direction with an acceleration $< g$.

- | | |
|-----------------------------|-----------------------------|
| 1) A-PQ ; B-PRS ; C-Q ; D-R | 2) A-P ; B-PRS ; C-R ; D-R |
| 2) A-Q ; B-P ; C-R ; D-P | 4) A-RS ; B-PRS ; C-R ; D-Q |

16. An arrangement of the pipes is shown in the Fig. The flow of water (incompressible and non-viscous) through the pipes is steady in nature. Three sections of the pipe are marked in which section (1) and section (2) are at the same horizontal level, while being at a greater height than section (3). Correctly match the order of the different physical parameters. R_1 , R_2 and R_3 are radii of cross sections with $R_3 = R_2$.



Sec: Jr.Super60_STERLING BT

Page 8



**THE PERFECT HAT-TRICK WITH ALL- INDIA RANK 1
IN JEE MAIN 2023 JEE ADVANCED 2023 AND NEET 2023**

JEE MAIN 2023	RANK	JEE Advanced 2023	RANK	NEET 2023	RANK
SINGARAJU VARUN KUNDINNYA MNR 100445772 KJ Somaiya 6 th -12 th Class		VAVALA VARUN AS REDDY MNR 100445772 KJ Somaiya 6 th -12 th Class		BORA VARUN CHAKRAVARTI MNR 100445772 KJ Somaiya 6 th -12 th Class	
300 300		341 360		720 720	



Column-I		Column- II	
(A)	Order of volume flow rate	(P)	$1 > 2 > 3$
(B)	Order of kinetic energy of a mass element	(Q)	$1 = 2 = 3$
(C)	Order of pressure in the sections	(R)	$1 > 2 = 3$
(D)	Order of flow speed in sections	(S)	$3 > 2 > 1$

1) A-Q B-R C-S D-R

2) A-P B-S C-Q D-R

3) A-R B-P C-Q D-S

4) A-S B-Q C-P D-P

17. Statement -1: Cross-sectional area of the water stream pouring out of a tap decreases as the height from the ground decreases. (in steady state)
Statement -2: Work done by gravity is equal to increase in the kinetic energy of the fluid and thus reduces the cross-sectional area.
1) Statement-1 is True, Statement-2 is True; Statement-2 is a Correct explanation for Statement-1
2) Statement-1 is True, Statement-2 is True; Statement-2 is not a Correct explanation for Statement-1
3) Statement-1 is True, Statement-2 is False
4) Statement-1 is False, Statement-2 is True
18. Statement -I: A barometer tube reads 76 cm of Hg. If the tube is gradually inclined at an angle of 60° with the vertical keeping the open end immersed in the mercury reservoir the length of the mercury column along the tube in the barometer will not change.
Statement - II: Barometer is a device used to measure atmospheric pressure.
1) Statement-1 is True, Statement-2 is True; Statement-2 is a Correct Explanation For Statement-1
2) Statement-1 is True, Statement-2 is True ; Statement-2 is not a Correct explanation for Statement-1
3) Statement-1 is True, Statement-2 is False
4) Statement-1 is False, Statement-2 is True
19. Statement - 1: A solid body of density ρ_b floats in a liquid (density ρ_L where $\rho_b < \rho_L$) kept in a beaker. When the beaker is accelerated vertically upward with an acceleration a , then the fraction of the submerged volume of the solid within the liquid increases.
Statement - 2: When accelerated upward, the net force on the body with respect to the beaker remains unchanged.
1) Statement-1 is True, Statement-2 is True; Statement-2 is a Correct Explanation For Statement-1
2) Statement-1 is True, Statement-2 is True; Statement-2 is Not a Correct Explanation For Statement-1
3) Statement-1 is True, Statement-2 is False
4) Statement-1 is False, Statement-2 is True

JEE MAIN
2023SINGARAJU
VEERAT KONDINYA
Sri Chaitanya
JEE-12th Class300
300
MARKS

RANK

1

JEE Advanced
2023VAVILALA
SHIVILAS REDDY
Sri Chaitanya
JEE-12th Class341
360
MARKS

RANK

1

NEET
2023BORA VARUN
CHAKRAVARTHI
Sri Chaitanya
JEE-12th Class720
720
MARKS

RANK

1



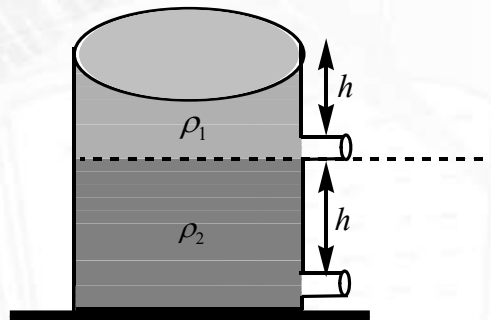
20. Statement - I: It is difficult to stop bleeding from a cut in the body at high altitude
Statement II: The atmospheric pressure at high altitude is lesser than the blood pressure.
1) Statement-1 is True, Statement-2 is True; Statement-2 is a Correct Explanation For Statement-1
2) Statement-1 is True, Statement-2 is True; Statement-2 is not a Correct Explanation For Statement-1
3) Statement-1 is True, Statement-2 is False
4) Statement-1 is False, Statement-2 is True

(NUMERICAL VALUE TYPE)

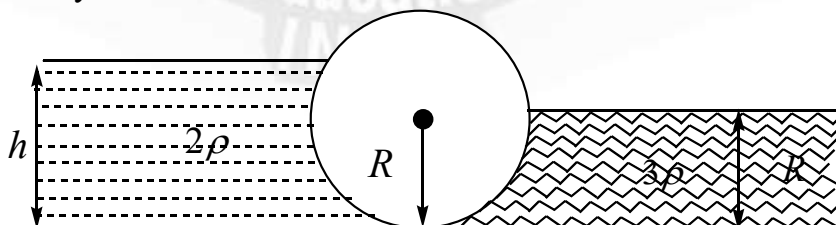
Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions only. If more than 5 questions attempted, First 5 Attempted questions will be considered. The Answer should be within 0 to 9999. If the Answer is in **Decimal** then round off to the **nearest Integer** value (Example i.e. If answer is above 10 and less than 10.5 round off is 10 and if answer is from 10.5 and less than 11 round off is 11).

Marking scheme: +4 for correct answer, 0 if **not attempt** and -1 in all other cases.

21. A small block of wood of relative density 0.5 is placed 10 m inside a vessel containing water. The vessel is accelerated upward with an acceleration of 10 m/s^2 . If the block is released at some instant then the time taken by the block to reach the surface of water from that instant is (consider $g=10 \text{ m/s}^2$).
22. In the figure shown density of lower liquid is three times of density of upper liquid. The cross-sectional areas of openings shown are same and very small compared to the container cross section. The ratio of mass flow rate from upper opening to lower opening at initial moment is $\frac{1}{N\sqrt{3}}$. Find N

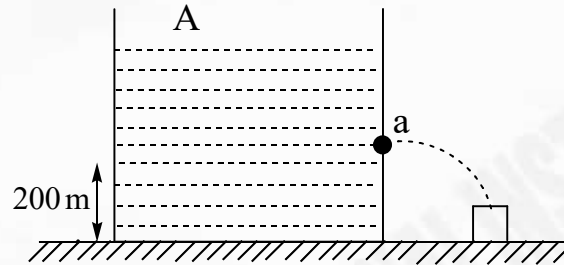


23. In the figure shown, the heavy cylinder (radius $\sqrt{\frac{8}{3}} \text{ m}$) kept on a smooth surface separates two liquids of densities 2ρ and 3ρ . The height h (in meter) for the translational equilibrium of the cylinder must be.

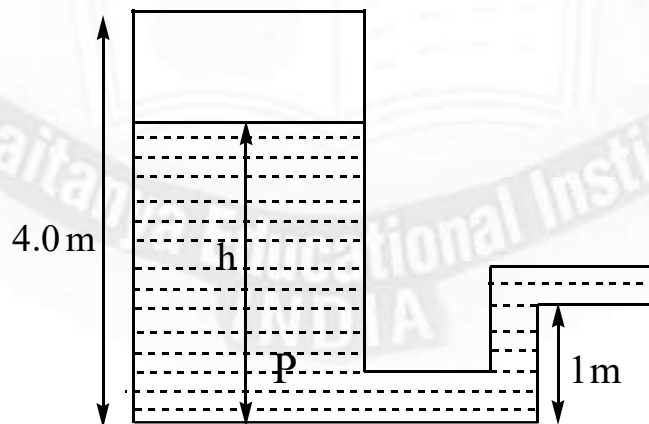
**JEE MAIN**
2023SINGARAJU
VEERAT KOUNDINYA
AIR 1st (2nd Attempt)
Sri Chaitanya
6th-12th Classes**300**
300
MARKS**RANK****1****JEE Advanced**
2023VAVILALA
CHIVILAS REDDY
AIR 1st (2nd Attempt)
Sri Chaitanya
6th-12th Classes**341**
360
MARKS**RANK****1****NEET**
2023BORA VARUN
CHAKRAVARTHI
AIR 1st (2nd Attempt)
Sri Chaitanya
6th-12th Classes**720**
720
MARKS**RANK****1**



24. Water is filled in a uniform container of area of cross section A . A hole of cross section area a is made in the container and a block is placed at some distance from container. With what approximate integral speed (in ms^{-1}) the block should be moved such that water stream always hits the block. (Given $\frac{a}{A} = \frac{1}{20}$). (Take $g = 10 \text{ ms}^{-2}$) (hole is at a height of 200m)



25. A small cube of negligible mass is floating on the surface of lake. The side of the cube is 30 cm and depth of lake is 2m. The cube is pushed very slowly under the water, down to the bottom of the lake. The density of water is 10^3 kg/m^3 and acceleration due to gravity is 10 m/s^2 . Find the work done (in multiples of 100 joule) by external pushing force in the process. (to the nearest integer)
26. A sealed vessel contains water ($\rho = 1000 \text{ kg/m}^3$) upto height $h = 3.5 \text{ m}$. The space above the water contains compressed air at pressure $4.2P_0$ ($P_0 = \text{atmospheric pressure} = 1 \times 10^5 \text{ Pa}$). The vessel is connected to a hose at the bottom as shown in the figure. Assuming the area of cross section of hose to be uniform and small as compared to the area of the vessel. The end of the hose is open to atmosphere. Initial speed of efflux of water is $(20+x) \text{ m/s}$. Then x is (closest integer)



**JEE MAIN
2023**

SINGARAJU
VENKAT KOUNDYIA
AIR 1 (2nd Attempt)
Sri Chaitanya
6th-12th Classes

300
300
MARKS



RANK

1

**JEE Advanced
2023**

NAVILALA
DHIVILAS REDDY
AIR 1 (2nd Attempt)
Sri Chaitanya
6th-12th Classes

341
360
MARKS



RANK

1

**NEET
2023**

BORA VARUN
CHAKRAVARTHI
AIR 1 (2nd Attempt)
Sri Chaitanya
6th-12th Classes

720
720
MARKS

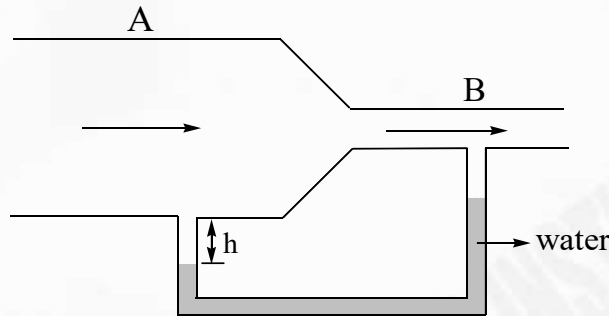


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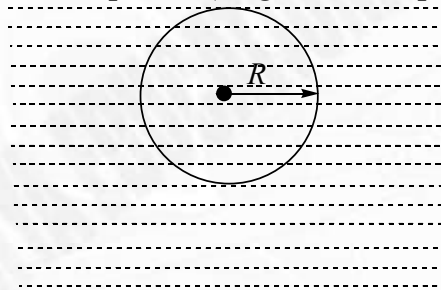
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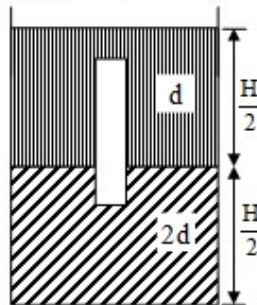
27. Air is blown through a pipe AB at a rate of 15 liters per minute. The cross-sectional area of the narrow portion is 0.5 cm^2 . The cross-sectional area of the broad portion is 2 cm^2 . The difference in water level h is $(N+0.546) \text{ mm}$ ($\rho_{\text{air}} = 1.32 \text{ kg/m}^3$) ($g = 10 \text{ m/s}^2$ density of water = 1000 kg/m^3) then N is (closest integer)



28. A sphere is just immersed in a liquid. Find the ratio of hydrostatic force acting on the lower half and upper half of the sphere. (Neglect atmospheric pressure).



29. A homogeneous solid cylinder of length L ($L < H/2$), cross sectional area $A/5$ is immersed such that it floats with its axis vertical at the liquid-liquid interface with length $L/4$ in the denser liquid as shown in the figure. The lower density liquid is open to atmosphere having pressure P_0 . If the density of solid is given by kd then find the value of $4k$



30. A cube of wood supporting 200 gm mass (on top of the cube with mass not in water) just floats (completely immersed with top face in line with water surface) in water. When the mass is removed, the cube rises by 2cm. What is the side of cube (in 10^{-1} m)

JEE MAIN
2023SINGARAJU
VENKAT KOUNDINYA
AIR 100, 20th Rank
Sri Chaitanya
B-12th Class300
300
MARKS

RANK

1

JEE Advanced
2023VAVILALA
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MARKS

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Sri Chaitanya
B-12th Class720
720
MARKS

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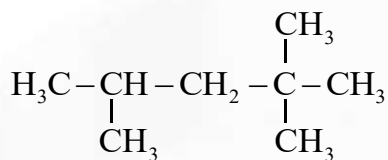
CHEMISTRY

Max Marks: 100

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases.



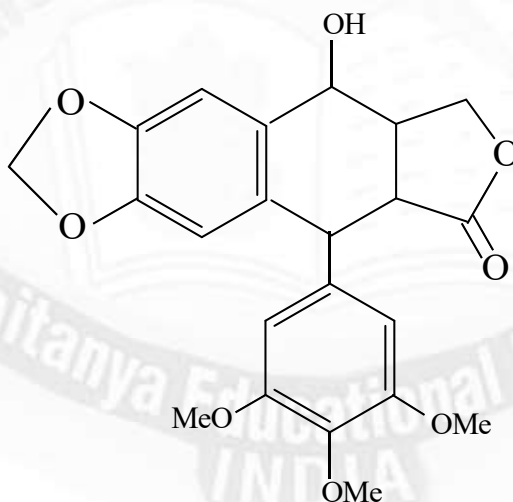
31. In the structure, the number of carbons are:

- 1) One primary, two secondary and one tertiary
- 2) Four primary, two tertiary and one secondary
- 3) One primary, one secondary, one tertiary and one quaternary
- 4) Five primary, one secondary, one tertiary and one quaternary

32. The correct IUPAC name of $(\text{C}_2\text{H}_5)_4\text{C}$ is

- 1) Tetraethyl methane
- 2) 2- Ethylpentane
- 3) 3, 3-Diethylpentane
- 4) 2, 2- Diethyl pentane

33. How many sp^3 hybridised carbon atoms are there in the given anti-cancer compound (podophyllotoxin) ?



the anti-cancer compound podophyllotoxin

- 1) 6
- 2) 7
- 3) 9
- 4) 8



34. Match the following

Column I compound	Column II IUPAC Nomenclature
A)	P) 3-Ethyl-2-methylpentane
B)	Q) 3-Methylhexane
C)	R) 2,3-Dimethylbutane
D)	S) 2,3-Dimethylpentane

1) A-S; B-Q; C-P; D-R

2) A-Q; B-S; C-P; D-R

3) A-S; B-Q; C-R; D-P

4) A-P; B-Q; C-S; D-R

35. 3-methyl penta-1, 3-diene is

1) $CH_2 = CH(CH_2)_2CH_3$ 2) $CH_2 = CHCH(CH_3)CH_2CH_3$ 3) $CH_3CH = C(CH_3)CH = CH_2$ 4) $H_2C = C = C(CH_3)_2$ 36. A mixture of two organic compounds A (*b.p.* $80^\circ C$) and B (*b.p.* $110^\circ C$) can be separated by

1) Sublimation

2) steam distillation

3) Fractional distillation

4) fractional crystallization

37. For the detection of phosphorus, the organic compound after fusion with Na_2O_2 , boiled with HNO_3 solution and then ammonium molybdate is added to it. A yellow ppt. is obtained which is due to the formation of

1) Ammonium phosphate

2) Ammonium phosphomolybdate

3) Ferric phosphate

4) Disodium ammonium phosphate

38. 0.5 g of an organic compound on Kjeldahl's analysis gave enough ammonia to just neutralize 10 cm^3 of $1M H_2SO_4$. The percentage of nitrogen in the compound is

1) 56

2) 28

3) 42

4) 14

39. In an experiment 0.22 g of magnesium pyrophosphate was produced from 0.1 g of an organic compound. The percentage of phosphorus in it is: (Gram atomic weight = 31g)

1) 14.64%

2) 64.14%

3) 62%

4) 44.16%

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Page 14

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40. Lassaigne's test for the detection of N fails in:

- 1) $\text{NH}_2 - \overset{\text{O}}{\parallel} \text{C} - \text{NH} - \text{NH}_2$ 2) $\text{NH}_2 - \text{NH}_2$ 3) $\text{CH}_3\text{CH}_2\text{NH}_2$ 4) $\text{C}_6\text{H}_5 - \text{NH} - \text{NH}_2$

41. given below are two statements; one is labelled as Assertion (A) and the other is labelled as Reason(R).

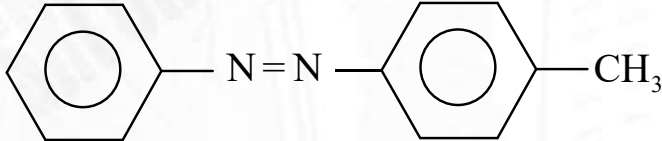
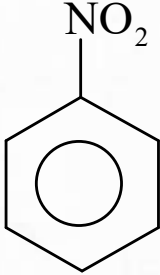
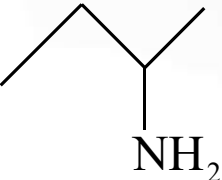

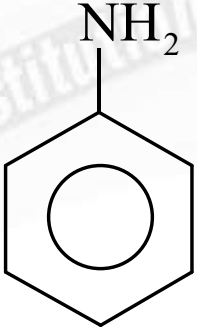
Assertion: In Duma's method the mixture of gases which is produced for estimation of Nitrogen is collected over aqueous solution of potassium hydroxide.

Reason: In duma's method compound is heated with copper oxide in an atmosphere of carbondioxide and potassium hydroxide absorbs CO_2 .

In the light of the above statements, choose the most appropriate answer from the options given below :

- 1) Both (A) and (R) are correct and (R) is the correct explanation of (A).
2) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
3) (A) is correct but (R) is not correct.
4) (A) is not correct but (R) is correct.

42. For which of the following compounds Kjeldahl method is not used for estimation of nitrogen

- A)  B) 
- C)  D)  E) 
- 1) A, B, D and E 2) A, B and D 3) A and D 4) D and E

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43. Match the column :

Column I Test product for element detection		Column II Colour	
A)	$[Fe(CN)_5NOS]^{4-}$	P)	Prussian blue
B)	$[Fe(SCN)]^{2+}$	Q)	Blood red
C)	$(NH_4)_3PO_4 \cdot 12MoO_3$	R)	Violet
D)	$Fe_4[Fe(CN)_6]_3 \cdot xH_2O$	S)	Yellow

1) A = Q, B = S, C = R, D = P

2) A = P, B = Q, C = R, D = S

3) A = Q, B = R, C = S, D = P

4) A = R, B = Q, C = S, D = P

44. Match the column :

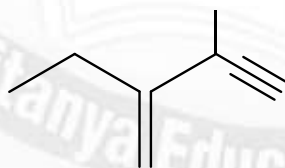
Column I Compound		Column II Hybridisation of carbon	
A)		P)	$sp^3 : sp^2 : sp = 1$
B)		Q)	$\frac{sp}{sp^2} = 1$
C)	$(CH_3)_2CO$	R)	$\frac{sp^2}{sp^3} = 2$
D)	$H_2C = C = C = CH_2$	S)	$\frac{sp^3}{sp^2} = 2$

1) A = P, B = R, C = Q, D = S

2) A = R, B = P, C = S, D = Q

3) A = S, B = P, C = R, D = P

4) A = S, B = P, C = R, D = Q

45. Which of the following molecules represents the order of hybridisation sp^2, sp^2, sp, sp From left to right atoms?1) $HC \equiv C - C \equiv CH$ 2) $CH_2 = CH - C \equiv CH$ 3) $CH_2 = CH - CH = CH_2$ 4) $CH_3 - CH = CH - CH_3$ 

46. The IUPAC name of is :

1) 2-Ethyl-3-methyl-1-penten-4-yne

2) 2-Ethyl-3-methyl-4-pentyne-1-ene

3) 4-Ethyl-3-methyl-1-pentyn-4-ene

4) 4-Ethyl-3-methyl-4-penten-1-yne

47. The catalyst used in Kjeldahl's method for the estimation of nitrogen is:

1) Copper

2) Magnesium

3) Mercury

4) Sodium

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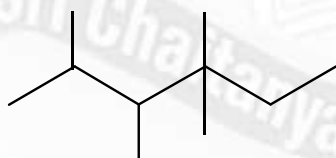


48. In Dumas method for the estimation of nitrogen in an organic compound, nitrogen is determined in the form of:
- 1) Gaseous nitrogen
 - 2) Sodium cyanide
 - 3) Ammonium sulphate
 - 4) Gaseous ammonia
49. Each of the following statements of Assertion (A) is followed by a corresponding statement of Reason (R) just below it. Mark the correct answers:
Assertion (A): Hydroxylamine (NH_2OH) contains N, and hence gives Prussian blue colour in Lassaigne's test.
Reason (R): Hydroxylamine does not contain C, so with Na metal, CN^\ominus ion is not formed.
- 1) If both (A) and (R) are correct and (R) is the correct explanation for (A).
 - 2) If both (A) and (R) are correct and (R) is not the correct explanation for (A).
 - 3) If (A) is correct and (R) is incorrect
 - 4) If (A) is incorrect and (R) is correct.
50. Each of the following statements of Assertion (A) is followed by a corresponding statement of Reason (R) just below it. Mark the correct answers:
Assertion (A): Benzene (boiling point 353 K) and methanol (boiling point 338 K) are separated by simple distillation.
Reason (R): Fractional distillation is used to separate two liquids from their mixture when their boiling points differ by 20°
- 1) If both (A) and (R) are correct and (R) is the correct explanation for (A).
 - 2) If both (A) and (R) are correct and (R) is not the correct explanation for (A).
 - 3) If (A) is correct and (R) is incorrect
 - 4) If (A) is incorrect and (R) is correct.

(NUMERICAL VALUE TYPE)

Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions only. If more than 5 questions attempted, First 5 Attempted questions will be considered. The Answer should be within 0 to 9999. If the Answer is in Decimal then round off to the nearest Integer value (Example i.e. If answer is above 10 and less than 10.5 round off is 10 and if answer is from 10.5 and less than 11 round off is 11).
Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

51. What is the ratio of 2° and 3° hydrogen atoms in the given structure.

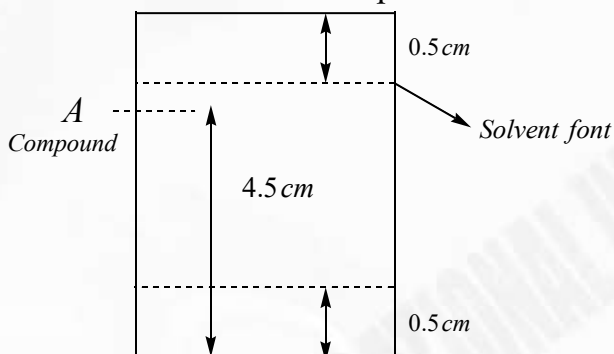


52. a, b, c, d, e are the successive members of homologous series in the increasing order of their Molecular weight. Atomic weight of b is 30 amu, what is the molecular weight of e in amu?
53. In Carius method of estimation of halogens, 250mg of an organic compound gave 141 mg of AgBr. The percentage of bromine in the compound is

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158th, 159th, 160th, 161st, 162nd, 163rd, 164th, 165th, 166th, 167th, 168th, 169th, 170th, 171st, 172nd, 173rd, 174th, 175th, 176th, 177th, 178th, 179th, 180th, 181st, 182nd, 183rd, 184th, 185th, 186th, 187th, 188th, 189th, 190th, 191st, 192nd, 193rd, 194th, 195th, 196th, 197th, 198th, 199th, 200th, 201st, 202nd, 203rd, 204th, 205th, 206th, 207th, 208th, 209th, 210th, 211st, 212th, 213th, 214th, 215th, 216th, 217th, 218th, 219th, 220th, 221st, 222nd, 223rd, 224th, 225th, 226th, 227th, 228th, 229th, 230th, 231st, 232nd, 233rd, 234th, 235th, 236th, 237th, 238th, 239th, 240th, 241st, 242nd, 243rd, 244th, 245th, 246th, 247th, 248th, 249th, 250th, 251st, 252nd, 253rd, 254th, 255th, 256th, 257th, 258th, 259th, 260th, 261st, 262nd, 263rd, 264th, 265th, 266th, 267th, 268th, 269th, 270th, 271st, 272nd, 273rd, 274th, 275th, 276th, 277th, 278th, 279th, 280th, 281st, 282nd, 283rd, 284th, 285th, 286th, 287th, 288th, 289th, 290th, 291st, 292nd, 293rd, 294th, 295th, 296th, 297th, 298th, 299th, 300th, 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873rd, 874th, 875th, 876th, 877th, 878th, 879th, 880th, 881st, 882nd, 883rd, 884th, 885th, 886th, 887th, 888th, 889th, 890th, 891st, 892nd, 893rd, 894th, 895th, 896th, 897th, 898th, 899th, 900th, 901st, 902nd, 903rd, 904th, 905th, 906th, 907th, 908th, 909th, 910th, 911st, 912nd, 913th, 914th, 915th, 916th, 917th, 918th, 919th, 920th, 921st, 922nd, 923rd, 924th, 925th, 926th, 927th, 928th, 929th, 930th, 931st, 932nd, 933rd, 934th, 935th, 936th, 937th, 938th, 939th, 940th, 941st, 942nd, 943rd, 944th, 945th, 946th, 947th, 948th, 949th, 950th, 951st, 952nd, 953rd, 954th, 955th, 956th, 957th, 958th, 959th, 960th, 961st, 962nd, 963rd, 964th, 965th, 966th, 967th, 968th, 969th, 970th, 971st, 972nd, 973rd, 974th, 975th, 976th, 977th, 978th, 979th, 980th, 981st, 982nd, 983rd, 984th, 985th, 986th, 987th, 988th, 989th, 990th, 991st, 992nd, 993rd, 994th, 995th, 996th, 997th, 998th, 999th, 1000th, 1001st, 1002nd, 1003rd, 1004th, 1005th, 1006th, 1007th, 1008th, 1009th, 1010th, 1011st, 1012nd, 1013th, 1014th, 1015th, 1016th, 1017th, 1018th, 1019th, 1020th, 1021st, 1022nd, 1023rd, 1024th, 1025th, 1026th, 1027th, 1028th, 1029th, 1030th, 1031st, 1032nd, 1033rd, 1034th, 1035th, 1036th, 1037th, 1038th, 1039th, 1040th, 1041st, 1042nd, 1043rd, 1044th, 1045th, 1046th, 1047th, 1048th, 1049th, 1050th, 1051st, 1052nd, 1053rd, 1054th, 1055th, 1056th, 1057th, 1058th, 1059th, 1060th, 1061st, 1062nd, 1063rd, 1064th, 1065th, 1066th, 1067th, 1068th, 1069th, 1070th, 1071st, 1072nd, 1073rd, 1074th, 1075th, 1076th, 1077th, 1078th, 1079th, 1080th, 1081st, 1082nd, 1083rd, 1084th, 1085th, 1086th, 1087th, 1088th, 1089th, 1090th, 1091st, 1092nd, 1093rd, 1094th, 1095th, 1096th, 1097th, 1098th, 1099th, 1100th, 1101st, 1102nd, 1103rd, 1104th, 1105th, 1106th, 1107th, 1108th, 1109th, 1110th, 1111st, 1112nd, 1113th, 1114th, 1115th, 1116th, 1117th, 1118th, 1119th, 1120th, 1121st, 1122nd, 1123rd, 1124th, 1125th, 1126th, 1127th, 1128th, 1129th, 1130th, 1131st, 1132nd, 1133rd, 1134th, 1135th, 1136th, 1137th, 1138th, 1139th, 1140th, 1141st, 1142nd, 1143rd, 1144th, 1145th, 1146th, 1147th, 1148th, 1149th, 1150th, 1151st, 1152nd, 1153rd, 1154th, 1155th, 1156th, 1157th, 1158th, 1159th, 1160th, 1161st, 1162nd, 1163rd, 1164th, 1165th, 1166th, 1167th, 1168th, 1169th, 1170th, 1171st, 1172nd, 1173rd, 1174th, 1175th, 1176th, 1177th, 1178th, 1179th, 1180th, 1181st, 1182nd, 1183rd, 1184th, 1185th, 1186th, 1187th, 1188th, 1189th, 1190th, 1191st, 1192nd, 1193rd, 1194th, 1195th, 1196th, 1197th, 1198th, 1199th, 1200th, 1201st, 1202nd, 1203rd, 1204th, 1205th, 1206th, 1207th, 1208th, 1209th, 1210th, 1211st, 1212nd, 1213th, 1214th, 1215th, 1216th, 1217th, 1218th, 1219th, 1220th, 1221st, 1222nd, 1223rd, 1224th, 1225th, 1226th, 1227th, 1228th, 1229th, 1230th, 1231st, 1232nd, 1233rd, 1234th, 1235th, 1236th, 1237th, 1238th, 1239th, 1240th, 1241st, 1242nd, 1243rd, 1244th, 1245th, 1246th, 1247th, 1248th, 1249th, 1250th, 1251st, 1252nd, 1253rd, 1254th, 1255th, 1256th, 1257th, 1258th, 1259th, 1260th, 1261st, 1262nd, 1263rd, 1264th, 1265th, 1266th, 1267th, 1268th, 1269th, 1270th, 1271st, 1272nd, 1273rd, 1274th, 1275th, 1276th, 1277th, 1278th, 1279th, 1280th, 1281st, 1282nd, 1283rd, 1284th, 1285th, 1286th, 1287th, 1288th, 1289th, 1290th, 1291st, 1292nd, 1293rd, 1294th, 1295th, 1296th, 1297th, 1298th, 1299th, 1300th, 1301st, 1302nd, 1303rd, 1304th, 1305th, 1306th, 1307th, 1308th, 1309th, 1310th, 1311st, 1312nd, 1313th, 1314th, 1315th, 1316th, 1317th, 1318th, 1319th, 1320th, 1321st, 1322nd, 1323rd, 1324th, 1325th, 1326th, 1327th, 1328th, 1329th, 1330th, 1331st, 1332nd, 1333rd, 1334th, 1335th, 1336th, 1337th, 1338th, 1339th, 1340th, 1341st, 1342nd, 1343rd, 1344th, 1345th, 1346th, 1347th, 1348th, 1349th, 1350th, 1351st, 1352nd, 1353rd, 1354th, 1355th, 1356th, 1357th, 1358th, 1359th, 1360th, 1361st, 1362nd, 1363rd, 1364th, 1365th, 1366th, 1367th, 1368th, 1369th, 1370th, 1371st, 1372nd, 1373rd, 1374th, 1375th, 1376th, 1377th, 1378th, 1379th, 1380th, 1381st, 1382nd, 1383rd, 1384th, 1385th, 1386th, 1387th, 1388th, 1389th, 1390th, 1391st, 1392nd, 1393rd, 1394th, 1395th, 1396th, 1397th, 1398th, 1399th, 1400th, 1401st, 1402nd, 1403rd, 1404th, 1405th, 1406th, 1407th, 1408th, 1409th, 1410th, 1411st, 1412nd, 1413th, 1414th, 1415th, 1416th, 1417th, 1418th, 1419th, 1420th, 1421st, 1422nd, 1423rd, 1424th, 1425th, 1426th, 1427th, 1428th, 1429th, 1430th, 1431st, 1432nd, 1433rd, 1434th, 1435th, 1436th, 1437th, 1438th, 1439th, 1440th, 1441st, 1442nd, 1443rd, 1444th, 1445th, 1446th, 1447th, 1448th, 1449th, 1450th, 1451st, 1452nd, 1453rd, 1454th, 1455th, 1456th, 1457th, 1458th, 1459th, 1460th, 1461st, 1462nd, 1463rd, 1464th, 1465th, 1466th, 1467th, 1468th, 1469th, 1470th, 1471st, 1472nd, 1473rd, 1474th, 1475th, 1476th, 1477th, 1478th, 1479th, 1480th, 1481st, 1482nd, 1483rd, 1484th, 1485th, 1486th, 1487th, 1488th, 1489th, 1490th, 1491st, 1492nd, 1493rd, 1494th, 1495th, 1496th, 1497th, 1498th, 1499th, 1500th, 1501st, 1502nd, 1503rd, 1504th, 1505th, 1506th, 1507th, 1508th, 1509th, 1510th, 1511st, 1512nd, 1513th, 1514th, 1515th, 1516th, 1517th, 1518th, 1519th, 1520th, 1521st, 1522nd, 1523rd, 1524th, 1525th, 1526th, 1527th, 1528th, 1529th, 1530th, 1531st, 1532nd, 1533rd, 1534th, 1535th, 1536th, 1537th, 1538th, 1539th, 1540th, 1541st, 1542nd, 1543rd, 1544th, 1545th, 1546th, 1547th, 1548th, 1549th, 1550th, 1551st, 1552nd, 1553rd, 1554th, 1555th, 1556th, 1557th, 1558th, 1559th, 1560th, 1561st, 1562nd, 1563rd, 1564th, 1565th, 1566th, 1567th, 1568th, 1569th, 1570th, 1571st, 1572nd, 1573rd, 1574th, 1575th, 1576th, 1577th, 1578th, 1579th, 1580th, 1581st, 1582nd, 1583rd, 1584th, 1585th, 1586th, 1587th, 1588th, 1589th, 1590th, 1591st, 1592nd, 1593rd, 1594th, 1595th, 1596th, 1597th, 1598th, 1599th, 1600th, 1601st, 1602nd, 1603rd, 1604th, 1605th, 1606th, 1607th, 1608th, 1609th, 1610th, 1611st, 1612nd, 1613th, 1614th, 1615th, 1616th, 1617th, 1618th, 1619th, 1620th, 1621st, 1622nd, 1623rd, 1624th, 1625th, 1626th, 1627th, 1628th, 1629th, 1630th, 1631st, 1632nd, 1633rd, 1634th, 1635th, 1636th, 1637th, 1638th, 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54. In Sulphur estimation. 0.471 g of an organic compound gave 1.4439 g of barium sulphate. The percentage of Sulphur in the compound is _____
55. An organic compound is estimated through Dumas method and was found to evolve 4 mole of CO_2 , 3 mole H_2O and 1 mole N_2 gas the formula of compound is $\text{C}_x \text{H}_y \text{N}_z$. The value of $x + y - z$ _____.
56. Following chromatogram was developed by adsorption of compound 'A' on a 9cm TLC glass plate retardation factor of the compound A is..... $\times 10^{-1}$



57. Amongst the following compounds the total number of compounds which give Beilstein test.
- | | | | |
|---------------------------|----------------------------|----------------------------|---------------------------|
| I. Urea | II. Thiourea | III. Pyridine | IV. CH_3F |
| V. CH_3Cl | VI. CH_3Br | VII. CH_3I | VIII. Benzamide |
| IX. Benzaldehyde | X. Aniline | | |
58. How many of the following Incorrect IUPAC names
- 1) 1- pentene
 - 2) 2- pentene
 - 3) 3- pentene
 - 4) 1- methyl pentene-2
 - 5) 2 - methyl pentene-1
 - 6) 3 - methyl pentene-2
 - 7) 2,4 – di Methyl butane
59. For the estimation of nitrogen, 1.4 g of organic compound was digested by Kjeldahl method and the evolved ammonia was absorbed in 60 mL of $\frac{M}{10}$ sulphuric acid. The unreacted acid required 20 ml of $\frac{M}{10}$ sodium hydroxide for complete neutralization. The percentage of nitrogen in the compound is:
60. The number of σ – and π – bonds in but- 1-en-3-yne is x,y respectively then x-y is

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MATHEMATICS

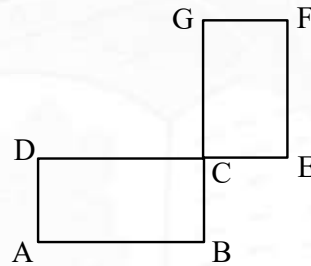
Max Marks: 100

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases.

61. If the point $[x_1 + t(x_2 - x_1), y_1 + t(y_2 - y_1), z_1 + t(z_2 - z_1)]$ divides internally the line segment joining (x_1, y_1, z_1) and (x_2, y_2, z_2) then
 1) $t < 0$ 2) $0 < t < 1$ 3) $t > 1$ 4) $t = 1$
62. Let $A(5, 4, 6)$, $B(1, -1, 3)$ and $C(4, 3, 2)$ form $\triangle ABC$. If the internal bisector of angle A meets BC in D, then the length of \overline{AD} is
 1) $\frac{1}{8}\sqrt{170}$ 2) $\frac{3}{8}\sqrt{170}$ 3) $\frac{5}{8}\sqrt{170}$ 4) $\frac{7}{8}\sqrt{170}$
63. If $\hat{i} - 3\hat{j} + 5\hat{k}$ bisects the angle between \hat{a} and $-\hat{i} + 2\hat{j} + 2\hat{k}$, where \hat{a} is a unit vector, then
 1) $\hat{a} = \frac{1}{105}(41\hat{i} + 88\hat{j} - 40\hat{k})$ 2) $\hat{a} = \frac{1}{105}(41\hat{i} + 88\hat{j} + 40\hat{k})$
 3) $\hat{a} = \frac{1}{105}(-41\hat{i} + 88\hat{j} - 40\hat{k})$ 4) $\hat{a} = \frac{1}{105}(41\hat{i} - 88\hat{j} - 40\hat{k})$
64. In the following figure, AB, DE, and GF are parallel to each other and AD, BG and EF are parallel to each other. If $\overline{DC} = 2\overline{CE}$ and $\overline{CG} = 2\overline{BC}$, then the value of area $\triangle AEG$: area $\triangle ABD$ is equal to



- 1) $7/2$ 2) 3 3) 4 4) $9/2$
65. The angles of a triangle, two of whose sides are represented by the vectors $\sqrt{3}(\hat{a} \times \hat{b})$ and $\hat{b} - (\hat{a} \cdot \hat{b})\hat{a}$; where \hat{b} is a non-zero vector and \hat{a} is a unit vector in the direction of \vec{a} are
 1) $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right), \tan^{-1}\left(\frac{1}{2}\right), \tan^{-1}\left(\frac{\sqrt{3}+2}{1-2\sqrt{3}}\right)$ 2) $\tan^{-1}(\sqrt{3}), \tan^{-1}\left(\frac{1}{\sqrt{3}}\right), \cot^{-1}(0)$
 3) $\tan^{-1}(\sqrt{3}), \tan^{-1}(2), \tan^{-1}\left(\frac{\sqrt{3}+2}{2\sqrt{3}-1}\right)$ 4) $\tan^{-1}(1), \tan^{-1}(1), \cot^{-1}(0)$





66. Match the following
Column I

Column II

A) The angle between any two diagonals
of a cube is

P) $\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)$

B) The angle between one diagonal of unit
Cube and a diagonal of its face is

Q) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

C) The angle between a diagonal of a cube
and the diagonal of a face intersecting it.

R) $\cot^{-1}\left(\frac{1}{\sqrt{3}}\right)$

D) The angle between the diagonal of the

S) $\cos^{-1}\left(\frac{1}{3}\right)$

Faces of the cube through the same vertex is

1) $A \rightarrow S, B \rightarrow P, C \rightarrow Q, D \rightarrow R$

2) $A \rightarrow P, B \rightarrow S, C \rightarrow R, D \rightarrow Q$

3) $A \rightarrow R, B \rightarrow Q, C \rightarrow S, D \rightarrow P$

4) $A \rightarrow Q, B \rightarrow S, C \rightarrow R, D \rightarrow Q$

67. If ABCDEF be a regular hexagon in the xy-plane and $\overline{AB} = 4\hat{i}$ then $\overline{CD} =$

1) $6\hat{i} + 2\sqrt{3}\hat{j}$

2) $-2\hat{i} + 2\sqrt{3}\hat{j}$

3) $2(\hat{i} + \sqrt{3}\hat{j})$

4) $2(\hat{i} - \sqrt{3}\hat{j})$

68. A vector \vec{a} has components a_1, a_2, a_3 in a right-handed rectangular Cartesian coordinate system OXYZ. The coordinate system is rotated about Y-axis through an angle $\frac{\pi}{2}$. The

component of \vec{a} in the new system are

1) $(-a_3, a_2, a_1)$

2) $(a_3, a_2, -a_1)$

3) $(-a_3, a_2, -a_1)$

4) (a_3, a_2, a_1)

69. Statement-I: A line makes the same angle θ with each of the x and z-axis. If the angle α which it makes with y-axis, is such that $\sin^2 \alpha = 3 \sin^2 \theta$, then $\cos^2 \theta = \frac{3}{5}$.

Statement-II: If a line with direction ratios l, m, n make angles α, β, γ respectively with

x, y and z-axis, then $\cos \alpha = \frac{l}{\sqrt{l^2 + m^2 + n^2}}, \cos \beta = \frac{m}{\sqrt{l^2 + m^2 + n^2}}, \cos \gamma = \frac{n}{\sqrt{l^2 + m^2 + n^2}}$

1) Statement-I is true, Statement-II is true, and Statement-II is correct explanation for Statement-I

2) Statement-I is true, Statement-II is true, but Statement-II is not correct explanation for Statement-I

3) Statement-I is true, and Statement-II is false

4) Statement-I is false, Statement-II is true

Sec: Jr.Super60_STERLING BT

Page 20



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70. A straight line cuts the sides AB, AC and AD of a parallelogram ABCD at points B₁, C₁ and D₁ respectively. If $\overline{AB_1} = \lambda_1 \overline{AB}$, $\overline{AD_1} = \lambda_2 \overline{AD}$ and $\overline{AC_1} = \frac{\lambda_3}{2} \overline{AC}$, where λ_1, λ_2 and λ_3 are positive real numbers, then:
- 1) λ_1, λ_3 and λ_2 are in AP
 - 2) λ_1, λ_3 and λ_2 are in GP
 - 3) λ_1, λ_3 and λ_2 are in HP
 - 4) $\lambda_1 + \lambda_2 + \lambda_3 = 0$
71. Let PQ and QR be diagonals of adjacent faces of a rectangular box, with its Centre at O. If $\angle QOR$, $\angle ROP$ and $\angle POQ$ are θ, ϕ and ψ respectively then the value of ' $\cos \theta + \cos \phi + \cos \psi$ ' is :
- 1) -2
 - 2) $-\sqrt{3}$
 - 3) -1
 - 4) 0
72. If O (origin) is a point inside the triangle PQR such that $\overline{OP} + k_1 \overline{OQ} + k_2 \overline{OR} = \vec{0}$, where k_1, k_2 are constants such that $\frac{\text{Area}(\Delta PQR)}{\text{Area}(\Delta OQR)} = 4$, then the value of $k_1 + k_2$ is:
- 1) 2
 - 2) 3
 - 3) 4
 - 4) 5
73. Let ABC be a triangle and let $\vec{p} = (\sin A)\hat{i} + (\sin B)\hat{j}$, $\vec{q} = (\cos B)\hat{i} + (\cos A)\hat{j}$ be two vectors such that $\vec{p} \cdot \vec{q} = \sin 2C$. If $\sin A, \sin C, \sin B$ are in A.P, and $\overline{AC} \cdot (\overline{BA} - \overline{CA}) = 32$, then which of the following is false
- 1) $\angle BCA = \pi/3$
 - 2) ΔABC is equilateral Δ .
 - 3) In-radius of ΔABC is $\frac{4}{3}\sqrt{3}$
 - 4) circumradius of ΔABC is $\frac{8}{3}$.
74. If D, E and F are the mid points of the sides BC, CA, AB respectively of a triangle ABC $\overline{AD} + \frac{2}{3}\overline{BE} + \frac{1}{3}\overline{CF} = K\overline{AC}$, then 2K is equal to
- 1) 1
 - 2) 3
 - 3) 2
 - 4) 5
75. L_1 and L_2 are two lines whose vector equations are $\vec{r} = \mu(a\hat{i} + b\hat{j} + c\hat{k})$ and $\vec{r} = \lambda[(\cos \theta - \sqrt{3})\hat{i} + (\sqrt{2} \sin \theta)\hat{j} + (\cos \theta + \sqrt{3})\hat{k}]$, where λ and μ are scalars and ' α ' is the acute angle between L_1 and L_2 . If the angle ' α ' is independent of θ , then the value of α is
- 1) $\frac{\pi}{3}$
 - 2) $\frac{\pi}{4}$
 - 3) $\frac{\pi}{2}$
 - 4) $\frac{\pi}{6}$

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76. The position vector of A, B are \vec{a}, \vec{b} respectively and the position vector of C is $\frac{\vec{a}}{2} + \frac{\vec{b}}{3}$. Then
- C is inside the ΔOAB
 - C is outside the but inside the angle AOB
 - cannot be said
 - C is outside the but inside the angle OAB
77. If the vectors $\vec{a} = 3i + j - 2k$, $\vec{b} = -i + 3j + 4k$, and $\vec{c} = 4i - 2j - 6k$ constitute the sides of a ΔABC , then the length of the median bisecting the vector \vec{c} is
- $\sqrt{2}$
 - $\sqrt{14}$
 - $\sqrt{74}$
 - $\sqrt{6}$
78. If the vector $6i - 3j - 6k$ is decomposed into vectors parallel and perpendicular to the vector $i + j + k$ then the vectors are respectively
- $-(i + j + k) \& 7i - 2j - 5k$
 - $-2(i + j + k) \& 8i - j - 4k$
 - $2(i + j + k) \& 4i - 5j - 8k$
 - $3(i + j + k) \& i - j + k$
79. Statement-I : If S is the circumcenter, G is the centroid, and O is the orthocenter of a ΔABC then $\vec{SA} + \vec{SB} + \vec{SC} = \vec{SO}$
Statement-II : In ΔABC , let O and H denote circumcenter and orthocenter respectively. Then $\vec{OA} + \vec{OB} + \vec{OC} = 3\vec{OG}$ Where G is centroid of the ΔABC ,
- Statement-I is true, and Statement-II is false
 - Statement-I is false, Statement-II is true
 - Both Statement-I and Statement-II are true
 - Neither Statement-I nor Statement-II are true
80. The vectors $\vec{a} = i + 2j + 3k$, $\vec{b} = 2i - j + k$, and $\vec{c} = 3i + j + 4k$ are so placed that the end point of one vector is the starting point of the next vector. Then the vectors are
- Not coplanar
 - coplanar but cannot form a triangle
 - coplanar but can form a triangle
 - coplanar and form a right-angled triangle.

(NUMERICAL VALUE TYPE)

Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions only. If more than 5 questions attempted, First 5 Attempted questions will be considered. The Answer should be within 0 to 9999. If the Answer is in **Decimal** then round off to the nearest **Integer** value (Example i.e. If answer is above 10 and less than 10.5 round off is 10 and if answer is from 10.5 and less than 11 round off is 11).

Marking scheme: +4 for correct answer, 0 if **not attempt** and -1 in all other cases.

81. If origin is the orthocenter of a triangle formed by the points $(\cos \alpha, \sin \alpha, 0)$, $(\cos \beta, \sin \beta, 0)$, $(\cos \gamma, \sin \gamma, 0)$ then $\sum \cos(2\alpha - \beta - \gamma) = \underline{\hspace{2cm}}$
82. $P(1, 2, -2)$ $Q(8, 10, 11)$ $R(1, 2, 3)$ $S(3, 5, 7)$. If λ denotes the length of projection of \vec{PQ} on \vec{RS} then $29\lambda^2 + 29$ is $\underline{\hspace{2cm}}$

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83. If V be the volume of a tetrahedron and V' be the volume of another tetrahedron formed by the centroids of faces of the previous tetrahedron and $V = KV'$, then K is equal to
84. Let O be an interior point of $\triangle ABC$ such that $\overrightarrow{OA} + 2\overrightarrow{OB} + 3\overrightarrow{OC} = \vec{0}$, then the ratio of area of $\triangle ABC$ to the area of $\triangle AOC$ is _____.
85. The distance between Two points P and Q is d and the length of their projections of PQ on the coordinate planes are d_1, d_2, d_3 . Such that $d_1^2 + d_2^2 + d_3^2 = Kd^2$, then K
86. If the angle between the lines whose direction cosines are connected by relations $l + m + n = 0$ and $2lm + 2nl - mn = 0$ is θ , then the value of $4\sin^2 \theta$ is _____.
87. If the straight line $\vec{r} = (i + 3j + k) + s(i - \lambda j + \lambda k)$ and $\vec{r} = (j + 2k) + t(i + 2j - 2k)$ with parameters s and t respectively, are coplanar, then the value of $|\lambda|$ is _____.
88. If two straight lines whose direction cosines are connected by relations $l + m + n = 0$ and $l^2 + m^2 = \lambda n^2$ are parallel, then the value of $\left| \frac{3}{\lambda} \right|$
89. If (p, q, r) is the image of point $i + 2j + 3k$ in the line $\vec{r} = (6i + 7j + 7k) + t(3i + 2j - 2k)$, then the value of $(p - q + r)$ is _____.
90. The perpendicular distance of a corner of a unit cube from a diagonal not passing through it is d , then the value of $3d^2$ is _____.

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