MasterJEE

IIT-JEE | Medical | Foundations

Master JEE CLASSES
Kukatpally, Hyderabad.

JEE-ADVANCE-2011-P2-Model

Max.Marks:240

2011-PAPER -II

IMPORTANT INSTRUCTIONS:

1) This booklet is your Question Paper.
2) Use the Optical Response Sheet (ORS) provided separately for answering the questions
3) Blank spaces are provided within this booklet for rough work.
4) Write your name, roll number and sign in the space provided on the back cover of this booklet.
5) You are allowed to take away the Question Paper at the end of the examination.

OPTICAL RESPONSE SHEET:

6) Darken the appropriate bubbles on the ORS by applying sufficient pressure. This will leave an impression at the corresponding place on the Candidate's sheet.
7) The ORS will be collected by the invigilator at the end of the examination.
8) Do not tamper with or mutilate the ORS. **Do not use the ORS for rough work**.
9) Write your name, roll number and code of the examination center, and sign with pen in the space provided for this purpose on the ORS. **Do not write any of these details anywhere else** on the ORS. Darken the appropriate bubble under each digit of your roll number.

DARKENING THE BUBBLES ON THE ORS

10) Use a **BLACK BALL POINT PEN** to darken the bubbles on the ORS.
11) Darken the bubble **COMPLETELY**.
12) The correct way of darkening a bubble is as:
13) The ORS is machine-gradable. Ensure that the bubbles are darkened in the correct way.
14) Darken the bubbles ONLY IF you are sure of the answer. There is NO WAY to erase or "un-darken" a darkened bubble.

JEE-ADVANCE-2011-P2-Model

IMPORTANT INSTRUCTIONS **Max Marks: 240**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I (Q.N : 1 – 8)	Questions with Single Correct Choice	3	-1	8	24
Sec – II (Q.N : 9 – 12)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III (Q.N : 13 – 18)	Questions with Integer Answer Type	4	0	6	24
Sec – IV (Q.N : 19 – 20)	Matrix Matching Type	8	0	2	16
Total				**20**	**80**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I (Q.N : 21 – 28)	Questions with Single Correct Choice	3	-1	8	24
Sec – II (Q.N : 29 – 32)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III (Q.N : 33 – 38)	Questions with Integer Answer Type	4	0	6	24
Sec – IV (Q.N : 39 – 40)	Matrix Matching Type	8	0	2	16
Total				**20**	**80**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I (Q.N : 41 – 48)	Questions with Single Correct Choice	3	-1	8	24
Sec – II (Q.N : 49 – 52)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III (Q.N : 53 – 58)	Questions with Integer Answer Type	4	0	6	24
Sec – IV (Q.N : 59 – 60)	Matrix Matching Type	8	0	2	16
Total				**20**	**80**

SECTION-I
(SINGLE CORRECT CHOICE TYPE)

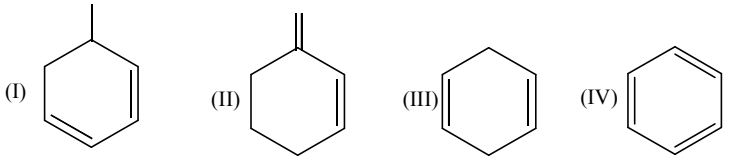
Section-I (Single Correct Answer Type, Total Marks: 24) contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.** For each question you will be awarded 3 marks if you darken ONLY the bubble corresponding to the correct answer and zero marks if no bubble is darkened. In all other cases, minus one (-1) mark will be awarded.

1. Which of the following has maximum number of hyper conjugative structures?

   A) Isopropyl carbocation B)Tertiary butyl carbocation

   C) N-propyl carbocation D) Benzyl carbocation

2. The order of decreasing stability is –



   A) IV > I > II > III B) I > IV > III > II

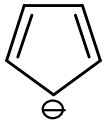
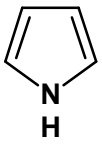
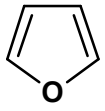
   C) I > II > IV > III D) IV > II > I > III

3. Which of the following is the least stable resonance structure of $CH_2 = CH - CHO$

   A) $\overset{\oplus}{C}H_2 - CH = \underset{|}{\overset{\ominus}{O}}\,CH$ B) $\overset{\ominus}{C}H_2 - CH = \underset{|}{\overset{\oplus}{O}}\,CH$

   C) $\overset{\ominus}{C}H_2 - \overset{\oplus}{C}H - \overset{\|}{\underset{O}{C}}H$ D) All are equally stable

4. Which of the following possesses highest resonance energy

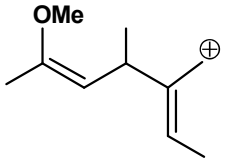
A)  B)  C)  D) 

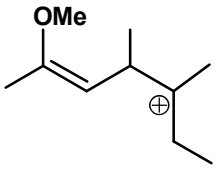
5. The correct stability order of the following resonance structures is

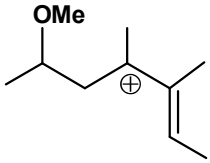
I) $H_2C=\overset{+}{N}=\overset{-}{N}$ II) $H_2\overset{+}{C}-N=\overset{-}{N}$ III) $H_2\overset{-}{C}-\overset{+}{N}\equiv N$ IV) $H_2\overset{-}{C}-N=\overset{+}{N}$

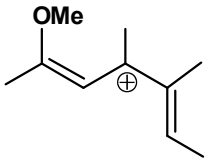
A) I>II>IV>III B) I>III>II>IV C) II>I>III>IV D) III>I>IV>II

6. Which of the following is the most stabilized carbocation?

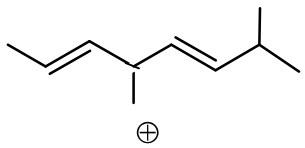
A) 

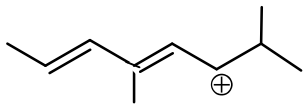
B) 

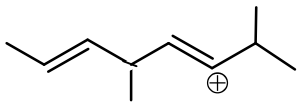
C) 

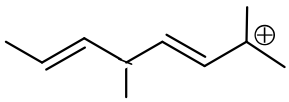
D) 

7. Which carbocation is most stable amongst the following?

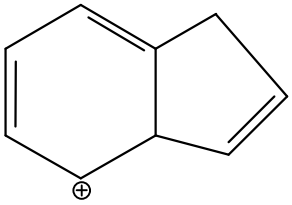
A) 

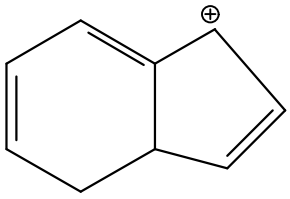
B) 

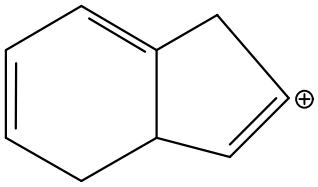
C) 

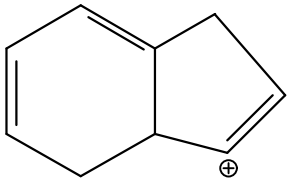
D) 

8. Which carbocation is most stabilized?

A) 

B) 

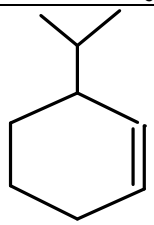
C) 

D) 

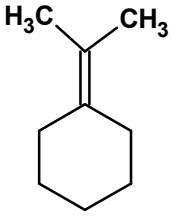
space for rough work

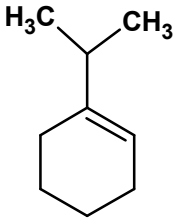
SECTION-II
(MORE THAN ONE TYPE)

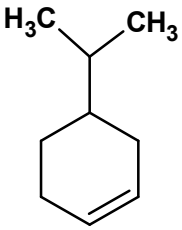
Section - II (Multiple Correct Answers Type, Total Marks: 16) contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE may be correct. For each question you will be awarded 4 marks if you darken ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. There are no negative marks in this section.

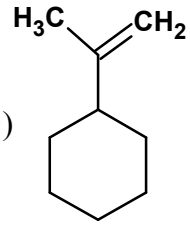


9. Which of the following alkenes are more stable than

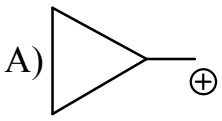
A) 

B) 

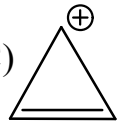
C) 

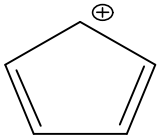
D) 

10. Among the following which is/are more stable than $C_6H_5\overset{\oplus}{C}H_2$

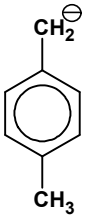
A) 

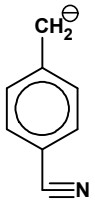
B) $(CH_3)_3C^+$

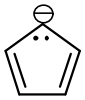
C) 

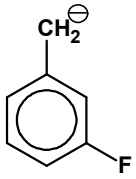
D) 

11. Among the following which are more stable carbanions than $PhCH_2^{\ominus}$?

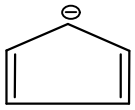
A) 

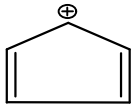
B) 

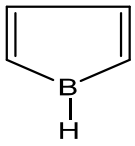
C) 

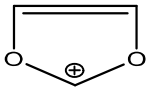
D) 

12. Among the given molecules, anti-aromatic

A) 

B) 

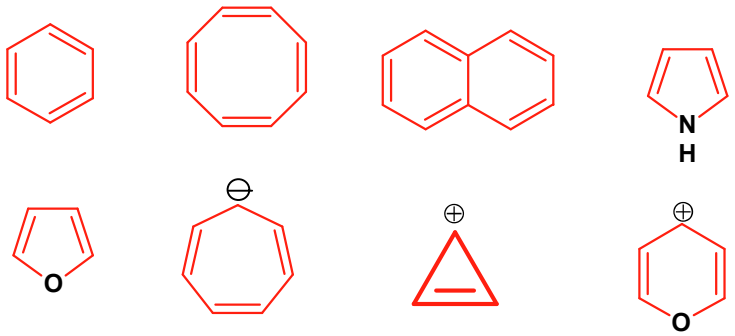
C) 

D) 

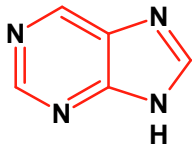
SECTION-III
(INTEGER TYPE)

Section-III (Integer Answer Type, Total Marks: 24) contains 6 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9. The bubble corresponding to the correct answer is to be darkened in the ORS. For each question you will be awarded 4 marks if you darken ONLY the bubble corresponding to the correct answer and zero marks otherwise. There are no negative marks in this section.

13. Find out number of aromatic compounds or ion from following.

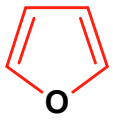


14. The purine heterocycle occurs mainly in the structure of DNA. Identify number of 'N' atoms having localized lone pair of electrons.



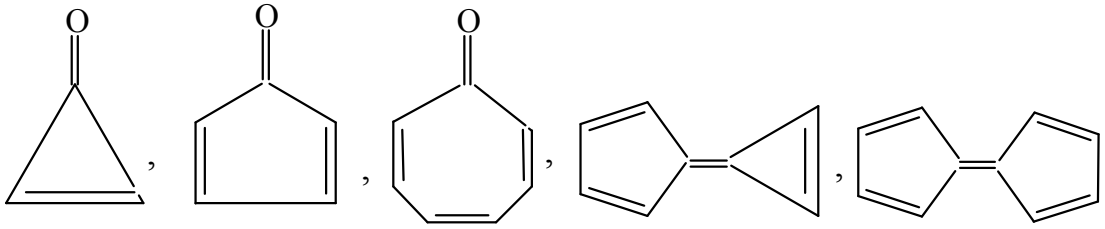
(Purine)

15. How many resonating structures are possible for the compound?

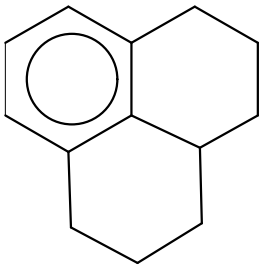


(Furan)

16. Find out number of compounds which have stable ionic structure, from following.



17. Find out number of benzylic hydrogen in.....



18. Number of maximum benzenoid structures which can be present in a particular resonating structures of phenanthracene are .....

SECTION-IV

(Matrix Matching Type)

Section-IV (Matrix-Match Type, Total Marks: 16) contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for the particular question, against statement B, darken the bubbles corresponding to q and r in the ORS. For each question you will be awarded 2 marks for each row in which you have darkened ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. Thus, each question in this section carries a maximum of 8 marks. There are no negative marks in this section.

19. Match the following Column-I (groups) and column-II (effect shown by the groups).

Column-I(groups)	column-II (effect shown by the groups)
A) $-NO_2$	P) – m effect
B) $-O^-$	Q) + m effect
C) $-O-CH_3$	R) + I effect
D) $-C\equiv N$	S) - I effect

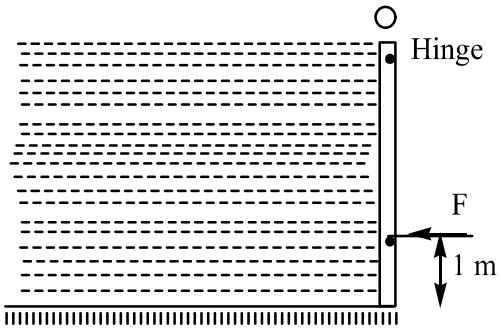
20. Match the following Column-I and Column-II.

Column-I	**Column-II**
SPECIES	**PROPERTIES**
(A) Carbanion(CH_3^-)	(P) Electrophile
(B) SO_3	(Q) Nucleophile
(C) $C_6H_5-\overset{\oplus}{C}H_2$	(R) sp^2 hybridised central atom
(D) Ethene	(S) sp^3 hybridised central atom

SECTION-1
(SINGLE CORRECT CHOICE TYPE)

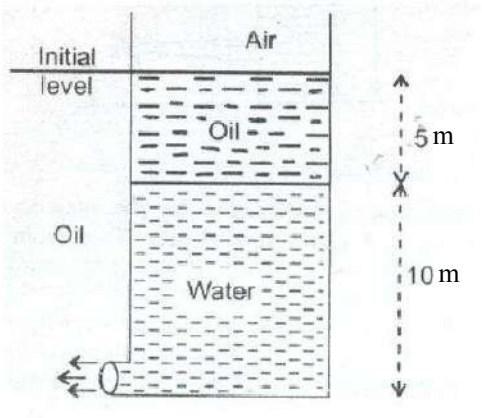
Section-I (Single Correct Answer Type, Total Marks: 24) contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.** For each question you will be awarded 3 marks if you darken ONLY the bubble corresponding to the correct answer and zero marks if no bubble is darkened. In all other cases, minus one (-1) mark will be awarded.

21. A square gate of size $4m \times 4m$ is hinged at topmost point. A liquid of density ρ fills the space left of it. The horizontal force (F) which acting 1m from lowest point can hold the gate stationary is: (There is no friction between gate and floor)



A) $\frac{256}{3}\rho g$ B) $\frac{256}{9}\rho g$ C) $\frac{128}{9}\rho g$ D) $\frac{128}{3}\rho g$

22. A tank with a small circular hole at the bottom contains oil on top of water. It is immersed in a large tank of same oil. Initially oil levels are same in both the tanks and water flows through the hole. If the ratio of cross-sectional areas of tank to that of the hole is 10^3, determine the time in which the flow stops. Density of oil = 800 kg/m^{3}and that of water $=1000\,kg/m^3$. Assume that level of oil outside the tank above the orifice does not change)

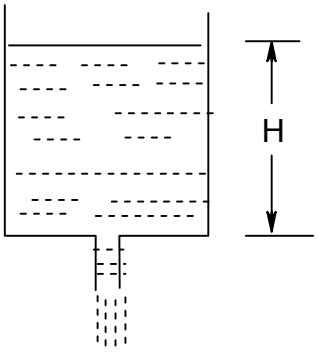


A) $\frac{32}{\sqrt{2}}$ s B) $32\sqrt{2}$ s C) $\sqrt{\frac{2}{5}}$ s D) 32 s

23. A cylindrical tank of base area A has a small hole of area 'a' at the bottom. At time t = 0, a tap starts to supply water into the tank at a constant $\alpha\, m^3/s$. Then find the maximum level of water in the tank.

A) $\frac{\alpha^2}{ga^2}$ B) $\frac{2\alpha^2}{ga^2}$ C) $\frac{3}{4}\frac{\alpha^2}{ga^2}$ D) $\frac{\alpha^2}{2ga^2}$

24. A tank of cross sectional area A_0 is filled with a liquid. A small orifice of area A ($A<<A_0$) is present at the bottom of tank. At a moment the height of liquid in the tank is 'H'. What is acceleration of top layer of liquid at this moment?

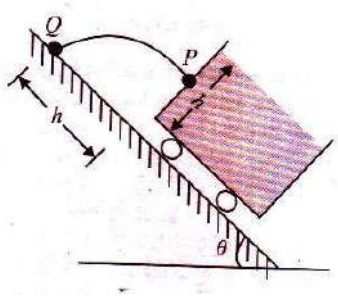


A) g B) $\frac{A}{A_0}g$ C) $\left(\frac{A}{A_0}\right)^2 g$ D) zero

25. A hole is made at the bottom of a tank filled with water (density $=10^3\ kg/m^3$). If the total pressure at the bottom of the tank is 3 atm (1atm $= 10^5\ N/m^2$), then the velocity of efflux is

A) $\sqrt{400}\ m/s$ B) $\sqrt{200}\ m/s$ C) $\sqrt{600}\ m/s$ D) $\sqrt{500}\ m/s$

26. A cubical tank carrying a non-viscous liquid (water, say) moves down a smooth incline plane freely. When we open the hole made at the mid-point P of the face of the tank, it strikes the point Q of the inclined plane. Speed of the tank at the time of opening the valve is



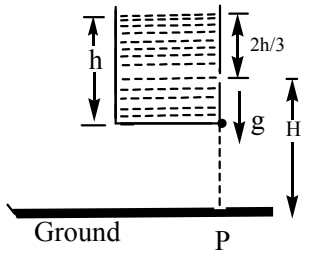
A) $\sqrt{gh\cos\theta}\left[2+\frac{\tan\theta}{2}\right]$ B) $\sqrt{gh\cos\theta}\left(\frac{\tan\theta}{2}\right)$

C) $\sqrt{gh\cos\theta}\left(1+\tan\theta\right)$ D) None of the above

27. Water (density ρ) flows through a uniform pipe bent an angle α with a velocity v. What is the force exerted on the bend of the pipe if cross-sectional area of the pipe is S ?

A) $2\rho v^2 S \sin \alpha/2$ B) $2\rho v^2 S \cos\alpha$ C) $2\rho v^2 S \sin\alpha$ D) $2\rho v^2 S \sin\alpha \cos\alpha$

28. An open vessel full of water is falling freely under gravity. There is a small hole in one face of the vessel, as shown in the figure. The water which comes out from the hole at the instant when hole is at height H above the ground, strikes the ground at a distance of x from P. Which of the following is correct for the situation described?



A) The value of x is $2\sqrt{\frac{2hH}{3}}$

B) The value of x is $\sqrt{\frac{4hH}{3}}$

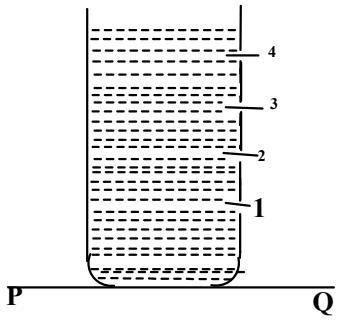
C) The value of x can't be computed from information provided.

D) The question is irrelevant as no water comes out from the hole

SECTION-II
(MORE THAN ONE TYPE)

Section - II (Multiple Correct Answers Type, Total Marks: 16) contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE may be correct. For each question you will be awarded 4 marks if you darken ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. There are no negative marks in this section.

29. A cylindrical vessel of 90 cm height is kept filled upto the brim. It has four holes 1,2,3,4 which are respectively at heights 20 cm, 30cm, 40 cm and 50 cm from the horizontal floor PQ. The water falling at the maximum horizontal distance from the vessel comes from

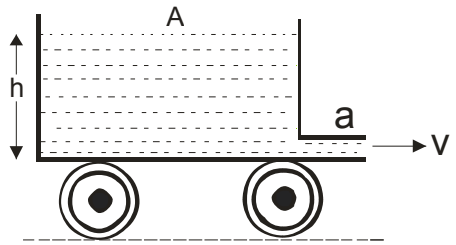


A) hole number 4 B) hole number 3

C) hole number 2 D) hole number 1

30. A container having a hole at the bottom is free to move on a frictionless horizontal surface. As the liquid comes out, container moves in backward direction with an

acceleration α and finally acquired velocity v (when all liquid drains out) Neglect the mass of container. The correct options are



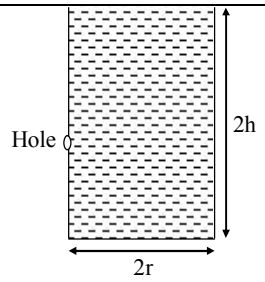
A) α is independent of height of liquid in vessel.

B) α depends only A and a and g.

C) v depends upon α and h

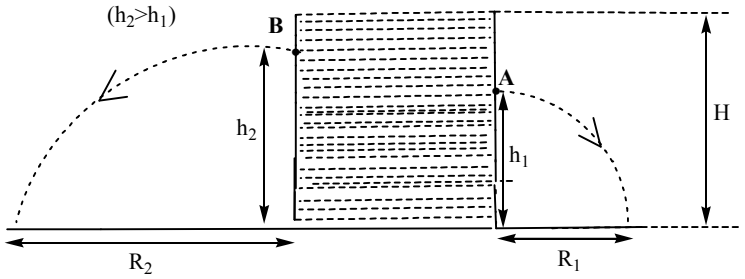
D) v independent of α

31. A light cylindrical vessel of radius r is kept on a rough horizontal surface so that it cannot slide but can topple. It is filled with water upto a height '2h' and a small hole of area 'a' is punched in it so that the water coming out of it falls at the maximum distance from its wall along horizontal surface. Water comes out horizontally from the hole. The value of h for which the cylinder topples is/are



A) $\frac{\pi r^3}{2a}$ B) $\frac{2\pi r^3}{a}$ C) $\frac{3\pi r^3}{2a}$ D) $\frac{4\pi r^3}{3a}$

32. A tank is placed on a horizontal surface and is full of water up to height 'H'. Two very small holes are created simultaneously on the vertical side of tank at height h_1 & h_2 from bottom of tank as shown in figure and R_1 & R_2 are the ranges corresponding heights h_1 & h_2 respectively. Choose the correct statement(s).



A) If $R_1 = R_2$ then H = $h_1 + h_2$

B) If t_1 & t_2 are the time taken by water ejecting from holes 'A' and 'B' to reach on horizontal surface, then $t_1 = t_2$ if $R_1 = R_2$

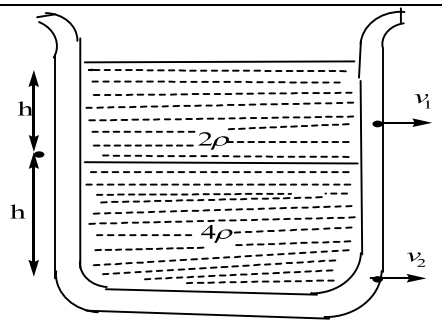
C) The water ejected from both holes strikes on horizontal surface with velocity $\sqrt{2gH}$

D) If the ratio of the velocity head of water just after ejecting from holes A to B is 3:2, then $H = (3h_2 - 2h_1)$

SECTION-III
(INTEGER TYPE)

Section-III (Integer Answer Type, Total Marks: 24) contains 6 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9. The bubble corresponding to the correct answer is to be darkened in the ORS. For each question you will be awarded 4 marks if you darken ONLY the bubble corresponding to the correct answer and zero marks otherwise. There are no negative marks in this section.

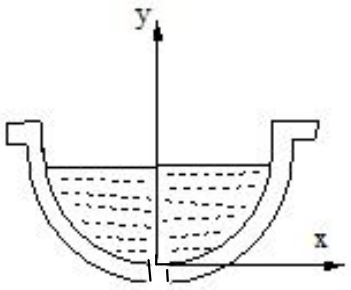
33. Equal volumes of two immiscible liquids of densities 2ρ and 4ρ are filled in a vessel as shown in figure. Two small holes are punched at depths $h/2$ and $2h$ from the surface of lighter liquid. If v_1 and v_2 are the velocities of efflux at these two holes, then $\frac{v_2}{v_1}$ is k. Find k^2 _____



34. Water level is maintained in a cylindrical vessel placed on horizontal floor up to a fixed height 'H'. A tiny hole of area 'A' is punched in the side wall at a height 'y' from the bottom of the vessel. The emerging stream strikes the ground at a horizontal distance $y(\neq 0)$ from cylinder. To maintain the level in the vessel at 'H', the rate (volume /sec) of addition of water is $A\sqrt{\frac{2gH}{n}}$. Find n

35. Water is used as the manometric liquid in a pitot tube mounted in an aircraft to measure air speed. If the maximum difference in height between the liquid columns is 0.1 m, the maximum air speed that can be measured is 5z m/s (nearly). Find z. Density of air $d_{air} = 1.3 kg/m^3$; $(g = 10 m/s^2)$

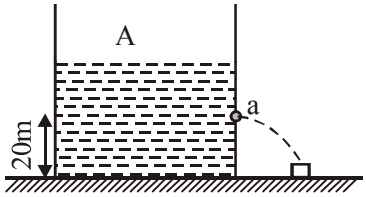
36. A small hole is made at the bottom of a symmetrical jar as shown in fig. A liquid is filled into the jar up to a certain height. The rate of fall of liquid surface is independent of the level of liquid in the jar. Then the surface of jar is a surface of revolution of the curve $y = k x^n$, the value of n is



37. A tank has a small hole of area of cross-section A at the bottom. Water from a pipe of inner cross-section area 2A is entering the tank with a velocity of 5 m/s. Calculate the height (in m) upto which the water will be filled inside the tank at steady state?

38. Water is filled in a uniform container of area of cross section A. A hole of cross section area a (<< A) is made in the container at a height of 20 m above the base. Water streams out and hits a small block placed at some distance from container. With

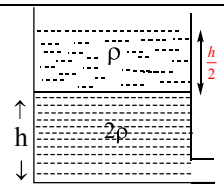
what speed (in ms^{-1}) should the block be moved such that water stream always hits the block? (Given $\frac{a}{A} = \frac{1}{20}$). (Take g = 10 ms^{-2})

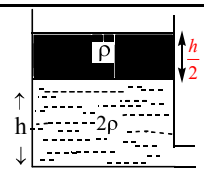
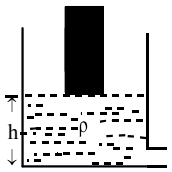


SECTION-IV
(Matrix Matching Type)

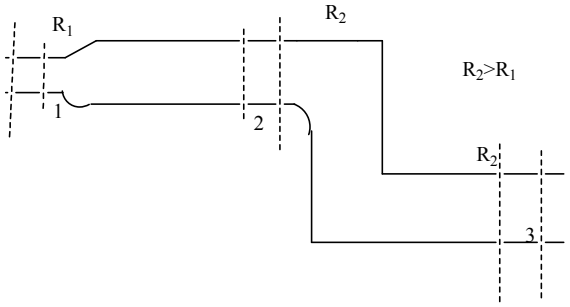
Section-IV (Matrix-Match Type, Total Marks: 16) contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for the particular question, against statement B, darken the bubbles corresponding to q and r in the ORS. For each question you will be awarded 2 marks for each row in which you have darkened ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. Thus, each question in this section carries a maximum of 8 marks. There are no negative marks in this section.

39. For the cases in Column I match the velocity of efflux (cross section of opening is very small) in Column II

Column I		Column II	
(A)	 Two immiscible liquids of densities ρ & 2ρ	(P)	$\sqrt{2gh}$

(B)	 A perfectly fitting piston made of material of density ρ which can slide without friction	(Q)	$\sqrt{2.5gh}$
(C)	 A solid cylinder of half the cross section of tank is just touching the water surface. Now it is pushed by a distance $\frac{h}{2}$ downward (An external agent holds cylinder, vessel is large).	(R)	$\sqrt{3gh}$
(D)	Arrangement is same as in option C but cylinder is pushed down by a distance h	(S)	$\sqrt{3.5gh}$
		(T)	$\sqrt{4gh}$

40. 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 same horizontal level, while being at a greater height than section (3). Correctly match order of the different physical parameters.



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

SECTION-1

(SINGLE CORRECT CHOICE TYPE)

Section-I (Single Correct Answer Type, Total Marks: 24) contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.** For each question you will be awarded 3 marks if you darken ONLY the bubble corresponding to the correct answer and zero marks if no bubble is darkened. In all other cases, minus one (-1) mark will be awarded.

41. If $\vec{a}$ and $\vec{b}$ are two unit vectors and θ is the angle between them, then the unit vector along the angular bisector of $\vec{a}$ and $\vec{b}$ will be given by

A) $\frac{\vec{a}-\vec{b}}{2\cos\frac{\theta}{2}}$ B) $\frac{\vec{a}+\vec{b}}{2\cos\frac{\theta}{2}}$ C) $\frac{\vec{a}-\vec{b}}{\cos\frac{\theta}{2}}$ D) $\frac{\vec{a}+\vec{b}}{\cos\frac{\theta}{2}}$

42. If vectors $\vec{a}$ and $\vec{b}$ are two adjacent sides of a parallelogram, then the vectors representing the altitude of the parallelogram which is perpendicular to $\vec{a}$ is

A) $\vec{b}+\frac{\vec{b}.\vec{a}}{|\vec{a}|^2}\vec{a}$ B) $\frac{\vec{a}.\vec{b}}{|\vec{b}|^2}$ C) $\vec{b}-\frac{\vec{b}.\vec{a}}{|\vec{a}|^2}\vec{a}$ D) $\vec{a}-\frac{\vec{b}.\vec{a}}{|\vec{b}|^2}\vec{b}$

43. In a quadrilateral ABCD, $\overrightarrow{AC}$ is the bisector of $\overrightarrow{AB}$ and $\overrightarrow{AD}$, angle between $\overrightarrow{AB}$ and $\overrightarrow{AD}$ is $\frac{2\pi}{3}, 15\left|\overrightarrow{AC}\right| = 3\left|\overrightarrow{AB}\right| = 5\left|\overrightarrow{AD}\right|$. Then the angle between $\overrightarrow{BA}$ and $\overrightarrow{CD}$ is

A) $\cos^{-1}\frac{\sqrt{14}}{7\sqrt{2}}$ B) $\cos^{-1}\frac{\sqrt{21}}{7\sqrt{3}}$ C) $\cos^{-1}\frac{2}{\sqrt{7}}$ D) $\cos^{-1}\frac{2\sqrt{7}}{14}$

44. ABCDEF is a regular hexagon where O is its centre. The value of $\overrightarrow{AB}+\overrightarrow{AC}+\overrightarrow{AD}+\overrightarrow{AE}+\overrightarrow{AF}$ is

A) $\overline{AO}$ B) $2\overline{AO}$ C) $4\overline{AO}$ D) $6\overline{AO}$

45. If $(x,y,z)\neq(0,0,0)$ *and* $(\vec{i}+\vec{j}+3\vec{k})x+(3\vec{i}-3\vec{j}+\vec{k})y+(-4\vec{i}+5\vec{j})z=a(x\vec{i}+y\vec{j}+z\vec{k})$, then the value of a is

A) 1 B)-1 C) 2 D) 3

46. The sides of a parallelogram are $2\vec{i}+4\vec{j}-5\vec{k}$ *and* $\vec{i}+2\vec{j}+3\vec{k}$. Then the unit vector parallel to one of the diagonals is

A) $\frac{1}{\sqrt{41}}\left(1\vec{i}+6\vec{j}-2\vec{k}\right)$ B) $\frac{1}{7}\left(3\vec{i}-6\vec{j}-2\vec{k}\right)$ C) $\frac{1}{\sqrt{69}}\left(\vec{i}+2\vec{j}+8\vec{k}\right)$ D) $\frac{1}{\sqrt{69}}\left(-\vec{i}-2\vec{j}+8\vec{k}\right)$

47. A vector $\vec{a}$ has the components 2p and 1 w.r.t. a rectangular Cartesian system. This system is rotated through a certain angle about the origin in the counter clockwise sense. If with respect to the new system, $\vec{a}$ has components (p+1) and 1, then p is equal to

A) -1 B) -1/3 C) 1/2 D) 2

48. $\vec{a}=\vec{i}+\vec{j}+\vec{k}, \vec{b}=4\vec{i}+3\vec{j}+4\vec{k}$ *and* $\vec{c}=\vec{i}+x_1\vec{j}+x_2\vec{k}$ are linearly dependent vectors and $\left|\vec{c}\right|=\sqrt{3}$, then which of the following is/are may be true?

A) $x_2=-1$ B) $x_2=1$ C) $x_1=-2$ D) $x_1=\pm 2$

space for rough work

SECTION-II
(MORE THAN ONE TYPE)

Section - II (Multiple Correct Answers Type, Total Marks: 16) contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE may be correct. For each question you will be awarded 4 marks if you darken ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. There are no negative marks in this section.

49. If $\vec{a},\vec{b},\vec{c}$ are non coplanar vectors and λ is real number, then the vectors $\vec{a}+2\vec{b}+3\vec{c},\ \lambda\vec{b}+\mu\vec{c}$ *and* $(2\lambda-1)\,\vec{c}$ are coplanar for

A) All values of μ B) $\lambda=\frac{1}{2}$

C) $\lambda=0$ D) no value of λ

50. If the vectors $\vec{i}-\vec{j},\ \vec{j}+\vec{k}$ *and* $\vec{a}$ from a triangle, then the possible vector $\vec{a}$ may be

A) $-\vec{i}-\vec{k}$ B) $\vec{i}-2\vec{j}-\vec{k}$ C) $2\vec{i}+\vec{j}+\vec{k}$ D) $\vec{i}+\vec{k}$

51. The vector $\vec{i}+x\vec{j}+3\vec{k}$ is rotated through an angle θ and double in magnitude and becomes $4\vec{i}+(4x-2)\vec{j}+2\vec{k}$. Then the possible values of x are

A) 1 B) -2/3 C) 2 D) 4/3

52. If non-Zero vectors $\vec{a}$ *and* $\vec{b}$ are equally inclined to vector $\vec{c}$, then $\vec{c}$ is

A) $\frac{|\vec{a}|}{|\vec{a}|+2|\vec{b}|}\vec{a}+\frac{|\vec{b}|}{|\vec{a}|+|\vec{b}|}\vec{b}$ B) $\frac{|\vec{b}|}{|\vec{a}|+|\vec{b}|}\vec{a}+\frac{|\vec{a}|}{|\vec{a}|+|\vec{b}|}\vec{b}$

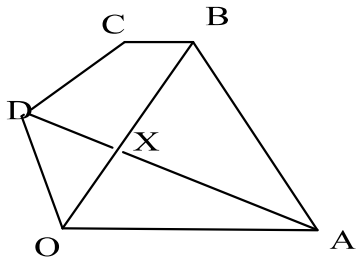
C) $\frac{|\vec{a}|}{|\vec{a}|+2|\vec{b}|}\vec{a}+\frac{|\vec{b}|}{|\vec{a}|+2|\vec{b}|}\vec{b}$ D) $\frac{|\vec{b}|}{2|\vec{a}|+|\vec{b}|}\vec{a}+\frac{|\vec{a}|}{2|\vec{a}|+|\vec{b}|}\vec{b}$

SECTION-III
(INTEGER TYPE)

Section-III (Integer Answer Type, Total Marks: 24) contains 6 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9. The bubble corresponding to the correct answer is to be darkened in the ORS. For each question you will be awarded 4 marks if you darken ONLY the bubble corresponding to the correct answer and zero marks otherwise. There are no negative marks in this section.

53. ABCD is a parallelogram. L is a point on BC which divides BC in the ratio 1:2. AL intersects BD at P. M is a point on DC which divides DC in the ratio 1:2 and AM intersects BD in Q. Then Point P divides AL in the ratio K:1 , then value of K is?

54. Let OABCD be a pentagon in which the sides OA and CB are parallel and the sides OD and AB are parallel. AD and OB intersect at X according to the diagram Also OA: CB=2:1 and OD: AB=1:3, Then The ratio $\frac{AX}{XD}$ is?



55. Consider the regular hexagon ABCDEF with centre at O(origin) , Then If $\overrightarrow{AD}+\overrightarrow{EB}+\overrightarrow{FC}$ is equal to $k\left(\overrightarrow{AB}\right)$, then k is?

56. Let two non – collinear vectors $\vec{a}$ and $\vec{b}$ inclined at an angle $\frac{2\pi}{3}$ be such that $|\vec{a}|=3$ and $|\vec{b}|=4$. A point P moves so that at any time *t* the position vector $\overrightarrow{OP}$ (where O is the origin) is given as $\overrightarrow{OP}=\left(e^{t}+e^{-t}\right)\vec{a}+\left(e^{t}-e^{-t}\right)\vec{b}$. If the least distance of P from origin is $\sqrt{2}\sqrt{\sqrt{a}-b}$ where $a,b\in N$, then find the value of " b" is.

57. Let the position vectors of the points A, B, C be $\vec{a}=\hat{i}+2\hat{j}+3\hat{k},\vec{b}=-\hat{i}-\hat{j}+8\hat{k}$ and $\vec{c}=-4\hat{i}+4\hat{j}+6\hat{k}$ respectively, then If $\left|\vec{b}-\vec{c}\right|^{2}+\left|\vec{c}-\vec{a}\right|^{2}=t\left|\vec{a}-\vec{b}\right|^{2}$, value of t is ?

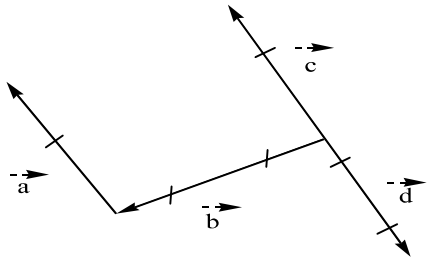
58. Given two vectors $\vec{a}=2\hat{i}-3\hat{j}+6\hat{k}$, $b=-2\hat{i}+2\hat{j}-\hat{k}$,*and* $\lambda=\dfrac{\left|the\ projection\ of\ \vec{a}\ on\ \vec{b}\right|}{\left|the\ projection\ of\ \vec{b}\ on\ \vec{a}\right|}$ then 3λ is equal to

SECTION-IV

(Matrix Matching Type)

Section-IV (Matrix-Match Type, Total Marks: 16) contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for the particular question, against statement B, darken the bubbles corresponding to q and r in the ORS. For each question you will be awarded 2 marks for each row in which you have darkened ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. Thus, each question in this section carries a maximum of 8 marks. There are no negative marks in this section.

59. Refer to the following diagram and match the following from Column-1 to Column-II.



Column I	Column II
A) Collinear Vectors	P) $\vec{a}$
B) Co-initial Vectors	Q) $\vec{b}$
C) Equal Vectors	R) $\vec{c}$
D) Unlike Vectors with same initial point	S) $\vec{d}$ T) $2\vec{d}$

60. Suppose $\vec{a},\vec{b},\vec{c}$ be any three 3 dimensional unit vectors and let

$k = \left|\vec{a}-\vec{b}\right|^2 + \left|\vec{c}-\vec{b}\right|^2 + \left|\vec{a}-\vec{c}\right|^2$.

Column I	Column II
A) If $k = 2$,then	P) $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a} = 3$
B) If $k = 0$,then	Q) $\left\|\vec{a}+\vec{b}+\vec{c}\right\| = 1$
C) If $k = 8$,then	R) $\vec{a}+\vec{b}+\vec{c} = \vec{0}$
D) If k has to be maximum ,then	S) $\left\|\vec{a}+\vec{b}+\vec{c}\right\| = \sqrt{7}$ T) $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a} = -1$

Master JEE CLASSES
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Max.Marks:240

KEY SHEET

CHEMISTRY

1	**B**	2	**A**	3	**B**	4	**A**	5	**B**
6	**D**	7	**B**	8	**B**	9	**ABCD**	10	**ABC**
11	**BCD**	12	**BC**	13	**6**	14	**3**	15	**5**
16	**3**	17	**5**	18	**3**	19	**A-PS B-QR C-QS D-PS**	20	**A-QS B-PR C-PR D-QR**

PHYSICS

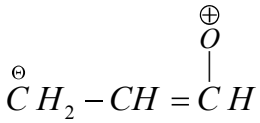
21	**B**	22	**C**	23	**D**	24	**C**	25	**A**
26	**B**	27	**A**	28	**D**	29	**AB**	30	**ABC**
31	**BCD**	32	**ACD**	33	**3**	34	**5**	35	**8**
36	**4**	37	**5**	38	**1**	39	**A-Q B-Q C-R D-T**	40	**A-Q B-R C-S D-R**

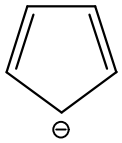
MATHS

41	**B**	42	**C**	43	**C**	44	**D**	45	**B**
46	**D**	47	**B**	48	**B**	49	**ABC**	50	**ABD**
51	**BC**	52	**BD**	53	**3**	54	**6**	55	**4**
56	**7**	57	**2**	58	**7**	59	**A-PRST B-QRST C-PR D-RST**	60	**A-S B-P C-QT D-R**

SOLUTIONS
CHEMISTRY

1. 1.Among the given the hyper conjugative structures are more for 3^0-butyl carbonium ion due to $3-\alpha-C$ & $9-\alpha-H$ atoms.
2. Due to localized lone pair/ in pyridine.
3. Among the given resonance structures is the least stable one EN atom, O is carrying positive charge.



4. Among the structures given  has the highest resonance energy, due to delocalization 6 electrons. Further it has aromaticity as it satisfies 4n+2 rule.
5. Octet rule, charge separation, electronegative atom with positive charge.
6. Conceptual.
7. Conceptual.
8. Conceptual.
9. E.N $\alpha-I$.
10. Concept of mesomeric effect.
11. Conceptual.
12. Conceptual.
13. Conceptual.
14. Conceptual.
15. Conceptual.
16. Conceptual.
17. Conceptual.
18. Conceptual.
19. Conceptual.
20. Conceptual

21. Conceptual.

22. Conceptual.

23. Conceptual.

24. Velocity of efflux. $v = \sqrt{2gh}$

Velocity of top layer $= \frac{AV}{Av} = \frac{A}{A_0}\sqrt{2gh}$

$\therefore$ Acceleration top layer $= \frac{d}{dx}\left[\frac{A}{Av}\sqrt{2gh}\right]$

$\frac{A}{Av}\sqrt{2g} \times \frac{1}{2\sqrt{h}} \times \frac{dh}{dt}$

$= \frac{A}{A_0}\sqrt{2g} \times \frac{1}{2\sqrt{h}} \times \frac{A}{A_0}\sqrt{2gh}$

$\left(\frac{A}{A_0}\right)^2 g$

Correct option is (c)

25. Total pressure at the bottom = 3 atm

Pressure due to water in the tank = 3 atm – 1 atm = 2atm = 20 m of water column

Height of water in the tank is $h = 20\ m$

So, velocity of efflux $= \sqrt{2gh} = \sqrt{2 \times 10 \times 20} = \sqrt{400}\ m/s$

26. $v_{rel} = \sqrt{2g_{eff}\frac{h}{2}} = \sqrt{g_{eff}h} = \sqrt{gh\cos\theta}$

The actual velocity of the liquid, $v = (v_r - v_o)$

Then, the time of flight, $T = \sqrt{\frac{2(h/2)}{g\cos\theta}} = \sqrt{\frac{h}{g\cos\theta}}$

$h = vt - \frac{1}{2}(g\cos\theta)T^2$ putting T and v, we have

$v_0 = h\left(1 + \frac{\tan\theta}{2}\right)\sqrt{\frac{g\cos\theta}{h}} + \sqrt{gh\cos\theta}$

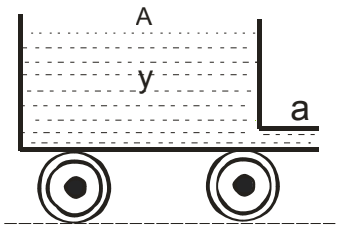
27. Conceptual.

28. Conceptual.

29. Conceptual.

30. $v = \sqrt{2gy}$

$F = \rho a\ 2gy$



$(\rho Ay)\alpha = \rho a\, 2gy \Rightarrow \alpha = \frac{a}{A}2g$

31. Since waterfalls at maximum distance from wall so the hole should be made at h.

For toppling, $\rho av^2 \times h \geq \pi r^2 2h\rho g \times r$

$\Rightarrow \quad \rho a 2gh \times h \geq \pi r^2 2h\rho gr$

$\Rightarrow \quad h \geq \frac{\pi r^3}{a}$

32. *P and Q* are the Claussius – Clayperon equation and Vant Hoff isochore.

33. Hint: $v_1 = \sqrt{2g\left(\frac{h}{2}\right)} = \sqrt{gh} \qquad \rightarrow (1)$

From Bernouli's theorem

$2\rho gh + 4\rho gh = \frac{1}{2}(4\rho)v_2^2$

$\therefore\ v_2 = \sqrt{3gh} \qquad \rightarrow (2)$

$\therefore\ \frac{v_2}{v_1} = \sqrt{3}$

34. $y = \left(\frac{w^2}{2g}\right)x^2 = \frac{(2\pi \times 2)^2}{2\times 10}.x^2$

$y = 8x^2$

$\therefore y = 8(0.05)^2 = 200\times 10^{-4}$

$= 2\times 10^{-2}\ m$

$\therefore y = 2\,cm$

35. For gases, Velocity is given by

$v = \sqrt{\frac{2h\rho g}{d}} = \sqrt{\frac{2\times 0.1\times 1000\times 10}{1.3}} = 39.22\ m/s\ \approx 40\,m/s$

36. At steady state the rate at which the liquid is entering the tank should be equal to the rate at which the liquid is flowing out of the tank therefore

$$A\sqrt{2gh} = 2Av$$

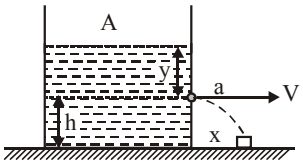
$$h = \frac{2v^2}{g} = 5m$$

37. Conceptual

38. Velocity of efflux $v = \sqrt{2gy}$

Range $x = \sqrt{2gy} \times \sqrt{\frac{2h}{g}}$

The velocity of the block must be $\left(\frac{dx}{dt}\right)$.



$$\therefore \quad V_b = \frac{dx}{dt} = \sqrt{\frac{2h}{g}} \times \sqrt{2g} \times \frac{1}{2\sqrt{y}} \frac{dy}{dt}$$

$$V_b = \frac{\sqrt{h}}{\sqrt{y}} \cdot \frac{dy}{dt} \quad \ldots(i)$$

Using equation of continuity

$$\frac{Ady}{dt} = a\sqrt{2gy} \ldots(ii)$$

equation (i) and (ii)

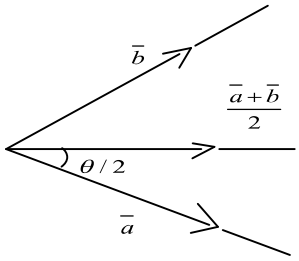
$$V_b = \sqrt{\frac{h}{y}} \times \frac{a}{A}\sqrt{2gy}$$

$$V_b = \sqrt{2gh} \times \frac{a}{A} = 20 \times \frac{1}{20} = 1 \text{ ms}^{-1}.$$

39. Conceptual.

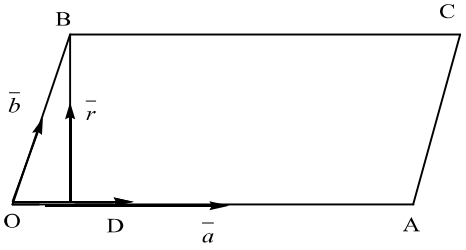
40. Conceptual.

41. But $\left|\frac{\bar{a}+\bar{b}}{2}\right| = Cos\frac{\theta}{2}$



$\therefore$ Required unit vector is $\frac{\bar{a}+\bar{b}}{2\cos\frac{\theta}{2}}$

42.

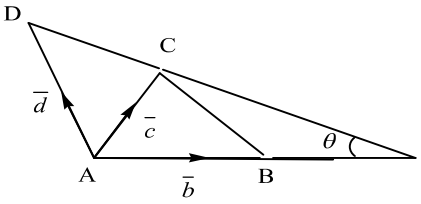


Let $\overline{OD} = x\bar{a}$, $\overline{DB} = \bar{r} = \bar{b} - x\bar{a}$

But $\bar{r}.\bar{a} = 0 \Rightarrow x = \frac{(\bar{b}.\bar{a})}{|\bar{a}|^2}$

43. Let $AC = \lambda \Rightarrow AB = 5\lambda$ and $AD = 3\lambda$
$\overline{AB} = \bar{b}, \overline{AC} = \bar{c}, \overline{AD} = \bar{d}$

$\cos\theta = \frac{\overline{BA}.\overline{CD}}{\left|\overline{BA}\right|\left|\overline{CB}\right|}$



$= \frac{-\bar{b}(\bar{d}-\bar{c})}{\left|\bar{b}\right|\left|\bar{c}-\bar{d}\right|}$

$= \frac{\bar{d}.\bar{b}-\bar{b}.\bar{c}}{5\lambda.\sqrt{7}\lambda}$

$= \frac{10\lambda^2}{5\sqrt{7}\lambda^2}$

$\theta = \cos^{-1}\left(\frac{2}{\sqrt{7}}\right)$

44. $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF}$

$= \overrightarrow{ED} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{CD}$

$(\because \overrightarrow{AB} = \overrightarrow{ED} \quad and \quad \overrightarrow{AF} = \overrightarrow{CD})$

$= (\overrightarrow{AC} + \overrightarrow{ED}) + (\overrightarrow{AE} + \overrightarrow{ED}) + \overrightarrow{AD}$

$= \overrightarrow{AD} + \overrightarrow{AD} + \overrightarrow{AD} = 3\overrightarrow{AD} = 6\overrightarrow{AO}$

45. The given vector equation can be written as

$\left[(1-a)x + 3y - 4z\right]\vec{i} + \left[x - (3+a)y + 5z\right]\vec{j} + \left[3x + y - az\right]\vec{k} = 0$

$\Rightarrow (1-a)x + 3y - 4z = 0$

$x - (3-a)y + 5z = 0 \quad and \quad 3x + y - az = 0$

The above system of equation has a non-trivial solution.

$$\Rightarrow \begin{vmatrix} 1-a & 3 & -4 \\ 1 & -(3+a) & 5 \\ 3 & 1 & -a \end{vmatrix} = 0$$

$\Rightarrow a = 0, -1$

46. Let $\vec{a} = 2\vec{i} + 4\vec{j} - 5\vec{k} \quad and \quad \vec{b} = \vec{i} + 2\vec{j} + 3\vec{k}$.

Then the diagonals of the parallelogram are

$\vec{p} = \vec{a} + \vec{b} \quad and \quad \vec{q} = \vec{b} - \vec{a},$

$i.e., \ \vec{p} = 3\vec{i} + 6\vec{j} - 2\vec{k}, \quad \vec{q} = -\vec{i} - 2\vec{j} + 8\vec{k}$

So unit vectors along the diagonals are

$\frac{1}{7}\left(3\vec{i} + 6\vec{j} - 2\vec{k}\right) \ and \ \frac{1}{\sqrt{69}}\left(-\vec{i} - 2\vec{j} + 8\vec{k}\right).$

47. We have, $\vec{a} = 2p\vec{i} + \vec{j}$

on rotation, let $\vec{b}$, be the vector with components (p+1) and 1 so that $\vec{b} = (p+)\vec{i} + \vec{j}$.

$Now, \ |\vec{a}| = |\vec{b}| \Rightarrow a^2 = b^2$

$\Rightarrow 4p^2 + 1 = (p+1)^2 + 1$

$\Rightarrow 4p^2 = (p+1)^2 \qquad \Rightarrow 3p = -1 \ or \ p = 1$

$\Rightarrow 2p = \pm(p+1) \qquad \therefore p = -1/3 \ or \ p = 1$

48. Clearly $\vec{a}, \vec{b} \ and \ \vec{c}$ must be coplanar

$$\begin{vmatrix} 1 & 1 & 1 \\ 4 & 3 & 4 \\ 1 & x_1 & x_2 \end{vmatrix} = 0 \Rightarrow x_2 = 1$$

$Also \quad |\vec{c}| = \sqrt{3} \Rightarrow 3 = 1 + x_1^2 + x_2^2 \Rightarrow x_1^2 = 1 \Rightarrow x_1 = \pm 1$

46. For Coplanar Vectors $\begin{vmatrix} 1 & 2 & 3 \\ 0 & \lambda & \mu \\ 0 & 0 & 2\lambda - 1 \end{vmatrix} = 0$

$\Rightarrow (2\lambda - 1)\lambda = 0 \Rightarrow \lambda = 0, \frac{1}{2}$

47. $\vec{a} = \left[\pm\left(\vec{i}-\vec{j}\right)\pm\left(\vec{j}+\vec{k}\right)\right]$

$= \pm\left(\vec{i}+\vec{k}\right), \pm\left(\vec{i}-2\vec{j}-\vec{k}\right)$

51. Let $\vec{\alpha} = \vec{i} + x\vec{j} + 3\vec{k},\ \vec{\beta} = 4\vec{i} + (4x-2)\vec{j} + 2\vec{k}$

Given, $2\left|\vec{\alpha}\right| = \left|\vec{\beta}\right|$

$\Rightarrow 2\sqrt{10+x^2} = \sqrt{20+4\left(2x-1\right)^2}$

$\Rightarrow 10 + x^2 = 5 = (4x^2 - 4x + 1)$

$\Rightarrow 3x^2 - 4x - 4 = 0$

$\Rightarrow x = 2, -\frac{2}{3}$

52. Since $\vec{a}$ *and* $\vec{b}$ are equally inclined to $\vec{c}$, $\vec{c}$ must be of form $t\left(\frac{\vec{a}}{\left|\vec{a}\right|}+\frac{\vec{b}}{\left|\vec{b}\right|}\right)$. Now,

$$\frac{\left|\vec{b}\right|}{\left|\vec{a}\right|+\left|\vec{b}\right|}\vec{a} + \frac{\left|\vec{a}\right|}{\left|\vec{a}\right|+\left|\vec{b}\right|}\vec{b} = \frac{\left|\vec{a}\right|\left|\vec{b}\right|}{\left|\vec{a}\right|+\left|\vec{b}\right|}\left(\frac{\vec{a}}{\left|\vec{a}\right|}+\frac{\vec{b}}{\left|\vec{b}\right|}\right)$$

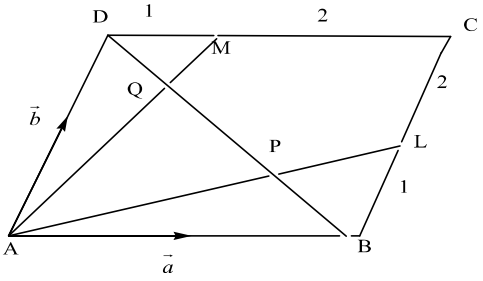
Also, $\frac{\left|\vec{b}\right|}{2\left|\vec{a}\right|+\left|\vec{b}\right|}\vec{a} + \frac{\left|\vec{a}\right|}{2\left|\vec{a}\right|+\left|\vec{b}\right|}\vec{b} = \frac{\left|\vec{a}\right|\left|\vec{b}\right|}{2\left|\vec{a}\right|+\left|\vec{b}\right|}\left(\frac{\vec{a}}{\left|\vec{a}\right|}+\frac{\vec{b}}{\left|\vec{b}\right|}\right)$

Other two vector cannot be written in the form $t\left(\frac{\vec{a}}{\left|\vec{a}\right|}+\frac{\vec{b}}{\left|\vec{b}\right|}\right)$

53. $\overline{BL} = \frac{1}{3}\vec{b}$

$\therefore \overline{AL} = \vec{a} + \frac{1}{3}\vec{b}$

Let $\overline{AP} = \lambda\overline{AL}$ and P divides DB in the ratio $\mu : 1-\mu$.



Then $\overrightarrow{AP} = \lambda\vec{a} + \frac{\lambda}{3}\vec{b}$ (1)

Also $\overrightarrow{AP} = \mu\vec{a} + (1-\mu)\vec{b}$ (2)

From (1) *and* (2),

$\lambda\vec{a} + \frac{\lambda}{3}\vec{b} = \mu\vec{a} + (1-\mu)\vec{b}$

$\therefore \lambda = \mu \quad and \quad \frac{\lambda}{3} = 1-\mu$

$\therefore \lambda = \frac{3}{4}$

Hence, P divides AL in the ratio 3:1

54. Let the position vectors of A,B,C and D be $\vec{a},\vec{b},\vec{c}$ *and* $\vec{d}$ respectively.

Then OA:CB =2:1

$\Rightarrow \overrightarrow{OA} = 2\overrightarrow{CB}$

$\Rightarrow \vec{a} = 2(\vec{b} - \vec{c})$ (1)

and $OD : AB = 1:3$

$3\overrightarrow{OD} = \overrightarrow{AB}$

$\Rightarrow 3\vec{d} = (\vec{b} - \vec{a}) = \vec{b} - 2(\vec{b} - \vec{c})$ [Using (1)]

$\Rightarrow 3\vec{d} = -\vec{b} + 2\vec{c}$ (2)

Let $OX : XC = \lambda : 1$ *and* $AX : XD = \mu : 1$

Now, x divides OC in the ratio $\lambda : 1$. Therefore,

$P.V \ of \ X = \frac{\lambda\vec{c}}{\lambda+1}$ (3)

X also divides AD in the ratio $\mu : 1$

$P.V \ of \ X = \frac{\mu\vec{d} + \vec{a}}{\mu+1}$ (4)

$\frac{\lambda\vec{c}}{\lambda+1} = \frac{\mu\vec{d} + \vec{a}}{\mu+1}$

$\Rightarrow \left(\frac{\lambda\vec{c}}{\lambda+1}\right)\vec{c} = \left(\frac{\mu}{\mu+1}\right)\vec{d} + \left(\frac{1}{\mu+1}\right)\vec{a}$

[using (1) and (4)]

$\Rightarrow \left(\frac{\lambda\vec{c}}{\lambda+1}\right)\vec{c} = \left(\frac{\mu}{\mu+1}\right)\left(\frac{-\vec{b}+2\vec{c}}{3}\right) + \left(\frac{1}{\mu+1}\right)2\left(\vec{b}-\vec{c}\right)$

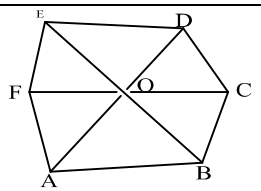
$\Rightarrow \left(\frac{\lambda\vec{c}}{\lambda+1}\right)\vec{c} = \left(\frac{6-\mu}{3(\mu+1)}\right)\vec{b} + \left(\frac{2\mu}{3(\mu+1)} - \frac{2}{\mu+1}\right)\vec{c}$

$\Rightarrow \left(\frac{6-\mu}{3(\mu+1)}\right)\vec{b} + \left(\frac{2\mu-6}{3(\mu+1)} - \frac{\lambda}{\lambda+1}\right)\vec{c} = \vec{0}$

$\Rightarrow \frac{6-\mu}{3(\mu+1)} = 0 \quad and \quad \frac{2\mu-6}{3(\mu+1)} - \frac{\lambda}{\lambda+1} = 0$ $\left[As \ \vec{b} \ and \ \vec{c} \ are \ non-Collinnear\right]$

$\Rightarrow \mu = 6, \quad \lambda = \frac{2}{5}$

55. Consider the regular hexagon ABCDEF with centre at O (origin)



$\overrightarrow{AD}+\overrightarrow{EB}+\overrightarrow{FC}=2\overrightarrow{AO}+2\overrightarrow{OB}+2\overrightarrow{OC}$

$=2\left(\overrightarrow{AO}+\overrightarrow{OB}\right)+2\overrightarrow{OC}$ [Since $\overrightarrow{OC}=\overrightarrow{AB}$]

$=2\overrightarrow{AB}+2\overrightarrow{AB}\Rightarrow 4\overrightarrow{AB}$

56 Conceptual

57. clearly ΔABC is equilateral

58. $\dfrac{\left|the\ projection\ of\ \vec{a}\ on\ \vec{b}\right|}{\left|the\ projection\ of\ \vec{b}\ on\ \vec{a}\right|}=\dfrac{\left|\vec{a}\right|}{\left|\vec{b}\right|}$

59. CONCEPTUAL.

60. $k=\left|\vec{a}-\vec{b}\right|^2+\left|\vec{c}-\vec{b}\right|^2+\left|\vec{a}-\vec{c}\right|^2=6-2\left(\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}\right)$

Clearly k is maximum when $\vec{a},\vec{b},\vec{c}$ are equally inclined at 120° to each other