MasterJEE

IIT-JEE | Medical | Foundations

Master JEE CLASSES

Kukatpally, Hyderabad.

JEE-ADVANCE-2014-P2-Model

Max.Marks:180

2014_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-2014-P2-Model

Time: 3:00 Hours **IMPORTANT INSTRUCTIONS** **Max Marks: 180**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec– I(Q.N: 01 – 10)	Questions with Single Correct Choice	3	-1	10	30
Sec– II(Q.N: 11 – 16)	Questions with Comprehension Type (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec– III(Q.N: 17 – 20)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 30)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N : 31 – 36)	Questions with Comprehension Type (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 37 – 40)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N: 51 – 56)	Questions with Comprehension Type (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 57 – 60)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

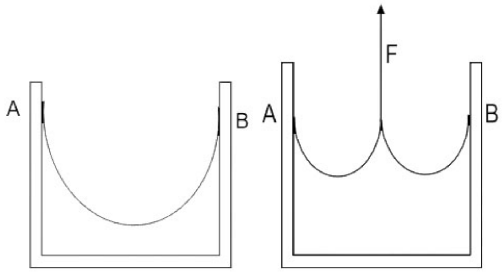
PHYSICS **Max Marks: 60**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 10 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

1. When a film of soap solution is created inside a loop formed by rectangular wire frame and an inextensible light thread AB of length l, the thread assumes shape of a semicircle and remains equilibrium. By pulling the midpoint of thread with a force F, the thread can be given shape of two semicircles as shown in Figure. Calculate surface tension σ of the soap solution.



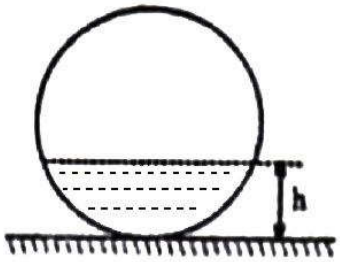
A) $\frac{\pi F}{\ell}$ B) $\frac{\pi F}{2\ell}$ C) $\frac{\pi F}{4\ell}$ D) *None*

2. A wire forming a loop is dipped into soap solution and taken out, so that a film of soap solution is formed. A loop of 6.28 *cm* long thread is gently put on the film and pricked

with a needle inside the loop. The thread loop takes the shape of a circle. The tension in the thread is (*Surface tension of soap solution* $= 0.03N/m.$)

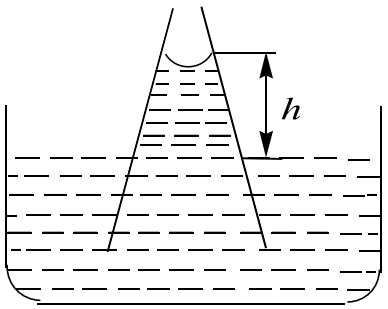
A) $3\times10^{-4}N$ B) $6\times10^{-4}N$ C) $2\times10^{-4}N$ D) $1.5\times10^{-4}N$

3. A liquid is filled in a spherical container of radius *R* till a height *h*. At this positions the liquid surface at the edges is also horizontal. The contact angle is



A) 0 B) $\cos^{-1}\left(\frac{R-h}{R}\right)$ C) $\cos^{-1}\left(\frac{h-R}{R}\right)$ D) $\sin^{-1}\left(\frac{R-h}{R}\right)$

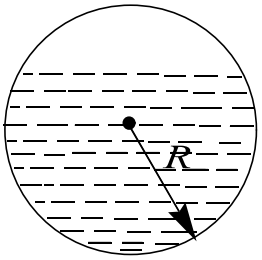
4. A capillary of the shape as shown is dipped in a liquid. Contact angle between the liquid and the capillary is 0^0 and effect of liquid inside the meniscus is to be neglected. *T* is surface tension of the liquid, *r* is radius of the meniscus, *g* is acceleration due to gravity and ρ is density of the liquid then height *h* in equilibrium is



A) Greater than $\frac{2T}{r\rho g}$ B) Equal to $\frac{2T}{r\rho g}$

C) Less than $\frac{2T}{r\rho g}$ D) $\frac{4T}{r\rho g}$

5. A spherical glass vessel filled with liquid is kept in uniform gravity. Horizontal surface represents meniscus of liquid. Now complete system is taken to gravity free space. *C* is the center of sphere.



A) Vessel + liquid is a wetting combination

B) Liquid forms drop & leaves contact of vessel

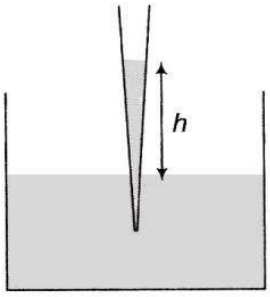
C) Finally, liquid forms a drop touching vessel

D) Finally, liquid spreads over entire surface of vessel

6. The following observations were taken for determining surface tension *T* of water by capillary method. Diameter of capillary $d = 1.25 \times 10^{-2} m$, rise of water $h = 1.45 \times 10^{-2} m$. Using $g = 9.80 m/s^2$ and the simplified relation $T = \frac{rhg}{2} \times 10^3 N/m$, the possible error in surface tension is closest to

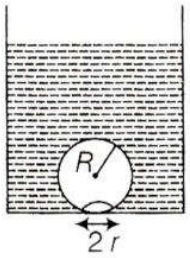
A) 1.5% B) 2.4% C) 10% D) 0.15%

7. A glass capillary tube is of the shape of truncated cone with an apex angle α so that its two ends have cross-sections of different radii. When dipped in water vertically, water rises in it to a height *h*, where the radius of its cross-section is *b*. If the surface tension of water is *S*, its density is ρ, and its contact angle with glass is θ, the value of *h* will be (*g is the acceleration due to gravity*)



A) $\frac{2S}{b\rho g}\cos(\theta-\alpha)$ B) $\frac{2S}{b\rho g}\cos(\theta+\alpha)$ C) $\frac{2S}{b\rho g}\cos(\theta-\alpha/2)$ D) $\frac{2S}{b\rho g}\cos(\theta+\alpha/2)$

8. On heating water, bubbles beings formed at the bottom of the vessel detach and rise. Take the bubbles to be spheres of radius *R* and making a circular contact of radius *r* with the bottom of the vessel. If $r << R$ and the surface tension of water is *T*, value of *r* just before bubbles detach is (*density of water is* ρ)



A) $R^2\sqrt{\frac{2\rho g}{3T}}$ B) $R^2\sqrt{\frac{\rho g}{6T}}$ C) $R^2\sqrt{\frac{\rho g}{T}}$ D) $R^2\sqrt{\frac{3\rho g}{T}}$

9. Assume that a drop of liquid evaporates by decrease in its surface energy, so that its temperature remains unchanged. What should be the minimum radius of the drop for this to be possible? The surface tension is T, density of liquid is ρ and L is its latent heat of vaporization

A) $\frac{\rho L}{T}$ B) $\sqrt{\frac{T}{\rho L}}$ C) $\frac{T}{\rho L}$ D) $\frac{2T}{\rho L}$

10. A cube of mass m = 3.2kg floats on the surface of water. Water wets it completely. The cube is 0.2m on each edge. By what additional distance it is buoyed up or down by surface tension? Surface tension of water = $0.07 Nm^{-1}$.

A) $2.8\times10^{-4} m$ B) $1.4\times10^{-4} m$ C) $3.2\times10^{-6} m$ D) $6.1\times10^{-2} m +$

SECTION - II
(PARAGRAPH TYPE)

This section contains **3 Paragraph of questions.** Each paragraph has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which ONLY **ONE IS** correct.
Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

Paragraph for Question Nos. 11 & 12

A glass capillary sealed at the upper end is of length 0.11 m and internal diameter $2\times10^{-5} m$. The tube is immersed vertically into a liquid of surface tension $5.06\times10^{-2} N/m$ (*Assume complete wetting liquid*)

11. To what length has the capillary to be immersed so that the liquid level inside and outside the capillary becomes the same.

A) $0.01m$ B) $0.11m$ C) $0.02m$ D) $0.20m$

12. The length of water column inside the capillary tube when the seal is broken is

A) $0.01m$ B) $0.10m$ C) $0.11m$ D) $1.01m$

Paragraph for Question Nos. 13 & 14

When liquid medicine of density ρ is to be put in the eye, it is done with the help of a dropper. As the bulb on the top of the dropper is pressed, a drop forms at the opening of the dropper. We wish to estimate the size of the drop.

We first assume that the drop formed at the opening is spherical because that requires a minimum increase in its surface energy. To determine the size, we calculate the net vertical force due to the surface tension T when the radius of the drop is R. When this force becomes smaller than the weight of the drop, the drop gets detached from the dropper.

13. If the radius of the opening of the dropper is r, the vertical force due to the surface tension on the drop of radius R (*assuming* $r << R$) is

A) $2\pi rT$ B) $2\pi RT$ C) $\frac{2\pi r^2 T}{R}$ D) $\frac{2\pi R^2 T}{r}$

14. If $r = 5\times10^{-4} m, \rho = 10^{3} kgm^{-3}, g = 10 ms^{-2}, T = 0.11 Nm^{-1}$, the radius of the drop when it detaches from the dropper is approximately

A) $1.4\times10^{-3} m$ B) $3.3\times10^{-3} m$ C) $2.0\times10^{-3} m$ D) $4.1\times10^{-3} m$

Paragraph for Question Nos. 15 & 16

A long capillary tube of radius 0.2 *mm* is placed vertically inside a beaker of water

15. If the surface tension of water is $7\times10^{-2} N/m$ and the angle of contact between glass of water is zero, then determine the height of water column in the tube above the surface of water in beaker

A) 3*cm* B) 9*cm* C) 7*cm* D) 5*cm*

16. If the tube is now pushed into water so that only 5.0*cm* of its length is above the surface, then determine the angle of contact between the liquid and glass surface.

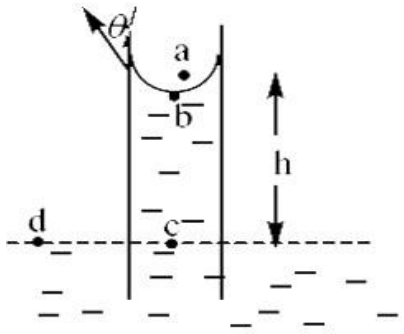
A) $\cos^{-1}\left(\frac{4}{5}\right)$ B) $\cos^{-1}\left(\frac{5}{7}\right)$ C) $\cos^{-1}\left(\frac{3}{5}\right)$ D) $\cos^{-1}\left(\frac{5}{4}\right)$

SECTION - III
(Matching List Type)

This section contains four questions, each having two matching lists (List-1 & List-II). The options for the correct match are provided as (A), (B),(C) and (D) out of which **ONLY ONE** is correct.

Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

17. One end of a capillary tube dipped into a liquid of surface tension *T*. as show in Figure.



If the rise in liquid in capillary tube is *'h'* and angle of contact $\theta = 37^0$. If the points *'a'* and *'b'* are lying just above & just below the meniscus and point *'c'* and *'d'* are on the same horizontal level as shown in the Figure. The radius of the capillary tube is *r*, and atmospheric pressure is P_0 and ρ is the density of liquid Match Column – I & II based on above paragraph.

Column – I	Column – II
I) P_a (Pressure at *'a'*)	*P*) P_0
II) P_b (pressure at *'b'*)	*Q*) $P_0 - \frac{8T}{5r}$
III) P_c (Pressure at *'c'*)	*R*) ρgh
IV) P_d (Pressure at *d'*)	*S*) $> \left(\rho gh - \frac{8T}{5r} \right)$

A) $I \to P,S; II \to Q : III \to P,S; IV \to P,S$

B) $I \to P; II \to Q,R,S; III \to P,S; IV \to S$

C) $I \to P; II \to R,S; III \to P,S; IV \to S$

D) $I \to P; II \to S; III \to P,S; IV \to S$

18. A capillary tube a glass of radius *R* is placed inside a tub containing water. Capillary rise is *h*. Assume that 2*h* length is outside the water. Column I contain conditions and Column – II contains the corresponding capillary rise. Contact angle for glass and water is 0^0.

Column – I		Column – II	
I)	If the arrangement is placed in an elevator going up with acceleration $g/2$	P)	$3h/2$
II)	If the whole arrangement is falling freely	Q)	$2h$
III)	If a glass rod of radius $R/2$ is inserted symmetrically in the capillary tube	R)	$2h/3$
IV)	If water in tub is replaced by fluid having density double and surface tension 3 times the values for water keeping other things same.	S)	Water spills out of the capillary

A) $I \to R; II \to P; III \to Q; IV \to P$

B) $I \to R; II \to Q, S; III \to Q; IV \to P$

C) $I \to R; II \to Q; III \to P; IV \to P$

D) $I \to P; II \to R; III \to Q; IV \to P$

19. Changes made — Most probable effect of changes made on the surface tension of liquid

A	Increase in temperature of liquid	Q	decrease
B	Addition of soluble impurities to liquid	P	Increase
C	Addition of insoluble impurities to liquid	R	No change
D	Changing container in which liquid is there	S	Cannot predict probable effect on surface tension

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

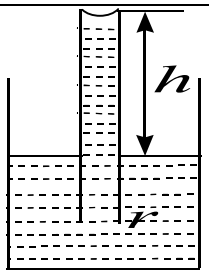
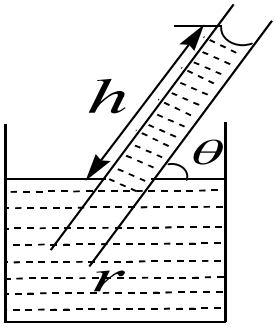
B) A-Q, B-Q, C-P, D-S

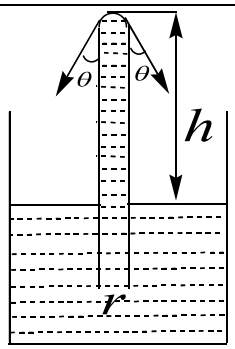
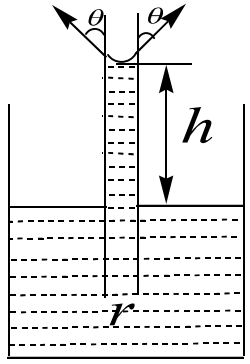
C) A-Q, B-P, C-Q, D-R

D) A-P, B-S, C-R, D-R

20. Assume angle of contact to be zero if not specified, r – radius of capillary

(T is surface tension) density is ρ

A) 	P) $h = \frac{2T}{r\rho g}\cos ec\theta$
B) 	Q) $h = \frac{2T}{r\rho g}$

C) 	R) $h = \frac{2T\cos\theta}{r\rho g}$
D) 	S) Not possible

A) A – Q : B – P : C – S : D – R

B) A – P : B – Q : C – R : D – S

C) A – Q : B – P : C – R : D – S

D) A – S : B – R : C – P : D – Q

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 10 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

21. $(CH_3)_3$ CMgCl on reaction with D_2O produces

A) $(CH_3)_3$ CD B) $(CH_3)_3 COD$ C) $(CD_3)_3 CD$ D) $(CD_3)_3 COD$

22. How many structural isomers (carbonyl compounds) of $C_5H_{10}O$ show ENOLIZATION?

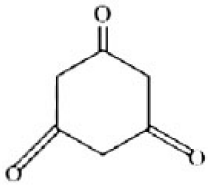
A) 4 B) 5 C) 6 D) 7

23. In which of the following compounds the methylene hydrogens are most acidic?

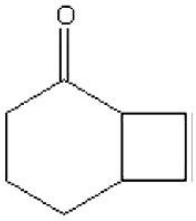
A) $CH_3COCH_2CH_3$ B) CH_3CH_2COOEt

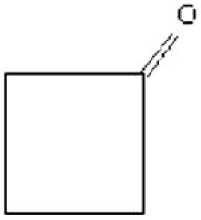
C) $CH_3CH_2CH\ (COOEt)_2$ D) CH_3COCH_2CN

24. Tautomerism is not exhibited by:

A) 

B) $C_6H_5-CH=O$

C) 

D) 

25. An equimolar mixture of propanoic acid and KOH is electrolysed in presence of water. Which of these products are obtained.

1) $CH_3-CH_2-CH_2-CH_3$

2) $CH_2=CH_2$

3) CH_3-CH_3

4) $C_2H_5-\underset{\underset{O}{\|}}{C}-O-Et$

A) 1,3 B) 1,2,3 C) 1,2,3,4 D) 3,4

26. A mixture of two organic compounds was treated with sodium metal in ether solution. Isobutane was obtained as one of chief product. The two chlorine compounds are

A) methyl chloride and propyl chloride

B) methyl chloride and ethyl chloride

C) Isopropyl chloride and methyl chloride

D) Isopropyl chloride and ethyl chloride

27. Methane cannot be synthesised as chief product under which reaction

1.wurtz reaction

2. Kolbe's reaction

3. De- Carboxylation of salts of fatty acids

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

28. When sodium acetate is heated with sodalime the reaction is called

A) Dehydration B) Decarboxylation

C) Dehydrogenation D) Dehydrohalogenation

29. Ethane cannot be obtained by the following

A) Heating methyl iodide with sodium metal in ether

B) Hydrogenation of ethene

C) Sodium acetate on Kolbe's electrolysis

D) Hydrolysis of Al_4C_3

30. Select the incorrect statement among the following

A) alkyl halides give alkane with n – Bu_3SnH

B) Decarboxylation of formic acid gives methane

C) Methane is formed from decarboxylation of sodium acetate with NaOH/CaO

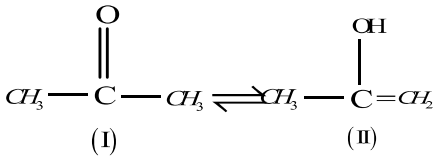
D) Grignard reagent gives alkane with ethyl alcohol.

SECTION - II
(PARAGRAPH TYPE)

This section contains **3 Paragraph of questions.** Each paragraph has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which ONLY **ONE IS** correct.
Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

Paragraph for Question Nos. 31 & 32

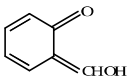
Tautomerism is the phenomenon in which two structural isomers differing in the relative position of their atoms are spontaneously interconvertible and can exist in dynamic equilibrium.

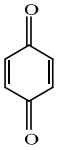


(I) (II)

Tautomers I and II are structural isomers that are related only by the shift of a hydrogen atom an one or more Pi bond.

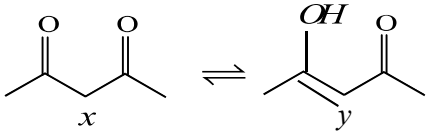
31. Identify the one which does not exhibit tautomerism

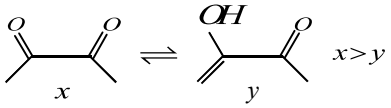
A) $C_6H_5CH = CHOH$ B) 

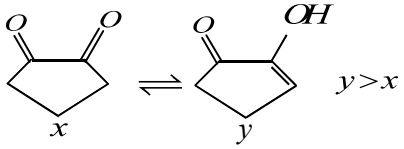
C)  D) All of these

32. Which of the following is not correct? (x,y represent % of the two in equilibrium)

A) $\underset{x}{CH-\overset{\overset{O}{\|}}{C}-CH_2-\overset{\overset{O}{\|}}{C}-OC_2H_5} \rightleftharpoons \underset{y}{CH_3-\overset{\overset{OH}{|}}{C}=CH-\overset{\overset{O}{\|}}{C}-OC_2H_5}$ $y > x$

B)  $y > x$

C  $x > y$

D)  $y > x$

Paragraph for Question Nos. 33 & 34

Wurtz reaction: Alkyl halide reacts with metallic sodium in the presence of dry ether to form alkanes containing the double the number of C atoms present in the alkyl halide. Corey-House Synthesis: Dialkyl copper lithium reacts with Alkyl halide gives alkane

33. A mixture of ethyl iodide and methyl iodide is subjected to wurtz reaction the product which is not possible is

A) ethane B) butane C) propane D) 2-methyl propane

34. The most convenient method to prepare 2-methyl pentane among the following is

A) $CH_3-\overset{\overset{CH_3}{|}}{C}H-CH_2Br+CH_3CH_2Br\xrightarrow[dryether]{Na}$

B) $CH_3-\overset{\overset{CH_3}{|}}{C}H-Br+CH_3CH_2CH_2Br\xrightarrow[dryether]{Na}$

C) $CH_3CH_2\underset{\underset{Br}{|}}{C}H_2+\left(CH_3\overset{\overset{CH_3}{|}}{C}H\right)_2CuLi\rightarrow$

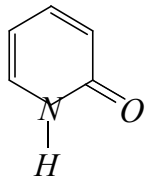
D) All of these

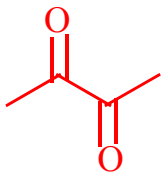
space for rough work

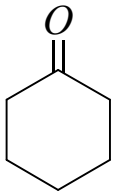
Paragraph for Question Nos. 35 & 36

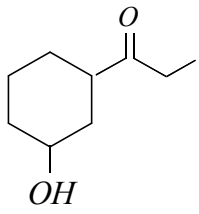
Tautomerism: It is a phenomenon in which a single compound exists in two readily interconvertible structures that differs in the relative position of at least one atom (hydrogen). In simple aldehydes and ketones the amount of enolic form is negligibly small. However, the enolic form is stabilised by intramolecular H-bonding and some other factors.

35. In which of the following the enol form is dominant over keto form

A) 

B) 

C) 

D) 

36. The extent of enolization is greately affected by

A) Solvent

B) Concentration

C) Temperature

D) All of these

SECTION - III
(Matching List Type)

This section contains four questions, each having two matching lists (List-1 & List-II). The options for the correct match are provided as (A), (B),(C) and (D) out of which ONLY ONE is correct.

Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

37. Match the following

Column I (Carbonyl compound)	Column II (Enol content %)
(A) $PhCOCH_2COCH_3$	(1) 6×10^{-5}
(B) $EtOOCCH_2COOEt$	(2) 2×10^{-1}
(C) $NCCH_2COOEt$	(3) 89
(D) CH_3CHO	(4) 7.7×10^{-3}

The correct combination is

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

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

38. Match the following

Column I[Reaction]	Column II [Product]
(A) $CH_3CH_2Cl \xrightarrow[CuI]{Li} \xrightarrow{CH_3CH_2CI} ?$	(1) $(CH_3)_2CHCH_2CH(CH_3)_2$
(B) $(CH_3)_2CHI \xrightarrow[CuI]{Li} \xrightarrow{(CH_3)_2CHCH_2Br} ?$	(2) $CH_3CH_2CH_2CH_3$
(C) $CH_3CH_2C(CH_3)_2Br \xrightarrow[CuI]{Li} \xrightarrow{CH_3CH_2Br} ?$	(3) $(CH_3)_3CCH_2CH_3$
(D) $(CH_3)_3CCl \xrightarrow[CuI]{Li} \xrightarrow{CH_3CH_2Br} ?$	(4) $CH_3CH_2C(CH_3)_2CH_2CH_3$

The correct match is

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

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

39. Column-I | Column-II

P) $CH_3Cl + (CH_3)_2 CuLi \rightarrow H_3C - CH_3$ | 1) Free radical intermediate

Q) $CH_3COONa \xrightarrow[CaO]{NaOH} CH_4$ | 2) Carbanion intermediate

R) $CH_2 = CH_2 \xrightarrow[Ni]{H_2} H_3C - CH_3$ | 3) Carbocation intermediate

S) $CH_3COONa \xrightarrow{electroysis} H_3C - CH_3$ | 4) No intermediate

A) P-4 Q-2 R-4 S-1 | B) P-2 Q-1 R-4 S-3

C) P-1 Q-3 R-2 S-4 | D) P-4 Q-2 R-3 S-1

40. Preparation methods for alkanes is given in list –I. Some information about bond formation and cleavages of each preparation method is given in list II.

List – I	List - II
P) $RCOONa \xrightarrow{soda\,lime}$	1) $C-C$ bond formation
Q) $R-X \xrightarrow{(C_2H_5)_2CuLi}$	2) $C-C$ bond cleavage
R) $RCOOK(aq) \xrightarrow{electrolysis}$	3) both $C-C$ bond formation and cleavage
S) $R-X \xrightarrow[ether]{Na}$	4) neither $C-C$ bond formation nor cleavage

Correct Matching is

	P	Q	R	S
A)	2	1	3	1
B)	3	4	2	1
C)	4	3	2	1
D)	2	4	3	1

MATHEMATICS **Max Marks: 60**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 10 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

41. If L, M are the feet of the perpendiculars from (2, 4, 5) to xy - plane and yz – plane respectively, then distance LM is -------units

A) $9\sqrt{2}$ B) $2\sqrt{2}$ C) $\sqrt{29}$ D) $\sqrt{31}$

42. Let A (4, 7, 8), B (2,3, 4) and C(2, 5, 7) be the vertices of ΔABC . The length of the median AD is-----units

A) $\sqrt{2}$ B) $\frac{\sqrt{2}}{2}$ C) $\frac{\sqrt{77}}{2}$ D) $\frac{\sqrt{89}}{2}$

43. If A(3, 2 ,0), B(5, 3, 2), C(-9, 6, -3) are three points forming a triangle then the coordinates of a point in which the bisector of $\angle BAC$ meets BC are given by----------

A) $\left(\frac{88}{16},\frac{57}{16},\frac{27}{16}\right)$ B) $\left(\frac{38}{16},\frac{57}{16},\frac{17}{16}\right)$

C) $\left(\frac{-88}{16},\frac{-57}{16},\frac{-27}{16}\right)$ D) $\left(\frac{38}{16},\frac{57}{16},\frac{27}{16}\right)$

44. The lines $\frac{x+1}{1}=\frac{y-1}{2}=\frac{z-2}{-1}, \frac{x-1}{2}=\frac{y}{1}=\frac{z+1}{4}$ are

A) parallel lines B) intersecting lines

C) perpendicular skew lines D) none of the above

45. If the d.c's l,m,n of two lines are connected by the relations $l+m+n=0$ and $l^2+m^2-n^2=0$, then the angle between the lines is

A) 30^0 B) 45^0 C) 90^0 D) 60^0

46. The lines $\frac{x-1}{2}=\frac{y+1}{-1}=\frac{z-3}{\lambda}$ and $\frac{x}{1}=\frac{y}{2}=\frac{z+1}{-1}$ are

A) coplanar for all λ

B) coplanar for $\lambda=19/3$

C) intersect at $\left(+\frac{1}{5},-\frac{2}{5},-\frac{4}{5}\right)$

D) intersect at $\left(\frac{1}{2},-\frac{1}{2},-1\right)$

47. The point on the line $\frac{x-2}{1}=\frac{y+3}{-2}=\frac{z+5}{-2}$ at a distance of 6 from the point $(2,-3,-5)$ is

A) $(3,-5,-3)$ B) $(4,-7,-9)$ C) $(0,2,-1)$ D) $(-3,5,3)$

48. If lines $x = y = z$ and $x = \frac{y}{2} = \frac{z}{3}$, and third line passing through (1, 1,1) from a triangle of area $\sqrt{6}$ units, then point of intersection of third line with second line can be

A) $(1,2,3)$ B) $(2,4,6)$ C) $\left(\frac{4}{3},\frac{8}{3},\frac{12}{3}\right)$ D) $(0,2,3)$

49. If a variable line in two adjacent positions has directional cosines l,m,n and $l+\delta l, m+\delta m, n+\delta n$ and $\delta\theta$ is small angle between two positions then $(\delta l)^2 + (\delta m)^2 + (\delta n)^2 =$

A) $(\delta\theta)^2$

B) $3(\delta\theta)^2$

C) $2(\delta\theta)^2$

D) constant that does not depend on $\delta\theta$

50. The point of intersection of the lines $\frac{x-5}{3} = \frac{y-7}{-1} = \frac{z+2}{1}$ and $\frac{x+3}{-36} = \frac{y-3}{2} = \frac{z-6}{4}$ is

A) $\left(21,\frac{5}{3},\frac{10}{3}\right)$ B) $(2,10,4)$ C) $(-3,3,6)$ D) $(5,7,-2)$

SECTION - II
(PARAGRAPH TYPE)

This section contains **3 Paragraph of questions.** Each paragraph has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which ONLY **ONE IS** correct.
Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

Paragraph for Question Nos. 51 & 52

A line L_1 with direction ratios -3 ,2, 4 passes through the point A(7, 6, 2) and a line L_2 with direction ratios 2, 1, 3 passes through the point B(5, 3, 4). A line L_3 with direction ratios 2, -2,-1 intersects L_1 and L_2 at C and D.

51. The length CD is equal to

A) 4 B) 6 C) 9 D) 11

52. Centroid of ΔBCD is ----------

A) $\left(\frac{13}{3},\frac{4}{3},\frac{7}{3}\right)$ B) $\left(\frac{2}{3},\frac{1}{3},7\right)$ C) $\left(\frac{7}{3},12,\frac{5}{3}\right)$ D) $\left(\frac{13}{3},\frac{17}{3},7\right)$

Paragraph for Question Nos. 53 & 54

In a parallelogram OABC with position vectors of A is $3\hat{i}+4\hat{j}$ and C is $4\hat{i}+3\hat{j}$ with reference to O as origin. A point E is taken on the side $\overline{BC}$ which divides it in the ratio of 2: 1. Also, the line segment AE intersects the line bisecting the $\angle AOC$ internally at P.

53. The position vector of P is

A) $\hat{i}+\hat{j}$ B) $\frac{2}{3}\left(\hat{i}+\hat{j}\right)$ C) $\frac{13}{3}\left(\hat{i}+\hat{j}\right)$ D) $\frac{21}{5}\left(\hat{i}+\hat{j}\right)$

54. The equation of line parallel to $\overline{CP}$ and passing through (2,3,4) is

A) $\frac{x-2}{1}=\frac{y-3}{5}=\frac{z-4}{0}$ B) $\frac{x-2}{1}=\frac{y-3}{6}=\frac{z-4}{0}$

C) $\frac{x-2}{2}=\frac{y-3}{5}=\frac{z-3}{0}$ D) $\frac{x-2}{3}=\frac{y-3}{5}=\frac{z-3}{0}$

Paragraph for Question Nos. 55 & 56

Consider a triangular pyramid ABCD the position vectors of whose angular points are $A(3,0,1), B(-1,4,1), C(5,2,3)$ and $D(0,-5,4)$. Let G be the point of intersection of the medians of the ΔBCD

55. The length of the vector $\overline{AG}$ is----- units

A) $\sqrt{17}$ B) $\sqrt{51}/3$ C) $\sqrt{51}/9$ D) $\sqrt{59}/4$

56. Area of the ΔABC (in sq units) is

A) 24 B) $8\sqrt{6}$ C) $4\sqrt{6}$ D) None of these

SSECTION-3
(MATCHING LIST TYPE)

This section contains four questions, each having two matching lists (List-1 & List-II). The options for the correct match are provided as (A), (B),(C) and (D) out of which **ONLY ONE** is correct.

Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.

57. Match the column I with column II

Column I	Column II
(P) The co-ordinates of a point on the line $\frac{x-5}{4}=\frac{y-0}{1}=\frac{z+6}{3}$ at a distance 3 from the point (5, 3, – 6) is	(1) (-1, -2, 0)
(Q) The point of intersection of the lines $\frac{x+2}{1}=\frac{y+5}{3}=\frac{z+1}{1}$ *and* $\frac{x}{1}=\frac{y-2}{4}=\frac{z-3}{3}$ is	(2) (5, 0, -6)
(R) A line passes through two points A(2, -3, -1) and B(8, –1, 2). The co-ordinates of a point on this line nearer to the origin at a distance of 14 units from A is	(3) (2, 5, 7)
(S) The co-ordinates of the foot of the perpendicular from the point (3, -1, 11) on the line $\frac{x}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ is	(4) (- 10, - 7, - 7)

CODE

	P	Q	R	S		P	Q	R	S
A)	2	1	4	3	B)	4	1	3	2
C)	3	2	4	1	D)	1	4	2	3

58. Consider the lines given by $L_1 : x + 3y - 5 = 0, L_2 : 3x - ky - 1 = 0$ and

$L_3 : 5x + 2y - 12 = 0$ in xy plane of 3dimensional space

	Column – I		Column – II
P	L_1, L_2 and L_3 are concurrent, iff	1	$k = -9, -\frac{6}{5}, 5$
Q	One of L_1, L_2 and L_3 is parallel to atleast one of the other two, iff	2	$k = -\frac{6}{5}, -9$
R	L_1, L_2 and L_3 form a triangle for k = --------(k < 1)	3	$k = \frac{5}{6}$
S	L_1, L_2 and L_3 do not form a triangle for k = -------- (k < 0)	4	$k = 5$

CODE

	P	**Q**	**R**	**S**		**P**	**Q**	**R**	**S**
A)	2	1	4	3	B)	4	2	3	2
C)	3	2	4	1	D)	1	4	2	3

59. A line L cuts 4 main diagonals L_1, L_2, L_3 and L_4 of a unit cube at angles $\theta_1, \theta_2, \theta_3$ and θ_4 respectively. Then Match the following

List – A	List – B
P) Acute angle between L_1 and L_3 is α .Then $\cos\alpha =$	1) $\frac{1}{3}$
Q) $\sum_{k=1}^{4} \sin^2\theta_K =$ ___	2) $\frac{16}{3}$
R) $\sum_{k=1}^{4} \cos^2\theta_k =$ ____	3) $\frac{4}{3}$
S) Acute angle between L_2 and L_4 is β .Then $6\sin^2\beta =$ ___	4) $\frac{8}{3}$

CODE

	P	**Q**	**R**	**S**
A)	2	1	4	3
B)	4	1	3	2
C)	3	2	4	1
D)	1	4	3	2

60. l,m,n are directional cosines of a line in 3 – dimensional space, Then Match the following

List – A	List – B
P) Maximum value of $54l^2m^2n^2$ = ___	1) 4
Q) $(l+m-n)^2+(m+n-l)^2+(n+l-m)^2+(l+m+n)^2$ = _____	2) 3
R) Maximum value of $3(lm+mn+nl)$ is _	3) 2
S) Maximum value of $\lvert 4l+4m+2n\rvert$ is ___	4) 6

CODE

	P	**Q**	**R**	**S**
A)	2	1	4	3
B)	4	1	3	2
C)	3	1	2	4
D)	1	4	2	3

Master JEE CLASSES

Kukatpally, Hyderabad.

JEE-ADVANCE-2014-P2-Model

Max.Marks:180

KEY SHEET

PHYSICS

1	**B**	2	**B**	3	**B**	4	**C**	5	**C**
6	**A**	7	**D**	8	**A**	9	**D**	10	**B**
11	**A**	12	**C**	13	**C**	14	**A**	15	**C**
16	**B**	17	**A**	18	**B**	19	**C**	20	**A**

CHEMISTRY

21	**A**	22	**C**	23	**D**	24	**B**	25	**C**
26	**C**	27	**A**	28	**B**	29	**D**	30	**B**
31	**C**	32	**A**	33	**D**	34	**C**	35	**A**
36	**D**	37	**A**	38	**C**	39	**A**	40	**A**

MATHS

41	**C**	42	**C**	43	**B**	44	**C**	45	**D**
46	**B**	47	**B**	48	**B**	49	**A**	50	**A**
51	**C**	52	**D**	53	**D**	54	**B**	55	**B**
56	**C**	57	**A**	58	**B**	59	**D**	60	**C**

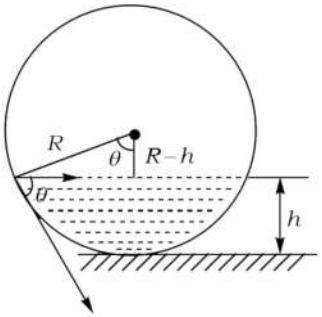
SOLUTIONS

PHYSICS

1. $2F = 8rT$

   $r = \frac{2l}{\Pi}$

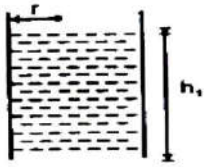
2. Conceptial

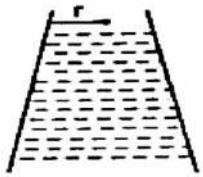
3. 

   $\cos\theta = \frac{R-h}{R}$

   From the Figure

4. (3) As weight of liquid in capillary is balanced by surface, then $T \times 2\pi r = \pi^2 h_1 \rho g$ (*From uniform r radius tube*) $h_1 = \frac{2T}{r\rho g}$

   But weight of liquid in tapered tube is more than uniform tube of radius *r,* then order to balance $h < h_1 \quad h < \frac{2T}{r\rho g}$

5. The bubble will detach if, Buoyant force ≥ surface tension force

   $\int \sin\theta T \times dl = T(2\pi r)\sin\theta$

   $\frac{4}{3}\pi R^3 \rho_w g \geq \int T \times dl \sin\theta$

$$(p_w)\left(\frac{4}{3}\pi R^3\right)g \le (T)(2\pi r)\sin\theta$$

$$\Rightarrow \sin\theta = \frac{r}{R}$$

Solving, $r = \sqrt{\frac{2\rho_w R^4 g}{3T}} = R^2\sqrt{\frac{2\rho_w g}{3T}}$

6. $$\frac{\Delta T}{T} = \frac{\Delta d}{d} + \frac{\Delta h}{h}$$

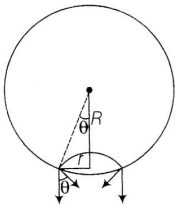
7. Using geometry

$$\frac{b}{R} = \cos\left(\theta + \frac{\alpha}{2}\right)$$

Using pressure equation

$$p_0 - \frac{25}{R} + h\rho g = p_0$$

8. The bubble will detach if,



$$\int \sin\theta T \times dl = T(2\pi r)\sin\theta$$

Buoyant force ≥ Surface tension force

$$\frac{4}{3}\pi R^3 \rho_w g \ge \int T \times dl \sin\theta$$

$$(\rho_w)\left(\frac{4}{3}\pi R^3\right)g \ge (T)(2\pi r)\sin\theta$$

$$\Rightarrow \sin\theta = \frac{r}{R}$$

Solving $r = \sqrt{\frac{2\rho_w R^4 g}{3T}}$

$$= R^2\sqrt{\frac{2\rho_w g}{3T}}$$

No option matches with the correct answer.

9. Conceptual

10. If surface tension is neglected, by the law of floatation $mg = \left(a^2 x\rho\right)g$ where a is the side the density of water and m is the mass of cube.

$3.2g = 0.2^2 \times \left(10^3\right)g$

The height to which the cube is immersed $x = \dfrac{3.2}{\left(0.2\right)^2 \times 10^3} = 0.08m$

Since water wets the cube, the angle of contact is zero and the force of surface tension acts vertically downwards. So its is buoyed down the surface tension $mg + 4aT^2 x'\rho g$, where T is surface tension of water $3.2g + 4\left(0.2\right)\left(0.07\right) = \left(0.2\right)^2 x'\left(10^3\right)g$

$x' = 0.8 + \dfrac{4\left(0.2\right)\left(0.7\right)}{\left(0.2\right)^2\left(10^3\right)\left(0.8\right)} = \left(0.08 + 1.4 \times 10^{-4}\right)m$

The additional distance it is buoyed down by surface tension $= 1.4 \times 10^{-4} m$

11. $P_2 - \dfrac{2T}{r} = P_0 ie P_2 = P_0 + \dfrac{2T}{r}$

If temperature is constant

$P_1 v_2 = p_2 v_2$

$P_0 AL = \left[P_0 + \dfrac{2T}{r}\right]A\left(L - x\right) \Rightarrow x = \dfrac{0.11}{11} = 0.01m$

12. If the seal is broken pressure inside the capillary will become atmospheric *ie.* P_0 in raise in the height $h = \dfrac{2T}{r\rho g} = \dfrac{2 \times 5.06 \times 10^{-2}}{10^{-5} \times 10^3} = 1.03m$

However the length of the tube outside water is $0.11 - 0.01 = 0.1m$

Liquid will rise to top of the tube

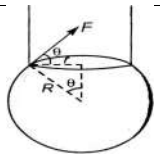
13. Vertical force due to surface tension,

$F_v = F\sin\theta = \left(T 2\pi r\right)\left(r / R\right)$

$= \dfrac{2\pi r^2 T}{R}$

$\therefore$ Correct option is (c)

14. $\dfrac{2\pi r^2 T}{R} = mg = \dfrac{4}{3}\pi R^3 \cdot \rho \cdot g$



$$\therefore R^4 = \frac{3r^2T}{2\rho g} = \frac{3\times\left(5\times10^{-4}\right)^2(0.11)}{2\times10^3\times10}$$

$$= 4.125\times10^{-12}\,m^4$$

$$\therefore R = 1.425\times10^{-3}m = 1.4\times10^{-3}m$$

$\therefore$ Correct option is (a)

15. Conceptual

16. Conceptual

17. $R = \dfrac{r}{\cos\theta} = \dfrac{5r}{4}$

$P_d = P_c = P_a = P_0$

$P_a - \dfrac{2T}{R} = P_b$

18. $h = \dfrac{2T}{r\rho g_{eff}}$

If $g = 0$ tube has in sufficient length

$2\pi\left(r_1 + r_2\right)T = \pi\left(r_2^2 - r_1^2\right)\rho hg$

19. Conceptual

20. Conceptual

CHEMISTRY

21. RMgX + Acidic H -------→ R-H

22. aldehdes----- THREE Ketones-----THREE

23. CH_3COCH_2CN

24. (b) no $\alpha - \mathrm{H}'s$

25. 1,2,3,4 are possible

26. $(CH_3)_2CHCl + CH_3Cl \xrightarrow{Na} (CH_3)_2CH - CH_3$

27. CH_4 can't be prepared by wurtz and kolbe's reaction

28. De carboxylation

29. Al_4C_3 $given\, CH_4$

30. (b) given H_2

31. $C_6H_5CH=CH-OH \rightleftharpoons C_6H_5-CH_2-CH=O$

32. In accetoacetic ester keto form predominates end so $x > y$

33. ethane,butane and propane are formed

34. Wurtz reaction is not suitable for the preparation of unsymmetrical alkanes

35. Enol has aromatic character

36. solvent, concentration and temperature

37. $PhCOCH_2COCH_3$-----89 $EtOOCCH_2COOEt$-----7.7 x 10^{-3}

$NCCH_2COOEt$----------2 x 10^{-1} CH_3CHO---------6 x 10^{-5}

38. Corey-House synthesis

39. Conceptual

40. P-Decarboxylation Q-Corey House R-Kolbe's S-Wurtz

MATHS

41. $L=(2,4,0)\ M=(0,4,5)\ LM=\sqrt{29}$

42. $D=(2,4,11/2)\ AD=\sqrt{\frac{77}{2}}$

43. Use $BD:DC=c:b$

44. Conceptual

45. Eliminate n and solve for dc's. We get $\frac{l}{1}=\frac{m}{0}=\frac{n}{-1}$ or $\frac{l}{0}=\frac{m}{1}=\frac{n}{-1}$ $\therefore \theta=60^0$

46. Use the condition for coplanarity $\begin{vmatrix}1 & -1 & 4\\ 2 & -1 & \lambda\\ 1 & 2 & -1\end{vmatrix}=0 \Rightarrow \lambda=\frac{19}{3}$

47. Required point $P=(r+2,-2r-3,-2r-5)$ and $r=2$

$\therefore P=(4,-7,-9)$

48. Verify from options the given data

49. Use $l^2+m^2+n^2=(l+\delta l)^2+(m+\delta m)^2+(n+\delta n)^2=1$

50. $(3\lambda+5,-\lambda+7,\lambda-2)=(-36\mu-3,2\mu+3,4\mu+6)$ solving for λ & μ we have

$\lambda=\frac{16}{3},\mu=\frac{-2}{3}$

$\therefore$ Required point $=(21,5/3,10/3)$

51&52. $L_1=\frac{x-7}{-3}=\frac{y-6}{2}=\frac{z-2}{4}$ and $L_2=\frac{x-5}{2}=\frac{y-3}{1}=\frac{z-4}{3}$

$\therefore C(-3\lambda+7, 2\lambda+6, 4\lambda+2)$ and $D(2\mu+5, \mu+3, 3\mu+4)$

So $\frac{2-3\lambda-2\mu}{2} = \frac{3+2\lambda-\mu}{-2} = \frac{-2+4\lambda-3\mu}{-1}$

$\therefore \lambda = 2, \mu = 1$

So C(1,10, 10) and D(7, 4, 7) $\Rightarrow l(CD) = 9$

53. $\overline{OB} = 7\hat{i} + 7\hat{j}, \overline{OE} = 5\hat{i} + \frac{13}{3}\hat{j}, \overline{OP} = \frac{21}{5}\left(\hat{i} + \hat{j}\right)$

54. Direction ratio of CP is (1,6,0) then equation of line passing through (2,3,4) and parallel to CP is $\frac{x-2}{1} = \frac{y-3}{6} = \frac{z-4}{0}$

55&56. Conceptual

57. (A) The given line is x = 4y + 5, z = 3y – 6,

or $\frac{x-5}{4} = y, \frac{z+6}{3} = y$ *or* $\frac{x-5}{4} = \frac{y}{1} = \frac{z+6}{3} = \lambda$ (*say*)

any point on this line is of the form of (4λ + 5, λ, 3λ - 6).

the distance between (4λ + 5, λ, 3λ - 6) and (5, 3, - 6) is 3 units (given). Therefore

$(4\lambda + 5 - 5)^2 + (\lambda - 3)^2 + (3\lambda - 6 + 6)^2 = 9 \Rightarrow \lambda = 0, \frac{3}{13}$.

so point is (5, 0, -6)

(B) The equation of the required plane is

$$\begin{vmatrix} x-2 & y+3 & z+5 \\ 1 & 4 & 7 \\ 3 & 5 & 7 \end{vmatrix} = 0 \Rightarrow x - 2y + z - 3 = 0$$

point (-1, -2, 0) lies on this plane.

(C) The line passing through points A(2, -3, -1) and B(8, -1, 2) is

$\frac{x-2}{8-2} = \frac{y+3}{-1+3} = \frac{z+1}{2+1}$ or $\frac{x-2}{6} = \frac{y+3}{2} = \frac{z+1}{3} = \lambda$ (say)

any point on this line is of the form P(6λ + 2, 2λ - 3, 3λ - 1) whose distance from point A(2, -3, -1) is 14 units. So PA = 14, $(PA)^2 = (14)^2 \Rightarrow (6\lambda)^2 + (2\lambda)^2 + (3\lambda)^2 = 196$

$\Rightarrow \lambda^2 = 4 \Rightarrow \lambda = \pm 2$.

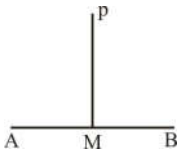
The required points are (14, 1, 5) and (-10, -7, -7).

The point nearer to origin is (14, 1, 5).

(D) Any point on line AB, $\frac{x}{2}=\frac{y-2}{3}=\frac{z-3}{4}=\lambda$ is

M(2λ, 3λ + 2, 4λ + 3).

Therefore the direction ratios of PM are 2λ - 3, 3λ + 3 and 4λ - 8



$\frac{x}{2}=\frac{y-2}{3}=\frac{z-3}{4}$

$\therefore$ 2 (2λ - 3) + 3(3λ + 3) + 4(4λ - 8) = 0 $\Rightarrow$ λ = 1

so foot of the perpendicular is M(2, 5, 7)

58,59,60. Conceptual