Master JEE CLASSES

Kukatpally, Hyderabad.

MasterJEE
IIT-JEE | Medical | Foundations

JEE-ADVANCE-2014-P2-Model **Max.Marks:180**

MATHS:

Matrices (30%); 2-D GEOMETRY: Distance Formula, Section formula, Finding various Centres with given vertices of a triangle, Area of Triangle, Collinearity of Points, Locus (Simple problems), Translation and Rotation of axes (60%);

Cumulative (10%)

PHYSICS:

constraint equations,Problems in NLM without friction (Including spring problems)(60%)

Newton's Laws Of Motion (Without Friction): Cause of motion, cause for the change of motion, Newton's first law, qualitative definition of force, inertia and mass, types of inertia,Newton's second law, quantitative definition of force, definition of unit force, dimensional formula and SI units of force, Newton's third law, action and reaction, Internal and external forces in case of system of objects,Discussion on cancellation of action and reaction forces,Inertial and non inertial frames of reference and pseudo force, Problems on simple application of NLM - Atwood machine, Lift problems, spring balance, weighing machine etc, EXCLUDE : The problems involving constraints like multiple plley & multiple contact problems(30%)

Cummulative syllabus covered till now (10%)

CHEMISTRY:

Liquid Solutions and Colligative Properties : Henry's law, Vapour pressure, Ideal solution,Determination of molecular weight by relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmtoic pressure(including Vant-hoff factor)(60%), Buffer solutions, INDICATORS, salt hydrolysis, Solubility of sparingly soluble salts and solubility product((30%), Cumulative Syllabus(10%)

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:

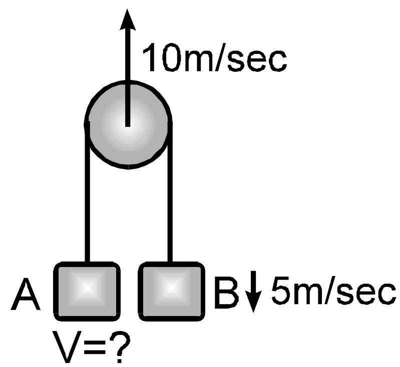
Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N: 51 – 56)	Questions with Comprehension Type (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 57 – 60)	Matrix Matching Type	3	-1	4	12
Total				**20**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

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. The pulley moves up with a velocity of 10 m/sec. Two blocks are tied by a string which passes over a pulley. The velocity V will be _________.
Given: v_B = 5 m/s downward

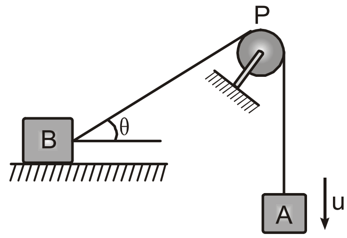


A) 25 m/s downwards B) 25 m/s upwards

C) 5 m/s downwards D) 5 m/s upwards

2. In the Figure, the blocks are of equal mass. The pulley is fixed & massless. In the position shown, A is given a speed u and v_B= the speed of B.

($\theta < 90°$)



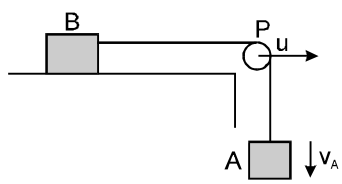
A) B will never lose contact with the ground.

B) The downward acceleration of A is equal in magnitude to the horizontal acceleration of B.

C) $v_B = u \cos\theta$

D) $v_B = u/\cos\theta$

3. In the Figure, the pulley P moves to the right with a constant speed u. The downward speed of A is v_A, and the speed of B to the right is v_B.



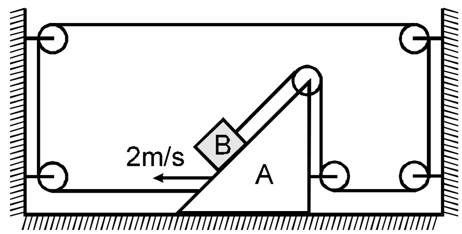
A) $v_B = v_A$

B) $v_B = u + v_A$

C) $v_B + u = v_A$

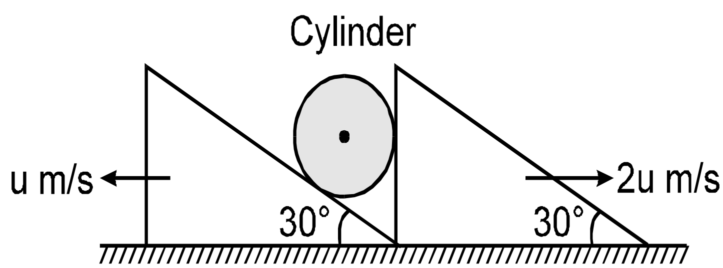
D) the two blocks have accelerations of different magnitude

4. System is shown in figure and wedge is moving towards left with speed 2 m/s. Then velocity of the block B will be:(inclination of wedge with horizontal is 60^0)



A) m/s B) 1 m/s C) 2 m/s D) 0 m/s

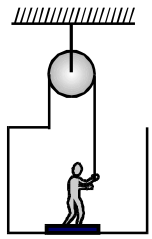
5. System is shown in the figure. Assume that cylinder remains in contact with the two wedges. The velocity of cylinder



A) $\sqrt{19-4\sqrt{3}}\,\frac{u}{2}$ m/s B) $\frac{\sqrt{13}\,u}{2}$ m/s

C) $\sqrt{3}u$ m/s D) $\sqrt{7}u$ m/s

6. Figure shows a man of mass 50 kg standing on a light weighing machine kept in a box of mass 30 kg. The box is hanging from a pulley fixed to the ceiling through a light rope, the other end of which is held by the man himself. If the man manages to keep the box at rest, the weight shown by the machine is



A) 50 N B) 100 N C) 150 N D) 200 N

7. A balloon of gross weight W newton descends with an acceleration f m/s^2. The weight that must be thrown out in order to give balloon an equal upward acceleration will be (Ignore air resistance)

A) Wf/g B) 2 Wf/g C) 2 Wf/(g + f) D) W(g + f)/f

8. Two particles of masses m_1 & m_2 ($m_1 > m_2$) are tied to the ends of a light inextensible string passing over a light smooth fixed pulley. The acceleration of m_1 is g/4 downwards. Then $m_1 : m_2$ is:

A) 4: 1 B) 5: 1 C) 3: 1 D) 5: 3

9. Which of the following statement is correct?

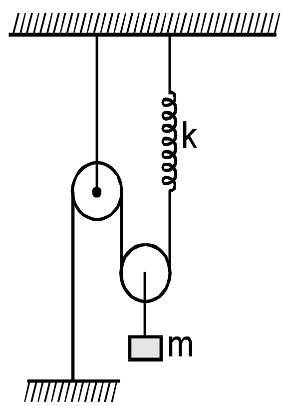
A) Two forces on the body which happen to be equal and opposite constitute an action reaction pair.

B) The mutual force of two bodies upon each other are always equal and directed opposite to each other

C) If action is gravitational then reaction need not be gravitational.

D) First two laws of newton can be derived from the third law.

10. Mass m shown in figure is in equilibrium. If it is displaced further by x and released find its acceleration just after it is released. Take pulleys to be light & smooth and strings light.



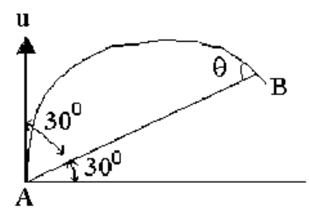
A) $\frac{4kx}{5m}$ B) $\frac{2kx}{5m}$ C) $\frac{4kx}{m}$ D) $\frac{4kx}{3m}$

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 body is projected with velocity u at angle 30^0 to the incline which is inclined at the angle 30^0 to the horizontal. If the time taken to hit the incline at B is't', then



11. The range on the incline AB is

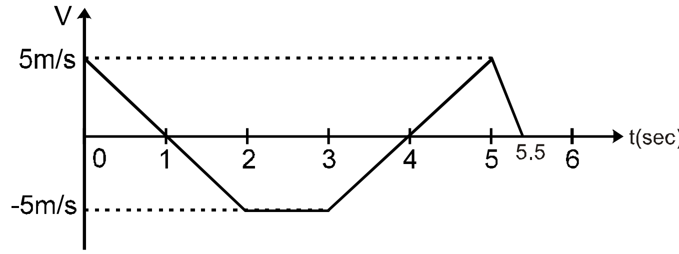
A) $\frac{ut}{\sqrt{2}}$ B) $\frac{2ut}{\sqrt{3}}$ C) $\frac{ut}{\sqrt{3}}$ D) $\frac{3ut}{\sqrt{2}}$

12. Speed with which the projectile strikes the incline is

A) $\frac{u}{\sqrt{2}}$ B) $\frac{2u}{\sqrt{3}}$ C) $\frac{u}{2\sqrt{3}}$ D) $\frac{u}{\sqrt{3}}$

Paragraph for Question Nos. 13 & 14

An elevator is moving in vertical direction such that its velocity varies with time as shown in figure. Their upward direction is taken as positive. A man of mass 60 kg is standing in the elevator on a weighing machine. When the lift is accelerated up, the reading of the weighing machine increases and when the lift is accelerating down, the reading decreases.



13. The man will not be in contact with weighing machine at time :

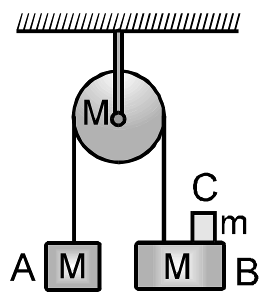
A) t = 1s
B) t = 5.1s
C) t = 2.4s
D) t = 4.2s

14. If the total mass of (elevator + man) system is 150 kg, the maximum tension in the cable supporting the lift will be:

A) 1500 N
B) 3000 N
C) 2250 N
D) 1250 N

Paragraph for Question Nos. 15 & 16

For the following system shown assume that pulley is frictionless, string is massless (m remains on M):



15. The acceleration of the block A is:

A) $\frac{mg}{2M+m}$ B) $\frac{2mg}{2M+m}$ C) $\frac{mg}{M+2m}$ D) $\frac{Mg}{M+2m}$

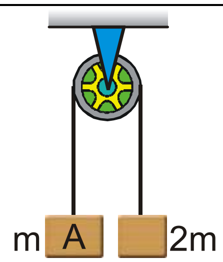
16. Normal reaction on m is (force on C due to B).

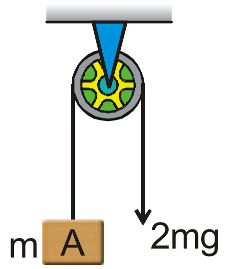
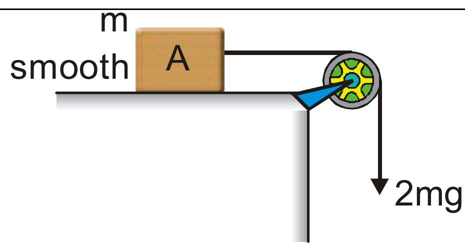
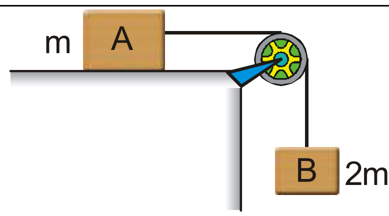
A) $\frac{M\,mg}{2M+m}$ B) $\frac{2Mmg}{2M+m}$ C) $\frac{M\,mg}{M+2m}$ D) $\frac{2M\,mg}{M+m}$

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. Match list I with acceleration of the blocks in list II

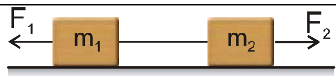
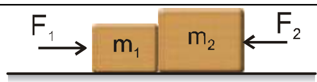
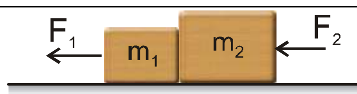
LIST-I		LIST-II(acceleration)	
			

B		Q	g
C		R	g/3
D		S	2g

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

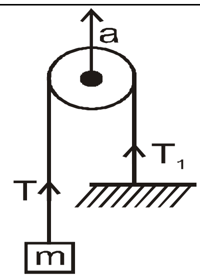
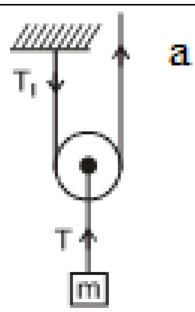
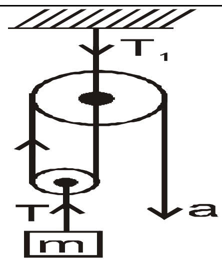
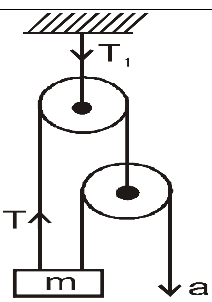
C) A-S, B-P, C-R, D-S D) A-P, B-R, C-Q, D-S

18. Column-I gives four different situations involving two blocks of mass m_1 and m_2 placed in different ways on a smooth horizontal surface as shown. In each of the situations horizontal forces F_1 and F_2 are applied on blocks of mass m_1 and m_2 respectively and also $m_2 F_1 < m_1 F_2$. Match the statements in column I with corresponding results in column-II.

Column-I		Column-II	
A)	 Both the blocks are connected by massless inelastic string. The magnitude of tension in the string is	p)	$\frac{m_1 m_2}{m_1+m_2}\left(\frac{F_1}{m_1}-\frac{F_2}{m_2}\right)$
B)	 Both the blocks are connected by massless inelastic string. The magnitude of tension in the string is	q)	$\frac{m_1 m_2}{m_1+m_2}\left(\frac{F_1}{m_1}+\frac{F_2}{m_2}\right)$
C)	 The magnitude of normal reaction between the blocks is	r)	$\frac{m_1 m_2}{m_1+m_2}\left(\frac{F_2}{m_2}-\frac{F_1}{m_1}\right)$
D)	 The magnitude of normal reaction between the blocks is	s)	$m_1 m_2\left(\frac{F_1+F_2}{m_1+m_2}\right)$

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

19. See the diagrams carefully in Column-1 and match each with the obeying relation (S) in column-2. The string is massless, inextensible and pulley is frictionless in each case. a = g/3, m = mass of block T = tension in a given string, a_{pulley} = acceleration of movable pulley in each case, acceleration due to gravity is g.

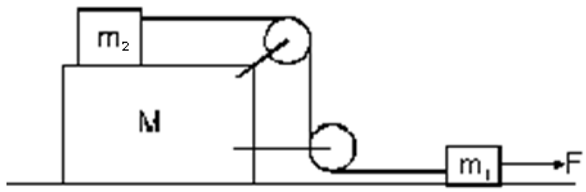
Column-I		Column-II	
A)		p)	$a_{block} < a$
B)		q)	$a_{pulley} < a$
C)		r)	$T > mg$
D)		s)	Force on fixed support $T_1 > (3/2)\ mg$

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

C) A-QRS, B-PQ, C-PQRS, D-PQ D) A-RS, B-PQR, C-PQRS, D-PQ

20. Match the following:

Three blocks of masses m_1, m_2 and M are arranged as shown in figure. All the surfaces are frictionless and string is inextensible. Pulleys are light. A constant force F is applied on block of mass m_1. Pulleys and string are light. Part of the string connecting both pulleys is vertical and part of the strings connecting pulleys with masses m_1 and m_2 are horizontal.



(A)	Acceleration of mass m_1	P)	$\frac{F}{m_1}$
(B)	Acceleration of mass m_2	Q)	$\frac{F}{m_1+m_2}$
(C)	Acceleration of mass M	R)	zero
(D)	Tension in the string	S)	$\frac{m_2F}{m_1+m_2}$

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

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

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

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

CHEMISTRY **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.

21. A solution of 18 g of glucose in 1000 g of water is cooled to -0.2^0C. The amount of ice separating out from this solution is (K_f (H_2O)=1.86 K $molal^{-1}$)

A) 70g B) 140g C) 90g D) 210g

22. Depression of freezing point of 0.01 molal aqueous CH_3COOH solution is 0.02046^0.1 molal urea solution freezes at -1.86^0C. Assuming molality of solution equal to its molarity, pH of CH_3COOH solution would be

A) 2 B) 3 C) 3.2 D) 4.2

23. Select incorrect statement:

A) Higher the value of k_H (Henry's law constant) at a given pressure, the lower is the solubility of the gas in the liquid.

B) Generally solubility of a gas in a liquid decreases with increase in temperature and pressure.

C) To minimize the painful effects accompanying the decomposition of deep sea divers, O_2 diluted with less soluble He gas is used as breathing gas.

D) Generally the solubility of a gas in a liquid is governed by Henry's law.

24. 3.24 g of $Hg(NO_3)_2$ (molar mass=324) dissolved in 1000 g of water constitutes a solution having a freezing point of -0.0558^0C while 21.68 g of $HgCl_2$ (molar mass=271) in 2000 g of water constitutes a solution with a freezing point

of -0.0744^{0}C. The K_f for water is 1.86 $\frac{k-kg}{Mol}$. About the state of ionization of these two solids in water it can be inferred that:

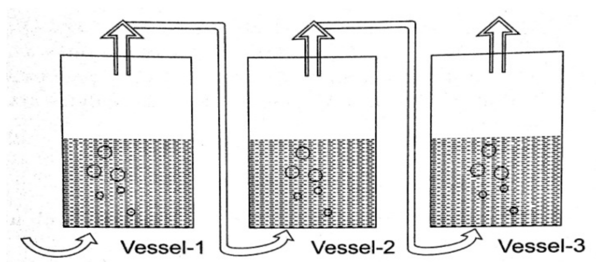
A) Hg $(NO_3)_2$ and $HgCl_2$ both are completely ionized

B) Hg $(NO_3)_2$ is fully ionized but $HgCl_2$ is fully unionized

C) Hg $(NO_3)_2$ and $HgCl_2$ both are completely unionized

D) Hg $(NO_3)_2$ is fully unionized but $HgCl_2$ is fully ionized

25. Dry air is slowly passed through three solutions of different concentrations, c_1,c_2 and c_3; each containing (non volatile) NaCl as solute and water as solvent, as shown in the figure. If the vessel 2 gains weight and the vessel 3 loses weight, then correct statement is



Concentration: C_1 C_2 C_3

A) Vessel-I solution is hypertonic than vessel-II solution

B) Elevation in boiling point of Vessel-II solution is greater than that of elevation in boiling point of vessel-I solution

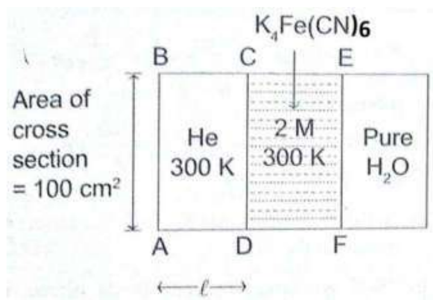
C) Freezing point of vessel-II solution is greater than that of freezing point of vessel-III solution

D) Vessel-I & vessel-III solution have same relative lowering in vapour pressure

26. 'x' mol of FeC_2O_4 dissolved in 186 gm of water, calculate depression in freezing point of the solution, if **'0.4 x'** mol of same FeC_2O_4 required 30 ml of 0.4 M $KMnO_4$ in acidic medium for complete oxidation. (k_f for $H_2O=1.86\frac{k-kg}{Mol}$, Assume 100% ionization of FeC_2O_4).

A) 1 B) 1.2 C) 1.5 D) 1.8

27. CD: Fixed wall, EF: SPM, Fixed wall: allows the pressure transfer but no mass transfer. If 16 gm Helium present in ABCD chamber calculate the length of this chamber in cm if no osmosis takes place through SPM EF.Assume 75% ionization of $K_4Fe(CN)_6$.



A) 3 B) 4 C) 5 D) 6

28. A mixture of nitrobenzene and water boils at 97º C. If vapour pressure of water is 733 mm of Hg here, then weight ratio of nitrobenzene and water in distillate.(Molar mass of Nitrobenzene = 123 g)

A) 0.35 B) 0.25 C) 0.40 D) 0.5

29. In a solution of $NaHCO_3$, the amphiprotic anion can undergo ionization to form H^+ ion and hydrolysis to from OH^- ion.

ionization

$HCO_3^- + H_2O \rightleftharpoons CO_3^{2-} + H_3O^+$

hydrolysis

$HCO_3^- + H_2O \rightleftharpoons H_2CO_3 + OH^-$

To calculate PH, suitable approximation is:

A) $\left[CO_3^{2-}\right] = \left[HCO_3\right]$

B) degree of ionization=degree of Hydrolysis

C) both (A) and (B)

D) neither 'A' nore 'B'

30. Consider 0.1 M solutions of two solutes X and Y. The solute X behaves as univalent electrolyte, while the solute Y dimerises in solution.Select incorrect statement regarding these solutions:

A) The boiling point of solution of 'X' will be higher than of 'Y'

B) The osmotic pressure of solution 'Y' will be lower than that of 'X'

C) The freezing point of solution of 'X' will be lower than that of 'Y'

D) The relative lowering of vapour pressure of 'Y' will be higher than that of 'X'

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

Thermodynamics is used to calculate ΔE, ΔH, ΔS and ΔG in the chemical change reactions, phase change reactions and closed systems (gas in cylinder system)and to express spontaneity condition.

31. Which of the following statement is correct?

A) For a spontaneous process $\Delta H_{system} < 0$ at constant temperature and pressure

B) For a spontaneous process $\Delta E_{system} < 0$ at constant entropy and volume

C) For a spontaneous process $\Delta G_{system} > 0$ at constant temperature and pressure

D) For a spontaneous process $\oint \frac{\delta q_{rev.}}{T} > 0$ at constant temperature and pressure

32. Which of the following statement is incorrect?

A) $P_1V_1 = P_2V_2$ is correct relation in adiabatic infinite free expansion of gas in cylinder

B) For $H_2O_{(l)} \rightleftharpoons H_2O_{(v)}$ at 100^0C, 1.1 atm pressure, $\Delta G = +ve$, $\Delta H = +ve, \Delta S = +ve$

C) In irreversible isothermal expansion of gas in cylinder, $\Delta S_{surroundings}$ *is* calculated by $2.303nR\log\left(\frac{V_f}{V_i}\right)$

D) In the boiling of egg, $\Delta S = +ve \quad and \quad \Delta H = +ve$

Paragraph for Question Nos. 33 & 34

A solution contains 0.01 M concentration each of Zn^{2+}, Mg^{2+}, Cu^{2+} and Mn^{2+} ions, they are to be precipitated as their sulphide by passing H_2S gas (0.1M) into the solution.

$K_{sp(ZnS)} = 10^{-17}, K_{sp(MnS)} = 10^{-22}, K_{sp(MgS)} = 10^{-12}$

$K_{sp(CuS)} = 10^{-13}, K_{a(H_2S)} = 10^{-21}.$

33. The pH range within which only MnS is precipitated is

A) 1 to 3 B) 3 to 5.5 C) pH > 6 D) 5.5 to 6

34. The pH range (1 to 5), which ions get precipitated

A) Mn^{2+}, Zn^{2+} B) Zn^{2+}, Cu^{2+} C) Mg^{2+}, Zn^{2+} D) Mg^{2+}, Cu^{2+}

Paragraph for Question Nos. 35 & 36

A system of greater disorder of molecules is more probable. The disorder of molecules is reflected by the entropy of the system. A liquid vaporizes to form a more disordered gas. When a solute is present, there is additional contribution to the entropy of the liquid due to increase randomness. As the entropy of solution is higher than that of pure liquid, there is weaker tendency to form the gas. Thus, a solute (non volatile) lowers the vapour pressure of a liquid, and hence a higher boiling point of the solution. Similarly, the greater randomness of the solution opposes the tendency to freeze. In consequence, a lower the temperature must be reached for achieving the equilibrium between the solid (frozen solvent) and the solution. Elevation of B.Pt. (ΔT_b) and depression of F.Pt. (ΔT_f) of a solution are the colligative properties which depend only on the concentration of particles of the solute, not their identity. For dilute solutions, ΔT_b *and* ΔT_f are proportional to the molality of the solute in the solution.

$\Delta T_b = K_b m$ K_b=Ebullioscopic constant

And $\Delta T_f = K_f m,\ \ K_f = Cryoscopic\ constant$

The values of K_b and K_f do depend on the properties of the solvent. For liquids, $\frac{\Delta H_{vap}}{T_b^0}$ is almost constant.

[Troutan ‘s Rule, this constant for most of the Unassociated liquids (not having any strong bonding like Hydrogen bonding in the liquid state) is equal to nearly 90 J/mol.]

For solute undergoing change of molecular state in solution (ionization or association), the observed ΔT values differ from the calculate ones using the above relations. In such situations, the relationships are modified as $\Delta T_b = iK_b m;\ \Delta T_f = iK_f m$

Where i=Van’t-Hoff factor, greater than unity for ionization and smaller than unity for association of the solute molecules.

35. Depression of freezing point of which of the following solutions does represent the cryoscopic constant of water?

A) 6% by mass of urea is aqueous solution

B) 100 g of aqueous solution containing 18 g of glucose

C) 59 g of aqueous solution containing 9 g of glucose

D) 1 M KCl solution in water

36. A liquid processing which of the following characteristics will be most suitable for determining the molecular mass of a compound by cryoscopic measurements?

A) That having low freezing point and small enthalpy of freezing

B) That having high freezing point and small enthalpy of freezing

C) That having high freezing point and small enthalpy of vaporization

D) That having large surface tension

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. Assuming all the solutes are non volatile and all solutions are ideal.

Column-I	**Column-II**
(a) When solid HgI_2 is added to Aqueous KI solution	(p) Osmotic pressure of solution increases
(b) When NaCl solid is added to Aqueous NaCl solution	(q) Vapour pressure of solution increases
(c) When water is added to 0.1 Molar acetic acid solution	(r) Boiling point of solution increases
(d) When extent of dimerization of benzoic acid in benzene increases	(s) Freezing point of solution increases

A) a-qs, b-pr, c-qs, d-pr

B) a-pr, b-pr, c-pr, d-pr

C) a-qs, b-pr, c-pr, d-qs

D) a-pr, b-qs, c-pr, d-qs

38. Column I contains concentration of aqueous solutions and Column II contains Colligative properties of aqueous solution (Matrix type)

Column-I	Column-II
(a) 5.555 molal aqueous solution of glucose	(p) The boiling point of the solution is 101.04^0C
(b) 26.47 mass% aqueous solution of glucose	(q) Relative lowering in vapour pressure is $\frac{1}{11}$
(c) 1.5 molal aqueous solution of NaCl which is 95% ionized	(r) Osmotic pressure at 27^0C is more than 1 atm
(d) 2 molal aqueous solution of Glucose	(s) The vapour pressure at 100^0C is 691 mm Hg

Molar mass of glucose =180

Given K_b (H_2O) (molal elevation solution constant,)

=0.52 K Kg mol^{-1} Assume non-volatile solute and ideal & $n_{total} \simeq n_{solvent}$

A) a-qrs, b-pr, c-r,d-pr B) a-prs, b-pr, c-pr,d-p

C) a-qr, b-pr, c-r, d-qr D) a-ps, b-r, c-r,d-pr

39. When we titrate sodium carbonate solution (in beaker) with hydrochloric acid

Column-I	Column-II
(a) At the start of titration	(p) Buffer solution of $HCO_3^- \text{ and } CO_3^{2-}$
(b) Before the first equivalent point	(q) Buffer solution of $H_2CO_3 \text{ and } HCO_3^-$
(c) At the first equivalent point	(r) Amphiprotic anion $pH = 1/2(pK_{a_1} + pK_{a_2})$
(d) Between the first and second equivalent points	(s) Hydrolysis of CO_3^{2-}

A) a-s, b-q, c-r, d-p B) a-r, b-p, c-s, d-q

C) a-s, b-r, c-p, d-q D) a-s, b-p, c-r, d-q

40. **Column-I** **Column-II**

(a) $CH_3COOH(pK_a = 4.74, 100\,mL, 0.1M)$ $NaOH(50mL, 0.1M)$

(b) $H_2CO_3(150\,\text{mL}, 0.1M, P^{K_{a_1}} = 6.37, P^{K_{a_2}} = 10.32)$ $+NaOH\,(100\,\text{mL}, 0.1M)$

(c) $NH_4OH(pK_b = 4.74, 200\,\text{mL}, 0.1M)$ $+\text{HCl}(200\,\text{mL}, 0.1M)$

(d) Na_2CO_3 $(300\,mL\,of\,0.1M)$ $+HCl\,(300\,mL\,of\,0.1M)$

(p) pH > $\frac{P^{K_W}}{2}$ at 25^0C

(q) pH = $\frac{P^{K_W}}{2}$ at 25^0C

(r) pH < $\frac{P^{K_W}}{2}$ at 25^0C

(s) Acidic buffer solution

(t) pH = $\frac{P^{K_{a_1}} + P^{K_{a_2}}}{2}$

A) a-rs, b-rs, c-r, d-pt B) a-ps, b-r, c-pq, d-s

C) a-rs, b-ps, c-r, d-qt D) a-ps, b-rs, c-r, d-p

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. The line joining A $(b\cos\alpha, b\sin\alpha)$ and $B(a\cos\beta, a\sin\beta)$ is produced to the point $M(x,y)$ so that $AM:MB = b:a$ then $x\cos\left(\frac{\alpha+\beta}{2}\right)+y\sin\left(\frac{\alpha+\beta}{2}\right)$

A) -1 B) 0 C) 1 D) a^2+b^2

42. If Δ_1 is the area of the triangle with vertices $(0,0)$ $(aTan\alpha, bCot\alpha)$ $(aSin\alpha, bCos\alpha)$;Δ_2 is the area of the triangle formed by the vertices (a,b) $(a\sec^2\alpha, b\cos ec^2\alpha)$ $(a+a\sin^2\alpha, b+b\cos^2\alpha)$ and Δ_3 is the area of the triangle with vertices $(0,0)$ $(aTan\alpha, -b\cot\alpha)$ $(aSin\alpha, bC\text{os}\alpha)$ if $\Delta_1, \Delta_2, \Delta_3$ are in G.P then No. of values of α

A) 0 B) 2 C) infinite D) 3

43 Let $A=(3,-4)\,B=(1,2)$ Let $P=(2K-1, 2K+1)$ be variable points such that $|PA-PB|$ is maximum then $K=$

A) $\frac{7}{9}$ B) 0 C) $\frac{7}{8}$ D) 1

44. If $A\left(\alpha,\frac{1}{\alpha}\right)B\left(\beta,\frac{1}{\beta}\right) and\, C\left(\gamma,\frac{1}{\gamma}\right)$ are the vertices of a triangle ABC where α,β are roots of $x^2-6P_1x+2=0$ β,γ are the roots of $x^2-6P_2x+3=0$ and γ,α are the root of $x^2-6P_3+6=0$ then the possible coordinates of centroid of the triangle ABC

A) (1, 1) B) (2, 3) C) (3, 2) D) $\left(2,\frac{11}{18}\right)$

45. If the co-ordinates of A_n are (n, n^2) and the ordinate of the center of mean position of the points $A_1, A_2 .... A_n$ is 46 then $n =$

A) 5 B) 7 C) 6 D) 11

46. The co-ordinates of extrimities a rod are $A(1,2)$ and $B(3,4)$. If s(0,0) is a point source of light the rod AB is parallel to the wall and is mid way between the point source and the wall if CD is a shadow of AB on wall then the possible co-ordinates of C are

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

47. A and B are two matrices of order 3×3 so that $AB = A$ and $BA = B$ then $(A+B)^7$

A) $7(A+B)$ B) $7I_3$ C) $64(A+B)$ D) $32(A^2+B^2)$

48. Consider three matrices $A = \begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix}$ then the value of

$$T_r(A) + T_r\left(\frac{ABC}{2}\right) + T_r\left(\frac{A(BC)^2}{4}\right) + T_r\left(\frac{A(BC)^3}{8}\right) + ...\infty$$

A) 6 B) 9 C) 12 D) 8

49. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}$ $I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $A^{-1} = \frac{1}{6}\left[A^2 + cA + dI\right]$ then the values of (c, d) are

A) (-6,-11) B) (6, 11) C) (-6, 11) D) (6,-11)

50. If $A_1, A_3......A_{2n-1}$ are n symmetric matrices of same order then $B=\sum_{r=1}^{n}(2r-1)(A_{2r-1})^{2r-1}$ will be

A) Symmetric B) Skew symmetric

C) Orthogonal D) Idempotent

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

Consider an orbitary 3×3 matrix $A=(a_{ij})$, A matrix $B=(b_{ij})$ is formed such that b_{ij} is the sum of all the elements except a_{ij} in the i^{th} row of A answer the following questions

51. If there exit a matrix X with constant elements such that $AX=B$ then X is

A) Skew symmetric B) null matrix

C) Diagonal matrix D) Symmetric

52. The value of $|B|=$

A) $|A|$ B) $\frac{|A|}{2}$ C) $2|A|$ D) None

Paragraph for Question Nos. 53 & 54

a and b are real numbers between 0 and 1, A (a,1) B (1,b) and C (0,0) are the vertices of a triangle

53. If the triangle ABC is equilateral its area is equal to

A) $2\sqrt{3}-3$ B) $\frac{7\sqrt{3}-12}{4}$ C) $\frac{\sqrt{3}}{4}$ D) $\left(19\sqrt{3}-24\right)$

54. If the triangle ABC is isosceles with $AC=BC$ and $5AB^2=2AC^2$ then

A) $a=\frac{1}{2}=b$ B) $a=\frac{1}{4}$ C) $b=1$ D) $b=\frac{1}{4}$

Paragraph for Question Nos. 55 & 56

Given two points A(-2,0) and B(0,4) M is a point with co-ordinate (x,x), x ≥ 0, P divides the join of A and B in the ratio 2:1 and C,D are midpoint of BM and AM respectively

55. Area of Δ AMB is minimum if the co-ordinates of m are

A) (1, 1) B) (0, 0) C) (2, 2) D) (3, 3)

56. Ratio of the areas of the triangle APM and BPM is

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

SECTION-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. If $P(x,y)$ is a point in the co-ordinate plane such that locus of P is

(a) P is equidistant from $(a+b,a-b)$ and $(a-b,a+b)$	(p) $9\left(x^2+y^2\right)^2=4x^2y^2$
(b) P is at a distance a + b from (a,b)	(q) $4x^2-y^2=0$
(c) distance of P from x-axis	(r) $x^2+y^2-2ax-2by-2ab=0$

is twice its distance from y axis

(d) distance of P from the origin is the Mean of distance from the co-ordinate axes — (s) x = y

A) $a\to s$ $b\to r$ $c\to q$ $d\to p$ B) $a\to p$ $b\to q$ $c\to r$ $d\to s$

C) $a\to r$ $b\to s$ $c\to p$ $d\to q$ D) $a\to s$ $b\to q$ $c\to r$ $d\to p$

58. If Δ denotes the area of the triangle with vertices $(P+1,1)$ $(2P+1,3)$ and $(2P+2,2P)$

(a) $p=0$ (p) $\Delta=\frac{7}{2}$

(b) $p=\pm1$ (q) $\Delta=\frac{25}{2}$

(c) $p=3$ (r) $\Delta=\frac{3}{2}$

(d) $p=-3$ (s) $\Delta=1$

A) $a\to p$ $b\to q$ $c\to r$ $d\to s$ B) $a\to s$ $b\to r$ $c\to p$ $d\to q$

C) $a\to q$ $b\to p$ $c\to s$ $d\to r$ D) $a\to r$ $b\to s$ $c\to p$ $d\to p$

59. The point to which the axis are to be shifted in order to eliminate the first degree terms in

(a) $4x^2+9y^2-8x+36y+4=0$ is (p) $(-1,2)$

(b) $x^2-xy+y^2+4x-5y-1=0$ is (q) $(1,-2)$

(c) $3xy+4x+4y+7=0$ is (r) $(3,4)$

(d) $(x-3)^2+(y-4)^2=10$ (s) $\left(\frac{-4}{3},\frac{-4}{3}\right)$

A) $a\to p$ $b\to q$ $c\to r$ $d\to s$ B) $a\to q$ $b\to p$ $c\to s$ $d\to r$

C) $a\to q$ $b\to r$ $c\to q$ $d\to p$ D) $a\to q$ $b\to q$ $c\to r$ $d\to r$

60. **Colum – I** **Colum – II**

(a) The locus of $p(x,y)$ such that

$\sqrt{x^2+y^2+8y+16}-\sqrt{x^2+y^2-6x+9}=5$

(b) The locus of $p(x,y)$ such that

$\sqrt{x^2+y^2+8y+16}-\sqrt{x^2+y^2-6x+9}=\pm 5$

(c) The locus of $p(x,y)$ such that

$\sqrt{x^2+y^2+8y+16}+\sqrt{x^2+y^2-6x+9}=5$

(d) The locus of $p(x,y)$ such that

$\sqrt{x^2+y^2+8y+16}-\sqrt{x^2+y^2-6x+9}=7$

(p) No such point P exist

(q) Line segment

(r) A ray

(s) Two rays

A) $a\to p, b\to r, c\to q, d\to s$ B) $a\to p, b\to q, c\to r, d\to s$

C) $a\to r, b\to s, c\to q, d\to p$ D) $a\to r, b\to r, c\to q, d\to q$

Jee-Advanced 2014_P2 MODEL **Max.Marks:180**

KEY SHEET

PHYSICS

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

CHEMISTRY

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

MATHS

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

SOLUTIONS

PHYSICS

1. Consider a datum line at distance x above the pulley. From there distances of blocks and pulley are x1, x2 and x respectively. Then

$x_1 - x + x_2 - x = L$.

$v_1 + v_2 - 2v = 0$. v1 is away from datum line where as pulley is moving towards that. $v_1 + 5 - 2(-10) = 0$

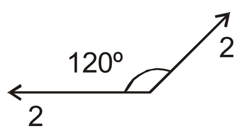
$v_1 = -25$ ie towards datum line

2. Since, velocity of A and B along the line joining them should be equal.

$\therefore \quad u = v_B \cos\theta$

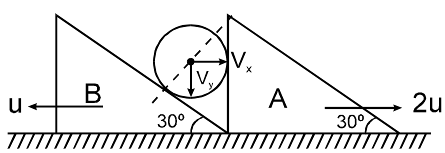
3. $v_B = u + v_A$

4. Resultant velocity of B with respect to ground is given by



$V_B = \sqrt{2^2 + 2^2 + 2(2)(2)\cos 120^o} = 2$ m/s

5. As cylinder will remains in contact with wedge A



$V_X = 2u$

As it also remain in contact with wedge B

$u \sin 30° = V_y \cos 30° - V_X \sin 30°$

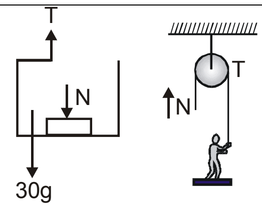
$V_y = V_X \dfrac{\sin 30°}{\cos 30°} + \dfrac{U \sin 30°}{\cos 30°}$

$V_y = V_X \tan 30° + u \tan 30°$

$V_y = 3u \tan 30° = \sqrt{3}u$

$V = \sqrt{V_x^2 + V_y^2} = \sqrt{7}u$

6.



$T = N + 30\ g$ ....(i)

$T + N = 50\ g$ ....(ii)

$N = 100\ N.$

7. Let upward force acting on the balloon be B.

$mg - B = mf$; $B-(m-x)g = (m-x)f$ where x is mass thrown out.

8. Acceleration of any body is given by

$$a = \frac{m_1 - m_2}{m_1 + m_2} g$$

9. The mutual actions of two bodies upon each other are always equal and directed to contrary parts action and reaction are of same nature.

10. (C) Initially the block is at rest under action of force 2T upward and mg downwards. When the block is pulled downwards by x, the spring extends by 2x. Hence tension T increases by 2kx. Thus the net unbalanced force on block of mass m is 4kx.

acceleration of the block is = $\frac{4kx}{m}$

11. Time on the inclined plane is given by $T = \frac{2u\ \sin(\theta - \alpha)}{g\ \cos\alpha}$.

$x = R_{incline} \cos\alpha = (u \cos\theta)T$

12. $\tan\alpha = \frac{y}{x}$

$v = \sqrt{u^2 - 2gy}$

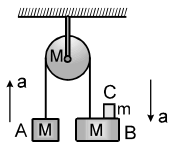
13. Acceleration between 0 to 2 seconds is $a_1 = \frac{-5-5}{2-0} = -5 m/s^2$

Acceleration between 3 to 5 seconds is $a_2 = \frac{5-(-5)}{5-3} = 5 m/s^2$

Acceleration between 5 to 5.5 seconds is $a_3 = \frac{0-5}{0.5} = -10\ m/s^2$ hence between 5 and 5.5 seconds the apparent weight becomes zero and loses concact with the weighing machine

14. Acceleration between 3 to 5 seconds is $a_2 = \frac{5-(-5)}{5-3} = 5 m/s^2$ as acceleration is positive the maximum tension in the cable is $(m+M)(g+a)$

15. $a = \frac{mg}{2M+m}$

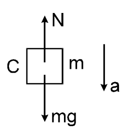
16. 

By newtons law on system of (A, B, C)

$(M + m - M)\ g = (2M + m)\ a$

a = $\frac{mg}{2M+m}$

free body diagram 'C' block



$mg - N = ma$

N = $m\left(g - \frac{gm}{2M+m}\right)$

N = $\frac{2M\ mg}{2M+m}$

17. A- r; B - q; C - s; D - p

A) $a = \frac{2m-m}{2m+m} g$

B) $2mg - mg = ma$

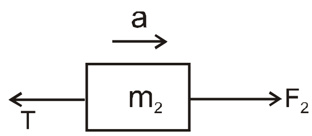
C) $2mg = ma$

D) $2mg = (2m+m)a$

18. (A) q (B) r (C) q (D) r

Let a be acceleration of two block system towards right

$a = \frac{F_2 - F_1}{m_1 + m_2}$

The F.B.D. of m_2 is 

$F_2 - T = m_2 a$

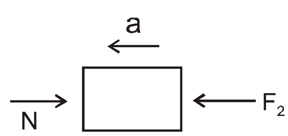
Solving $T = \frac{m_1 m_2}{m_1 + m_2}\left(\frac{F_2}{m_2} + \frac{F_1}{m_1}\right)$

(B) Replace F_1 by $-F_1$ is result of A

$T = \frac{m_1 m_2}{m_1 + m_2}\left(\frac{F_2}{m_2} - \frac{F_1}{m_1}\right)$

(C) Let a be acceleration of two block system towards left

$a = \frac{F_2 - F_1}{m_1 + m_2}$

The FBD of m_2 is 

$F_2 - N_2 = m_2 a$

Solving $N = \frac{m_1 m_2}{m_1 + m_2}\left(\frac{F_1}{m_1} + \frac{F_2}{m_2}\right)$

(D) Replace F_1 by $-F_1$ in result of C

$N = \frac{m_1 m_2}{m_1 + m_2}\left(\frac{F_2}{m_2} - \frac{F_1}{m_1}\right)$

19. (A) Q,R,S; (B) P,Q (C) P,Q,R,S; (D) P,Q

A) from constraint equations, $2a_{block} = a_{pulley}$

$T = T' = m(g+2a)$

B) from constraint equations $a_{block} = a_{pulley} = a/2$

$2T = T' = m(g+a/2)$

C) from constraint equations $a_{block} = a_{pulley} = a/2$

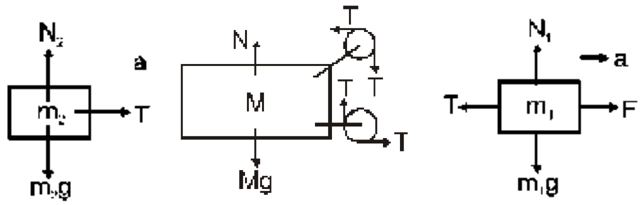
$T = 2T'/3 = m(g+a/2)$

D) from constraint equations $a_{block} = a_{pulley} = a/3$

T+T''=m(g+a/3) ; 2T=T' ; T=2T''

20. (A) Q (b) Q (C) R (D) S

FBD's



From FBD of m_2

$T = m_2 a$.

From FBD of m_1

$F - T = m_1 a$

$F = (m_1 + m_2)a$

$T = m_2 a$

$\Rightarrow \quad a = \dfrac{F}{m_1+m_2}$

$T = \dfrac{m_2 F}{m_1+m_2}$.

From FBD of M

$\sum F_x = 0 \Rightarrow a_M = 0$

CHEMISTRY

21. (a) $\Delta T_f = iK_f m = 0.2\times(1.86)m$

$m = \dfrac{0.2}{1.86} = 0.1075$

$m = 0.1$

$\dfrac{0.1}{W_A(kg)} = 0.1075 \Rightarrow W_A(g) = \dfrac{100}{0.1075} = 930.23\,g$

Hence, amount of water separated out (1000-930.23) g$\approx$70 g

22. $\Delta T_f = iK_f m$, $id = 1+(n-1)\alpha d$

$(H^+) = C\alpha$

23. CONCEPTUAL

24. (b) $0.0558 = i \times \frac{3.24}{324} \times 1.86$

$\Rightarrow i = 3(100\% \, dissociated)$

$0.0744 = i \times \frac{21.68}{271} \times \frac{1000}{2000} \times 1.86$

$\Rightarrow i \approx 1$ (almost dissociated)

25. CONCEPTUAL

26. $X_{FeC_2O_4} = X_{KMnO_4} \quad a\, FeC_2O_4 \rightarrow Fe^{+2} + C_2O_4^{-2}$

$\Delta T_F = mK_f i = \frac{25 \times 2}{1000} \times \frac{1000}{186} \times 1.86 \times 2 = \frac{100}{100} = 1$

27. $\pi = MRTi \qquad i = 1 + (y-1)\alpha$

$\pi = 2 \times 0.0821 \times 300 \times 4 \quad i = 1 + (5-10)0.75$

$For\ He\ PV = nRT \qquad i = 1 + 3$

$\pi V = nRT \qquad i = 4$

$2 \times 0.0821 \times 300 \times 4 \times 100 \times \ell \times 10^{-3} = \frac{16}{4} \times 0.0821 \times 300$

$\ell = \frac{4}{8 \times 10^{-1}} = \frac{40}{8} = 5$

28. CONCEPTUAL

29. (c) $\because PH = \frac{PK_{a_1} + PK_{a_2}}{2}$

30. CONCEPTUAL

31. For spontaneous process

$a)(\Delta H_{sys})_{S,P} < 0$

$b)(\Delta E_{sys})_{S,V} < 0$

$c)(\Delta G_{sys})_{T,P} < 0$

$d)\oint \frac{\delta Q_{rev}}{T} < 0$

32. a) For infinite face expansion of gas conditions: $Q = 0, W = 0, \Delta E = 0, \Delta T = 0, \Delta H = 0$

$\therefore P_1V_1 = P_2V_2$

$\therefore$ it is finally isothermal

$b)\ \Delta G = +ve$

$c)\ \Delta S_{surr} = \frac{-P_{ext}.\Delta V}{T}$

$d)\ \Delta S = +ve, \Delta H = +ve$ in the boiling of egg

33 & 34 $K_{sp} = \left[M^{2+}\right]\left[S^{2-}\right]$

But $\left[S^{2-}\right] = \dfrac{K_a\left(H_2S\right).[H_2S]}{\left[H^+\right]^2}$

35. (c) Cryoscopic constant $K_f = \Delta T_f$ of solution having unit molality of normal solute

Molality of glucose solution in (c)

$$= \frac{9 \times 1000}{(59-9) \times 180} = 1$$

36. (b) $K_f = \dfrac{RT_f^{02}M}{1000\Delta H_{fus}}$ would be larger for larger value of $T^0{}_f$ and smaller value of the enthalpy of fusion of the solid solvent.

37. (a) no. of ions decreases

(b) no. of ions increases

(c) no. of ions increases

(d) no. of particles decreases

38. $\Delta T_b = i.\mathrm{K}_b.m$

$\dfrac{\Delta p}{p^0} = i\dfrac{n_2}{n_1}$

$\pi = iCST$

39. Is t neutralization equation

$Na_2CO_3 + HCl \rightarrow NaHCO_3 + NaCl$

Acidic Buffer solution

2nd neutralization equation

$NaHCO_3 + HCl \rightarrow NaCl + H_2CO_3$

Acidic Buffer solution

40. (a) $CH_3COOH + CH_3COONa$: Acidic buffer solution $P^H = P^{K_a} = 4.74$

(b) $H_2CO_3 + NaHCO_3$: Acidic buffer solution $P^H = P^{K_1} + \log 2$

=6.37+0.3=6.67

(c) NH_4Cl salt : $P^H = 7 - \dfrac{1}{2}[4.47 + 0.01] < 7$

(d) $NaHCO_3$ (30 meq) $\therefore P^H = \dfrac{P^{K_{a_1}} + P^{K_{a_2}}}{2}$

MATHS

41. $x = \dfrac{b(a\cos\beta) - a(b\cos\alpha)}{b-a}$

$y = \dfrac{b(a\sin\beta) - a(b\sin\alpha)}{b-a}$

$\dfrac{x}{y} = \dfrac{\cos\beta - \cos\alpha}{\sin\beta - \sin\alpha} \Rightarrow x\cos\left(\dfrac{\alpha+\beta}{2}\right) + y\sin\left(\dfrac{\alpha+\beta}{2}\right) = 0$

42. $\Delta_1 = \dfrac{1}{2}ab\left|\sin\alpha - \cos\alpha\right|$

$\Delta_2 = \dfrac{1}{2}ab\left|\sin\alpha - \cos\alpha\right|\left|\sin\alpha + \cos\alpha\right|$

$\Delta_3 = \dfrac{1}{2}ab\left|\sin\alpha + \cos\alpha\right|$

$\Delta_1, \Delta_2, \Delta_3$ are in GP

$\Delta_2^2 = \Delta_1\Delta_3$

$1 = \left|\sin^2\alpha - \cos^2\alpha\right| \Rightarrow \cos 2\alpha = 1$

$2\alpha = 2n\pi$ OR $\alpha = n\pi$

For this values of α vertices are not defined

43. $PA + PB \geq AB$

For minimum $PA + PB = AB$

$\therefore P, A, B$ are collinear

44. $\alpha + \beta = 6P_1 \qquad \alpha\beta = 2$

$\beta + \gamma = 6P_2 \qquad \beta\gamma = 3 \Rightarrow \alpha = 2, \beta = 1, \gamma = 3$

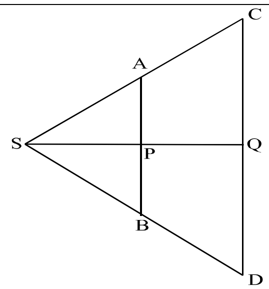
$\gamma + \alpha = 6P_3 \qquad \gamma\alpha = 6$

$\therefore$ Centred $= \left(\dfrac{\alpha+\beta+\gamma}{3}, \dfrac{\frac{1}{\alpha}+\frac{1}{\beta}+\frac{1}{\gamma}}{3}\right) = 2, \dfrac{11}{18}$

45. Given $\dfrac{1+2^2+3^2+......+n^2}{n} = 46$

$n\dfrac{(n+1)(2n+1)}{6n} = 46 \Rightarrow 2n^2 + 3n - 275 = 0$

$2n^2 - 22n + 25n - 275 = 0 \Rightarrow n = 11$

46. 

Given

$SP = PQ$

$\Delta^{le} SAP \sim \Delta^{le} SCQ^0$

$\frac{SP}{SO} = \frac{SA}{SC} = \frac{PA}{QC}$

$\frac{SP}{2SP} = \frac{SA}{SC} = \frac{PA}{QC}$

$\{\because SQ = 2SP, P\, is\, mid\, point\, of\, SQ\}$

$\frac{SA}{SC} = \frac{1}{2}$

$\therefore A\, mid\, point\, of\, SC$

$\therefore C = (2,4)$

47. $(A+B)^2 = (A+B)(A+B) = A^2 + B^2 + AB + BA = 2(A+B)$

$(A+B)^3 = 2(A+B) + (A+B) = 4(A+B)$

$(A+B)^5 = 4(A+B) + 2(A+B) = 8(A+B)^2 = 16(A+B)$

$(A+B)^7 = (A+B)^5 + (A+B)^2 = 16(A+B)2(A+B) = 64(A+B)$

48. $BC = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}\begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Given problem be comes

$Tr(A) + Tr\left(\frac{A}{2}\right) + Tr\left(\frac{A}{4}\right) + Tr\left(\frac{A}{8}\right) + ...\infty$

$Tr(A) + \frac{1}{2}Tr(A) + \frac{1}{4}Tr(A) + \frac{1}{8}Tr(A) + ...\infty$

$Tr(A)\left\{1 + \frac{1}{2} + \frac{1}{4} + ...\infty\right\} = 2Tr(A) = 2\times 3 = 6$

49. By characteristics equation

$A^3 - 6A^2 + 11A - 6I = 0$

$A^2 - 6A + 11I - 6A^{-1} = 0$ Multiplying with A^{-1}

$\therefore A^{-1} = \frac{1}{6}\left\{A^2 - 6A + 11I\right\}$

$c = -6 \quad d = 11$

50. Conceptual

51. Conceptual

52. $A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} B = \begin{bmatrix} a_{12}+a_{13} & a_{11}+a_{13} & a_{11}+a_{12} \\ a_{22}+a_{23} & a_{21}+a_{23} & a_{21}+a_{22} \\ a_{32}+a_{33} & a_{31}+a_{33} & a_{31}+a_{32} \end{bmatrix}$

$X = A^{-1}B = \frac{1}{|A|}\begin{bmatrix} c_{11}+c_{21} & c_{31} \\ c_{12}+c_{12} & c_{32} \\ c_{13}+c_{23} & c_{33} \end{bmatrix}\begin{bmatrix} a_{12}+a_{13} & a_{11}+a_{13} & a_{11}+a_{12} \\ a_{22}+a_{23} & a_{21}+a_{23} & a_{21}+a_{22} \\ a_{32}+a_{33} & a_{31}+a_{33} & a_{31}+a_{32} \end{bmatrix}$

$= \frac{1}{11}\begin{bmatrix} 0 & |A| & |A| \\ |A| & 0 & |A| \\ |A| & |A| & 0 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$

$\left|A^{-1}B\right| = 2 \quad \left|A^{-1}\right||B| = 2 \Rightarrow |B| = 2|A|$

53. $AC = BC = AB$

$a^2+1 = b^2+1 = (a-1)^2 + (b-1)^2$

$a = 1 \text{ or } a^2 - 2a + 1 + b^2 - 2b + 1 = b^2 + 1$

$a^2 - 2a - 2a + 1 = 0$

$AC^2 \ a^2 - 4a + 1 = 0 \ a = 2 - \sqrt{3} \ \{\because a < 1\}$

$a^2 + 1 = 4 + 3 - 2\sqrt{3} + 1 = 8 - 2\sqrt{3} = 2\left(4 - \sqrt{3}\right)$

Area $\frac{\sqrt{3}}{4}AC^2 = \frac{\sqrt{3}}{A} \quad 4\left(4-\sqrt{3}\right)^2$

$= \left(16 + 3 - 8\sqrt{3}\right)\sqrt{3} = 19\sqrt{3} - 24$

54. $BC = AC \Rightarrow a = b$

$5AB^2 = 2AC^2 \Rightarrow 5\left[(a-1)^2 + (b-1)^2\right] = 2\left(a^2+1\right)$

$5\left(2(a-0)^2\right) = 2\left(a^2+1\right)$

$5a^2 - 10a + 5 = a^2 + 1$

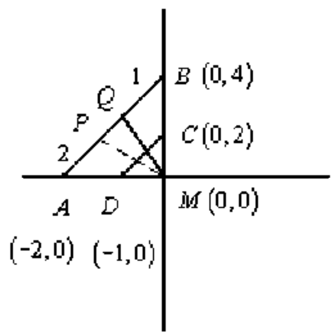
$4a^2 - 10a + 4 = 0 \Rightarrow 2a^2 - 5a + 2 = 0$

$a = \frac{1}{2}\ or\ a = 2$

But $a < 1\ \therefore a = \frac{1}{2} = b$

55. Area of $\Delta^4 AMB = \frac{1}{2}|x+4|$ this is minimum when x = 0 $\therefore M = (0,0)$

56. The box of Δ^4 APM and BPM are in the ratio 2:1 and the length of the perpendicular from M the base is same



$\therefore$ Area of Δ^4 APM : Area of Δ^4 BPM =2:1

57. Conceptual

58. Conceptual

59. Conceptual

60. (a) $A\ (0,-4)\ B = (3,0)$

$PA - PB = 5\ AB = 5 \Rightarrow PA - PB = AB\ a \to p$

Locus is a ray

(b) $A = (0,-4)\ B = (0,3)$

$PA - PB = \pm 5$

Locus is two rays $b \to 5$

(c) $PA + PB = 5 \quad AB = 5$

Locus is line segment $c \to q$

(d) $PA - PB = 7 > AB(5)$ No Locus $d \to p$