JEE ADVANCED-2017
MODEL PAPER-I

JEE-ADVANCED-P1

Time: 09.00 AM to 12.00 Noon **IMPORTANT INSTRUCTIONS** **Max Marks: 222**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 10)	Questions with Single Correct Choice	4	-2	10	40
Sec – II(Q.N : 11 – 16)	Questions with Comprehension Type Integer (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 17 – 20)	Matrix Matching Type	4	-2	4	16
Total				**20**	**74**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 30)	Questions with Single Correct Choice	4	-2	10	40
Sec – II(Q.N : 31 – 36)	Questions with Comprehension Type Integer (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 37 – 40)	Matrix Matching Type	4	-2	4	16
Total				**20**	**74**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Single Correct Choice	4	-2	10	40
Sec – II(Q.N : 51 – 56)	Questions with Comprehension Type Integer (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 57 – 60)	Matrix Matching Type	4	-2	4	16
Total				**20**	**74**

PHYSICS: **Max.Marks : 74**

Section-1

(Only one Option correct Type)

This section contains 10 Multiple Choice questions. Each Question has Four choices (A), (B), (C) and (D). Out of Which **Only One is correct**

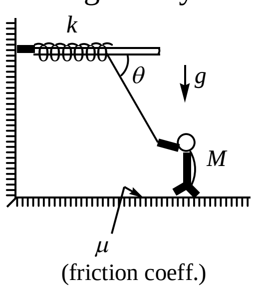
Marking scheme +4 for correct answer , 0 if not attempted and -2 in all other cases.

1. A particle is projected from a point on the level ground and its height is h when at horizontal distances a and 2a from its point of projection. The velocity of projection is

a) $\upsilon_0 = \frac{1}{64}\sqrt{\left(\frac{4a^2}{h}+9h\right)g}$ b) $\upsilon_0 = \frac{1}{8}\sqrt{\left(\frac{4a^2}{h}+9h\right)g}$

c) $\upsilon_0 = \frac{1}{16}\sqrt{\left(\frac{4a^2}{h}+9h\right)g}$ d) $\upsilon_0 = \frac{1}{2}\sqrt{\left(\frac{4a^2}{h}+9h\right)g}$

2. A man with mass M has its string attached to one end of a spring which can move without friction along a horizontal overhead fixed rod. The other end of the spring is fixed to a wall. The spring constant is k. The string is massless and inextensible and it maintains a constant angle θ with the overhead rod, even when the man moves. There is friction with coefficient μ between the man and the ground. What is the maximum distance (in m) that the man moving slowly can stretch the spring beyond its natural length?



a) $x = \frac{\mu Mg}{k(1+\mu\tan\theta)}$ b) $x = \frac{Mg}{k(1+\mu\tan\theta)}$

c) $x = \frac{\mu g}{k(1+\mu\tan\theta)}$ d) $x = \frac{g}{k(1+\mu\tan\theta)}$

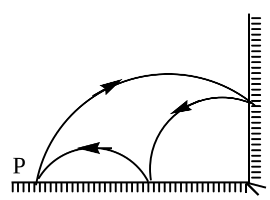
3. An object is displaced from a point A(0,0,0) to B(1m,1m,1m) under a force $\vec{F} = \left(y\hat{i} + x\hat{j}\right)N$.

The work done by this force and the nature of the force are:

a) 1 J, non – conservative b) 1 J, conservative

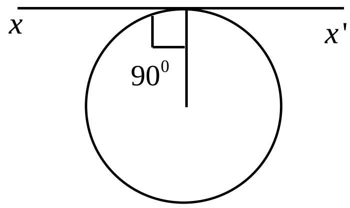
c) zero, conservative d) zero, non –conservative

4. A small ball is projected from point P on floor towards a wall as shown. It hits the wall when its velocity is horizontal. Ball reaches point P after one bounce on the floor. If the coefficient of restitution is the same for the two collisions, find its value.



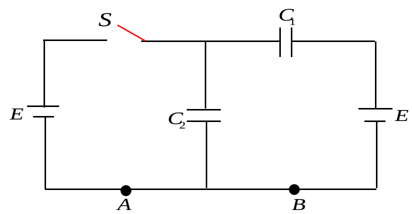
a) $e = 1/2$ b) $e = 1/4$ c) $e = 1/8$ d) $e = 1/3$

5. A thin wire of length L and uniform linear mass density ρ is bent in to a circular loop with centre at O as shown. The moment of inertia of the loop about the axis XX' is



a) $\frac{\rho L^3}{8\pi^2}$ b) $\frac{\rho L^3}{16\pi^2}$ c) $\frac{5\rho L^3}{16\pi^2}$ d) $\frac{3\rho L^3}{8\pi^2}$

6. The circuit shown in consists of two capacitors $C_1 = 2\mu F$ and $C_2 = 4\mu F$ and two batteries, each of emf E=3V. Find the charge flowing through point A when switch S is closed



a) $12\mu c$ b) $24\mu c$ c) $4\mu c$ d) $16\mu c$

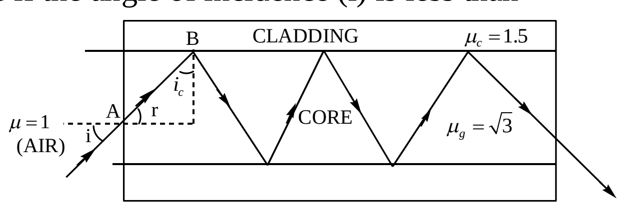
7. A particle of charge q is revolving in a circle of radius r with a constant speed υ. The ratio of the magnitudes of magnetic moment and angular momentum of the particle is

a) $\frac{q}{\sqrt{2}m}$ b) $\frac{q}{m}$ c) $\frac{q}{2m}$ d) $\frac{\sqrt{2}q}{m}$

8. A solenoid 1.0m long and 0.05 m diameter has 700 turns. Another solenoid of 50 turns is tightly wound over the first solenoid. Find the emf induced in the second solenoid when the current in the first solenoid changes from 0 to 5 A in 0.01 s.

a) $4.3\times10^{-2}V$ b) $8.6\times10^{-4}V$ c) $2.1\times10^{-1}V$ d) $6.9\times10^{-4}V$

9. An optical fibre made of glass core of refractive index $\mu_g = \sqrt{3}$ having an outer covering (called cladding) of refractive index $\mu_c = 1.5$. Total internal reflections will occur at the core – cladding interface if the angle of incidence (i) is less than



a) 30^0 b) 45^0 c) 60^0 d) 75^0

10. Two radioactive substances A and B initially contain equal number of atoms. The half lives of A and B are 1 hour and 2 hours respectively. Find the ratio of their rates of disintegration at the end of 2 hours.

a) 1 b) 4 c) 3 d) 5

Section-2

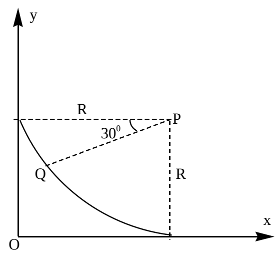
(Paragraph Type With Integer)

This section contains **6 Integer Type questions** relating to three paragraphs with two questions on each paragraph. The answer to each of the questions is a single-digit integer, ranging from 0 to 9. For each question you will be awarded 3 marks if you darken ONLY the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases, minus one (-1) mark will be awarded

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

Passage-I

A small block of mass 1kg is released from rest at the top of a rough track. The track is a circular arc of radius 40m. The block slides along the track without toppling and a frictional force acts on it in the direction opposite to the instantaneous velocity. The work done in overcoming the friction up to the point Q, as shown in the figure below, $\left(g = 10m/s^2\right)$ is 150J.

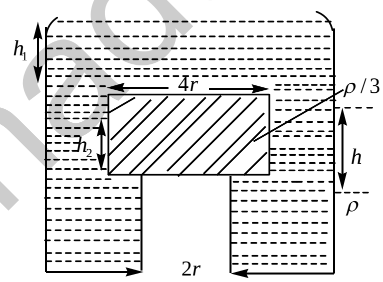


11. The magnitude of the normal reaction that acts on the block at the point Q is $n(2.5)$ Newton Then the value of 'n' is

12. The speed of the block when it reaches the point Q is $n \times 10 m/s$, then the value of 'n' is

Passage-II

A cylindrical tank has a hole of diameter 2r in its bottom. The hole is covered wooden cylindrical block of diameter 4r, height h and density $\rho/3$.



Situation I : Initially, the tank is filled with water of density ρ to a height such that the height of water above the top of the block is h_1 (measured from the top of the block)

Situation II : The water is removed from the tank to a height h_2 (measured from the bottom of the block). As shown in the figure. The height h_2 is smaller than h (height of the block) and thus the block is exposed to the atmosphere.

13. The minimum value of height h_1 (in situation 1), for which the block just starts to move up is 'n' times $h/3$, then 'n' value is

14. Find the height of the water level h_2 (in situation 2), for which the block remains in its original position without the application of any external force is $n\left(\frac{2h}{9}\right)$, the value of 'n' is

Passage-III

A thermal power plant produces electric power of 600 kW at 4000 V, which is to be transported to a place 20 km away from the power plant for consumer's usage. It can be transported either directly with a cable of large current carrying capacity or by using a combination of step – up and step – down transformers at the two ends. The drawback of the direct transmission is the large energy dissipation. In the method using transformers, the dissipation is much smaller. In this method, a step – up transformer is used at the plant side so that the current is reduced to a smaller value. At the consumer's end, a step – down transformer is used to supply power to the consumers at the specified lower voltage. It is reasonable to assume that the power cable is purely resistive and the transformers are ideal with power factor unity. All the currents and voltages mentioned are rms values.

15. If the direct transmission method with a cable of resistance $0.4\Omega km^{-1}$ is used, the power dissipation (in %) during transmission is n(10), the value of 'n' is

16. In the method using the transformers, assume that the ratio of the number of turns in the primary to that in the secondary in the step – up transformer is 1:10. If the power to the consumers has to be supplied at 200 V, the ratio of the number of turns in the primary to that in the secondary in the step- down transformer is n(50) : 1, the value of 'n' is

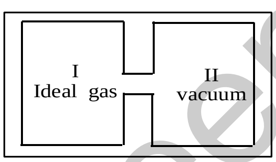
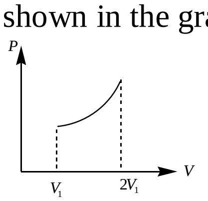
Section-3

(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 +4 for correct answer , 0 if not attempted and -2 in all other cases.

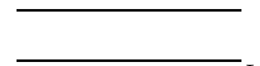
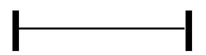
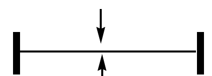
17. Column I contains a list of processes involving expansion of an ideal gas. Match this with Column II describing the thermodynamic change during this process.

	Column- I		**Column –II**
A)	An insulated container has two chambers separated by a valve. Chamber I contains an ideal gas and the Chamber II has vacuum. The valve is opened 	p)	The temperature of the gas decreases
B)	An ideal monoatomic gas expands to twice its remains original volume such that its pressure $P \propto 1/V^2$ where V is the volume of the gas	q)	The temperature of the gas increases or constant
C)	An ideal monoatomic gas expands to twice its original volume such that its pressure $P \propto 1/V^{4/3}$	r)	The gas loses heat where V is its volume
D)	An ideal monoatomic gas expands such that its pressure P and volume V follows the behaviour shown in the graph 	s)	The gas gains heat

a) $A \to q; B \to p,r; C \to p,s; D \to q,s$ b) $A \to p,r; B \to p,s; C \to q,s; D \to q$

c) $A \to p,a; B \to q,s; C \to q; D \to p$ d) $A \to q,s; B \to q; C \to p,r; D \to p,s$

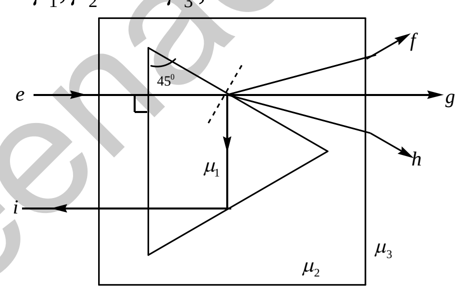
18. Column I shows four systems, each of the same length L, for producing standing waves. The lowest possible natural frequency of a system is called its fundamental frequency, whose wavelength is denoted as λ_f Match each system with statements given in Column II describing the nature and wavelength of the standing waves.

	Column- I		Column –II
A)	Pipe closed at one end 	p)	Longitudinal waves
B)	Pipe open at both ends 	q)	Transverse waves
C)	Stretched wire clamped at both ends 	r)	$\lambda_f = L$
D)	Stretched wire clamped at both ends 	s)	$\lambda_f = 2L$
		t)	$\lambda_f = 4L$

a) $A\to p,s;B\to q,s;C\to q,r;D\to p,t$ b) $A\to q,s;B\to q,r;C\to p,t;D\to p,s$

c) $A\to p,t;B\to p,s;C\to q,s;D\to q,r$ d) $A\to q,r;B\to p,t;C\to p,s;D\to q,s$

19. A right angled prism of refractive index μ_1 is placed in a rectangular block of refractive index μ_2, which is surrounded by a medium of refractive index μ_3, as shown in the figure. A ray of light 'e' enters the rectangular block at normal incidence. Depending upon the relationships between μ_1, μ_2 and μ_3, it takes one of the four possible paths 'ef','eg','eh'or 'ei'



Match the paths in List –I with conditions of refractive indices in List – II and select the correct answer using the codes given below the lists :

	Column- I		Column –II
A)	$e\to f$	p)	$\mu_1 > \sqrt{2}\mu_2$
B)	$e\to g$	q)	$\mu_2 > \mu_1$ and $\mu_2 > \mu_3$
C)	$e\to h$	r)	$\mu_1 = \mu_2$
D)	$e\to i$	s)	$\mu_2 < \mu_1 < \sqrt{2}\mu_2$ and $\mu_2 > \mu_3$

a) $A\to r;B\to s;C\to p;D\to q$ b) $A\to s;B\to p;C\to q;D\to r$

c) $A\to p;B\to q;C\to r;D\to s$ d) $A\to q;B\to r;C\to s;D\to p$

20. Column – II gives certain systems undergoing a process. Column-I suggests changes in some of the parameters related to the system. Match the statements in Column-I to the appropriate process from Column – II.

	Column- I		Column –II
A)	The energy of the system is increased	p)	System : A capacitor, initially uncharged Process : It is connected to a battery
B)	Mechanical energy is provided to the system, which is converted into energy of random motion of its parts	q)	System : A gas in an adiabatic container fitted with an adiabatic piston Process : The gas is compressed by pushing the piston
C)	Internal energy of the system is converted into its mechanical energy	r)	System : A gas in a rigid container Process : The gas gets cooled due to colder atmosphere surrounding it
D)	Mass of the system is decreased	s)	System : A heavy nucleus, initially at rest Process : The nucleus fissions into two fragments of nearly equal masses and some neutrons are emitted
		t)	System : A resistive wire loop Process : The loop is placed in a time varying magnetic field perpendicular to its plane

a) $A \to p,q,t; B \to q; C \to s; D \to s$
b) $A \to q; B \to s; C \to s; D \to p,q,t$
c) $A \to s; B \to s; C \to p,q,t; D \to q$
d) $A \to s; B \to p,q,t; C \to p,q,t; D \to q$

MATHS: Max.Marks : 74

Section-1

(Only one Option correct Type)

This section contains 10 Multiple Choice questions. Each Question has Four choices (A), (B), (C) and (D). Out of Which **Only One is correct**

Marking scheme +4 for correct answer , 0 if not attempted and -2 in all other cases.

21. If $I_1 = \int_0^{\frac{\pi}{2}} \frac{\sqrt{2}\cos\left(x-\frac{\pi}{4}\right)dx}{1+\pi^{\sin\left(x-\frac{\pi}{4}\right)}}, I_2 = \int_0^{\frac{\pi}{2}} \frac{\cos\left(x-\frac{\pi}{4}\right)dx}{1+\left(\frac{\pi}{2}\right)^{\sqrt{2}\sin\left(x-\frac{\pi}{4}\right)}}$ then

a) $I_1 = I_2$ b) $I_1 = I_2.\sqrt{2}$ c) $I_1.\sqrt{2} = I_2$ d) $2I_1 = I_2$

22. If $f(x) = \begin{vmatrix} u_1(x) & v_1(x) & w_1(x) \\ u_2(x) & v_2(x) & w_2(x) \\ u_3(x) & v_3(x) & w_3(x) \end{vmatrix}$ and , $u_1(x) = |x|, u_2(x) = x^2, u_3(x) = e^x + e^{-x}$,

$v_1(x) = \frac{x}{2} - \frac{x}{e^x+1}, v_2(x) = \cos x, v_3(x) = -x^4$ $w_1(x) = \frac{\cos x}{\left[\frac{x}{\pi}\right]+\frac{1}{2}}, w_2(x) = \frac{\sin^2 x}{\left[\frac{x}{\pi}\right]+\frac{1}{2}}, w_3(x) = x$,

then $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} f(x)dx + \int_{-\frac{\pi}{6}}^{\frac{\pi}{6}} f''(x)dx =$

a) 0 b) $\frac{1}{2}$ c) $\frac{1}{6}$ d)1

23. If $f(a)=\frac{e^a}{e^a+1}$, $I_1=\int_{f(-a)}^{f(a)} g\left(x(1-x)\right)dx, I_2=\int_{f(-a)}^{f(a)} x\,g\left(x(1-x)\right)dx$ then

a) $I_1=2I_2$ b) $2I_1=I_2$ c) $I_1+I_2=0$ d) $I_1=I_2$

24. If $f(x)\begin{vmatrix}\cos x & 1 & 0\\ 1 & 2\cos x & 1\\ 0 & 1 & 2\cos x\end{vmatrix}$ then $\int_{\frac{\pi}{18}}^{\frac{\pi}{6}} f(x)dx=$

a) $-\frac{1}{3}$ b) $\frac{1}{2}$ c) $\frac{1}{6}$ d)0

25. $\int_0^{\pi}[\cot x]dx=$ [When [*] represents greatest integer part]

a) $-\frac{\pi}{3}$ b) $-\frac{\pi}{2}$ c) $-\frac{\pi}{4}$ d) $-\frac{\pi}{6}$

26. If $f(x)=\begin{cases} x & x<1\\ x-1 & x\ge 1\end{cases}$ then $\int_0^2 x^2 f(x)=$

a) $\frac{3}{4}$ b)1 c)$\frac{5}{3}$ d)12

27. If $f(x)=\begin{cases}[x] & x\le 2\\ 0 & x>2\end{cases}$ then $\int_0^3 \frac{xf(x)dx}{1+f(x)}$

a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) 1 d) $\frac{3}{4}$

28. $If\ \int_0^1\left(\frac{x^2+2}{x^2+1}\right)e^{x+\tan^{-1}x}dx=I, then \log_e(I+1)$

a) $\frac{\pi-4}{4}$ b) $\frac{\pi+1}{4}$ c) $\frac{\pi-1}{4}$ d) $\frac{\pi+4}{4}$

29. Reflection of the parabola $y^2=4x$ in the line x + y + 4 = 0 is

a) $x^2+8x+4y+32=0$ b) $x^2+8x+16y^2+36=0$

c) $x+8y+4y^2+36=0$ d) $x^2+8x+4y-36=0$

30. Three different planes given by y = 0, x + z = 1 and ax + by + cz = d, intersect in same line. Distances from the points (0, 1, 0) and (α,β,γ) to the plane ax + by + cz = d are 1 unit and 2 units respectively then

a) $2\alpha-\beta+2\gamma=4$ b) $2\alpha+\beta+2\gamma=8$

c) $2\alpha-\beta+2\gamma=8$ d) $2\alpha-\beta-2\gamma=8$

Section-2

(Paragraph Type With Integer)

This section contains **6 Integer Type questions** relating to three paragraphs with two questions on each paragraph. The answer to each of the questions is a single-digit integer, ranging from 0 to 9. For each question you will be awarded 3 marks if you darken ONLY the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases, minus one (-1) mark will be awarded

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

Passage-I

Angle between the planes $a_1x+b_1y+c_1z=d_1$ and $a_2x+b_2y+c_2z=d_2$ is θ and

$$\cos\theta=\frac{|a_1a_2+b_1b_2+c_1c_2|}{\sqrt{a_1^2+b_1^2+c_1^2}\sqrt{a_2^2+b_2^2+c_2^2}}$$

$y^2=4ax$ & $x^2=4ay$ represents standard forms of parabola.

$(x-h)^2+(y-k)^2=r^2$ represents standard form of circle.

31. Angle between the plane $2x-y+2z=5$ and the line $\frac{x-0}{2}=\frac{y+1}{2}=\frac{z-1}{1}$ is θ then $9\sin\theta=$

32. If the normals to the parabola $y^2=4x$ drawn from the ends of latusrectum are touching the circle $(x-3)^2+(y-2)^2=r^2$, then r^2

Passage-II

$\bar{a}=a_1\bar{i}+b_1\bar{j}+c_1\bar{k}$, $\bar{b}=a_2\bar{i}+b_2\bar{j}+c_2\bar{k}$ are two vectors then $\bar{a}.\bar{b}=a_1a_2+b_1b_2+c_1c_2$,

$\sqrt[n]{1}=\cos\frac{2k\pi}{n}+i\sin\frac{2k\pi}{n},(k=0,1,2,3,.......)$

33. In a triangle ABC, $|\overline{BC}|=12, |\overline{CA}|=4\sqrt{3}$, $\overline{CA}.\overline{AB}=24$ then $\sqrt{|AB|^2-39}$

34. If $\alpha_k=\cos\frac{2k\pi}{7}+i\sin\frac{2k\pi}{7}, i=\sqrt{-1}$ and $If \sum_1^7|\alpha_{k+1}-\alpha_k|=k\sin\frac{6\pi}{7}, then\ k-13$

Passage-III

The general form of H.P is $\frac{1}{a},\frac{1}{a+d},\frac{1}{a+2d},.....,\frac{1}{a+(n-1)d}...$

$(x-\alpha_1)(x-\alpha_2)..........(x-\alpha_n)=x^n-\sum\alpha_1x^{n-1}+\sum\alpha_1.\alpha_2x^{n-2}+.........(-1)^n\alpha_1.\alpha_2........\alpha_n$

35. If $0.\overline{27}, x, 0.\overline{72}$ are in H.P then $x\square\frac{p}{q}$, $(HCF\ of\ \ p,q\ is\ 1)$ then $\frac{q}{11}-\frac{p}{6}=$

36. Sum all possible products drawn from (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) is 11! – K then $\left[\frac{K}{12}\right]$ is

[When [*] represents greatest integer part]

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 +4 for correct answer , 0 if not attempted and -2 in all other cases.

37.

	COLUMN–I		**COLUMN – II**
A	$\cos\frac{\pi}{10}$ is the root of	p	$4x^2-2x-1=0$
B	$if\ \cos p=\tan q, \cos q=\tan r, \cos r=\tan p$ then $\frac{1}{2}\sin p, \frac{1}{2}\sin q, \frac{1}{2}\sin r$ Are the roots of	q	$4x^2+2x-1=0$
C	$\cos\frac{\pi}{7}$ is the root of	r	$8x^3-4x^2-4x+1=0$
D	$\cos\frac{\pi}{5}$ is the root of	s	$16x^5-20x^3+5x=0$

a) A – s; B-q; C-r; D-p   b) A – s; B-q; C-p; D-r

c) A – s; B-r; C-s; D-p   d) A – s; B-r; C-r; D-p

38. If 5boys, 5Girls stand in a queue at random then

	COLUMN–I		**COLUMN – II**
A	Probability all girls together	p	$\frac{1}{42}$
B	Probability exactly 4 girls together	q	$\frac{5}{42}$
C	Probability all boys together	r	$\frac{1}{6}$
D	Probability boys and girls alternate	s	$\frac{1}{126}$

a) A – p; B-s; C-p; D-q   b) A – p; B-q; C-p; D-s

c) A – p; B-q; C-p; D-s   d) A – p; B-q; C-r; D-s

39. In a bag 1red ball and 2 blue balls are there and one ball is selected after noting its color, replaced with an additional ball of same color, if three such trials made then

	COLUMN–I		COLUMN – II
A	Probability of drawing at least one blue ball	p	0.9
B	Probability of drawing exactly one blue ball	q	0.2
C	Probability of drawing all balls red known that all are same color	r	0.3
D	Probability of drawing at least one red ball	s	0.6

a) A – p B-r; C-p; D-q
b) A – q; B-p; C-r; D-s
c) A – p; B-q; C-q; D-s
d) A – p; B-q; C-s; D-r

40. $A=\begin{bmatrix} 5 & -2 & 0 \\ -2 & 6 & 2 \\ 0 & 2 & 7 \end{bmatrix}$, and a homogeneous system $AX = \lambda X \ (X \neq 0)$

	COLUMN–I		COLUMN – II
A	Number of distinct values of λ	p	3
B	Sum of possible values of λ	q	18
C	Product of all possible values of λ	r	162
D	Sum of all possible products of values of λ	s	261

a) A – p; B-s; C-q; D-r
b) A – p; B-s; C-q; D-r
c) A – p; B-s; C-r; D-q
d) A – p; B-q; C-r; D-s

CHEMISTRY: Max.Marks : 74

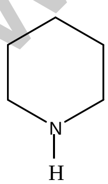
Section-1

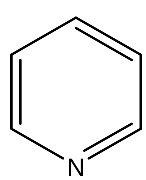
(Only one Option correct Type)

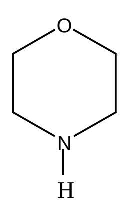
This section contains 10 Multiple Choice questions. Each Question has Four choices (A), (B), (C) and (D). Out of Which **Only One is correct**

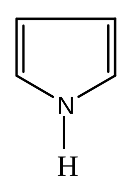
Marking scheme +4 for correct answer , 0 if not attempted and -2 in all other cases.

41. In the following compounds,


I)


II)

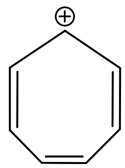

III)


IV)

The order of basicity is:

a) IV < I < III < II
b) III > I > IV > II
c) II < I < III < IV
d) I > III > II > IV

42. Arrange the following cations in decreasing order of stability:

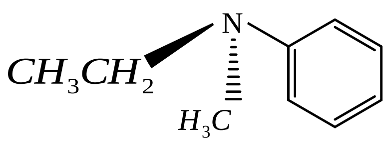


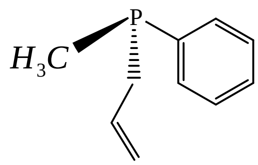
$CH_2{=}CH{-}\overset{\oplus}{C}H_2$ $\quad$ $Ph{-}\overset{\oplus}{C}H_2$ $\quad$ $CH_3{-}\overset{\oplus}{C}H_2$

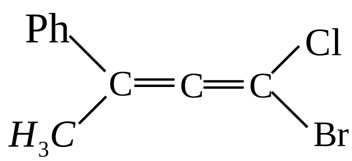
(P) (Q) (R) (S)

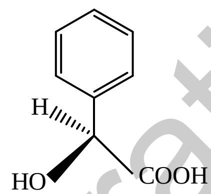
a) P > R > Q > S
b) R > P > S > Q
c) Q > R > P > S
d) P > Q > S > R

43. Among the following, the optically inactive compound is:

a) 

b) 

c) 

d) 

44. The number of S–S bonds, S – O – S bonds, σ – bonds & π - bonds are present in trimer of SO_3 are

a) 0, 3, 16, 2
b) 0, 3, 12, 6
c) 0, 6, 12, 16
d) 0, 4, 12, 6

45. Select the correct statement:

a) HSO_5^- ion has one S – O – H linkage
b) Number of B – O – B linkages in Borax is equal to number of P – O – P linkages in P_4O_{10}
c) Hybridization of both sulphur in $H_2S_2O_5$ is same but oxidation state of both sulphur are different
d) Tetra-polyphosphoric acid has four P – O – P and no P – P linkage

46. Consider the following conversions

i) $O_{(g)} + e^- \longrightarrow O^-_{(g)} \quad \Delta H_1$
ii) $F_{(g)} + e^- \longrightarrow F^-_{(g)} \quad \Delta H_2$
iii) $Cl_{(g)} + e^- \longrightarrow Cl^-_{(g)} \quad \Delta H_3$
iv) $O^-_{(g)} + e^- \longrightarrow O^{2-}_{(g)} \quad \Delta H_4$

The incorrect statement regarding above information:

a) ΔH_3 is more negative than ΔH_1 and ΔH_2

b) ΔH_1 is less negative than ΔH_2

c) ΔH_1, ΔH_2 and ΔH_3 are negative whereas ΔH_4 is positive

d) ΔH_1, and ΔH_3 are negative whereas ΔH_2 and ΔH_4 are positive

47. 'x' grams of $NaHSO_3$ could be completely neutralized by 200mL of a decimolar $NaOH$ solution. How much volume 0.1M $K_2Cr_2O_7$ can completely oxidize '2x' grams of $NaHSO_3$ in acidic medium?

a) 133.3 mL b) 66.5 mL c) 260 mL d) 200 mL

48. 0.01M CH_3COOH has 4.24% degree of dissociation. The degree of dissociation of 0.1M CH_3COOH will be.

a) 1.34% b) 4.24% c) 5.24% d) 0.33%

49. If 100 mL of H_2O takes 12 minutes to evaporate from a vessel on a heater connected to an electric source of 500W, the enthalpy of vaporization of water in kJ/mole is

a) 32.4 b) 43.2 c) 56.4 d) 64.8

50. 25 mL of household bleach solution was mixed with 30 mL of KI and 10 mL of 4N acetic acid. In the titration of liberated iodine, 48 mL of 0.25N $Na_2S_2O_3$ was used to reach the end point. The molarity of household bleach solution is

a) 0.48 M b) 0.96 M c) 0.24 M d) 0.024 M

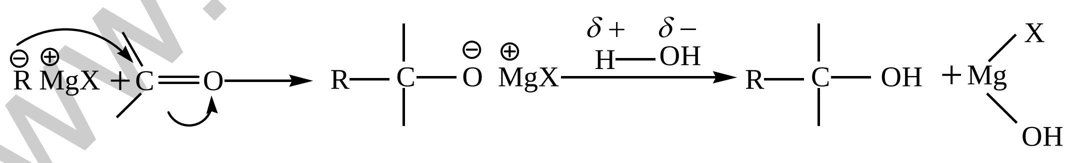
Section-2
(Paragraph Type With Integer)

This section contains **6 Integer Type questions** relating to three paragraphs with two questions on each paragraph. The answer to each of the questions is a single-digit integer, ranging from 0 to 9. For each question you will be awarded 3 marks if you darken ONLY the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases, minus one (-1) mark will be awarded

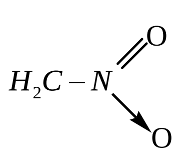
Marking scheme +3 for correct answer , 0 if not attempted and -1 in all other cases.

Passage-I

Since, Grignard reagents resemble carbanion, so they are strong nucleophile and strong base. Their most useful nucleophilic reaction is addition to carbonyl group.

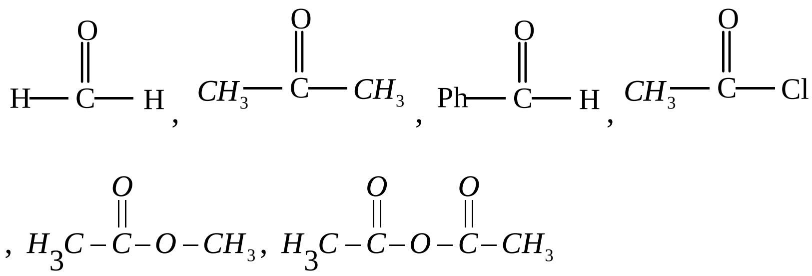


51. How many of the following compounds will not give acid-base reaction with RMgX?

CH_3-CH_2-Cl, CH_3OCH_3, 

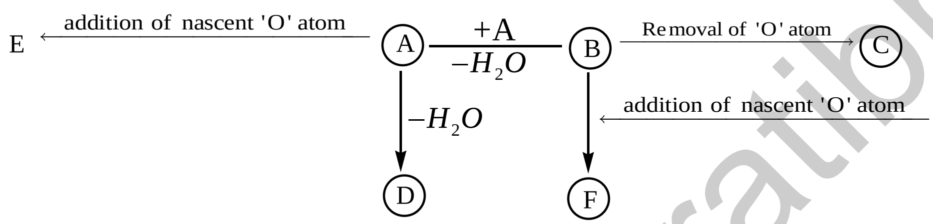
, H_2S, NH_3, CH_3CH_2OH

52. Number of compounds that give racemic mixture on reaction with excess $H_3C-MgBr$?



Passage-II

Consider the following sequence of reaction. If A is H_2SO_4, then give the answer of following Questions.



53. The number of hybrid orbitals involved in compound D

54. In the above reactions number of compounds which involves peroxy linkages.

Passage-III

The first law of thermodynamics for a closed system is $dU = dq + dw$; where $dw = dw_{pv} + dw_{non-pv}$. The most kind of w_{non-pv} is electrical work. As per IUPAC convention work done on the system is positive.

55. A system generates 50J is electrical energy, has 150 J of pressure – volume work done on it by the surroundings while releasing 300J of heat energy. The change in internal energy of the system is (-2×10^{x}). x is …………..

56 The system generates 50J of electrical energy and delivers 150J of PV- work against the surroundings, while releasing 300J heat energy. The change in internal energy of the system is $(-y\times10^{2})$ y is………..

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 +4 for correct answer , 0 if not attempted and -2 in all other cases.

57.

	Column-I		Column-II
A	$Ph-\overset{O}{\overset{\Vert}{C}}-CH_3$	P	Aldol condensation
B	$CH_3-\overset{O}{\overset{\Vert}{C}}-H$	Q	Positive iodoform test
C	$Ph-\overset{O}{\overset{\Vert}{C}}-H$	R	Negative test of Fehling's solution
D	CH_3CH_2OH	S	Oxidation with Cu/Δ

a) A – pqr; B-pq; C-r; D-qs
b) A – pqr; B-pq; C-rs; D-r
c) A – pqr; B-qs; C-r; D-pq
d) A – pq; B-rs; C-r; D-qs

58.

	Column-I		Column-II
A	Cellulose	P	Polymer
B	Protein	Q	Nitrogen containing
C	Glycogen	R	Stored food in human
D	Sucrose	S	Glycosidic linkage

a) A – ps; B-pq; C-s; D-pr
b) A – ps; B-s; C-pr; D-r
c) A – ps; B-pq; C-pr; D-s
d) A – ps; B-q; C-pr; D-rs

59.

	Column-I (Hydrolyzed Product)		Column-II (Compound that undergo hydrolysis)
A	H_2 gas evolved	p	CaH_2
B	Proton donor oxyacid is formed	q	$POCl_3$
C	Halogen acid is formed	r	NCl_3
D	Base is formed	s	SiH_4
		t	R_2SiCl_2

a) A–ps; B–qr; C–qs; D–ps
b) A–ps; B–qrs; C–qt; D–pr
c) A–ps; B–qr; C–pt; D–rs
d) A–ps; B–qs; C–qr; D–rs

60.

	Characteristic		Relation
A	Faraday's I law	p	$Z \times 96500$
B	Faraday's II law	q	96500C
C	Chemical equivalent mass	r	$W = Z \times i \times t$
D	One Faraday	s	$\frac{W_A}{W_B} = \frac{E_q.wt.of\ \ A}{E_q.wt.of\ \ B}$

a) A–q; B–r; C–p; D–s
b) A–r; B–q; C–s; D–p
c) A–r; B–s; C–p; D–q
d) A–s; B–r; C–p; D–q

KEY SHEET

Physics

1) D	2) A	3) B	4) A	5) D	6) A	7) C	8) A	9) C	10) A
11) 3	12) 1	13) 0	14) 2	15) 3	16) 4	17) A	18) C	19) D	20) A

Mathematics

21) B	22) A	23) A	24) C	25) B	26) C	27) D	28) D	29) A	30) C
31) 4	32) 2	33) 3	34) 1	35) 3	36) 4	37) A	38) B	39) C	40) D

Chemistry

41) D	42) A	43) A	44) B	45) C	46) D	47) A	48) A	49) D	50) C
51) 2	52) 1	53) 3	54) 2	55) 2	56) 5	57) A	58) C	59) B	60) C

EENADU PRATHIBHA NET

JEE ADVANCED-2017

MODEL PAPER-I : SOLUTIONS

PHYSICS

1. If υ_0 is the velocity of projection and α the angle of projection, the equation of trajectory is

$$y = x\tan\alpha - \frac{1}{2}\frac{gx^2}{\upsilon_0^2\cos^2\alpha}.......(1)$$

With origin at the point of projection,

$$gx^2 - 2\upsilon_0^2\sin\alpha\cos\alpha.x + 2\upsilon_0^2\cos^2\alpha.y = 0 ....(2)$$

Since the projectile passes through two points (a,h) and $(2a,h)$, then a and 2a must be roots of equation (2)

$$a + 2a = \frac{2\upsilon_0^2\sin\alpha\cos\alpha}{g}......(3)$$

And $a\times 2a = \frac{2\upsilon_0^2\cos^2\alpha h}{g}......(4)$

Dividing eqns. (3) by (4), we get

$$\frac{3a}{2a^2} = \frac{\tan\alpha}{h} \; or \; \tan\alpha = \frac{3h}{2a}$$

From eqn. (4) $\upsilon_0^2 = \frac{ga^2}{h}\sec^2\alpha = \frac{ga^2}{h}\left(1+\tan^2\alpha\right)$

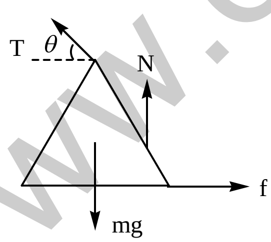
$$= \frac{ga^2}{h}\left(1+\frac{9h^2}{4a^2}\right) = \frac{g}{4}\left(\frac{4a^2}{h}+9h\right) \text{Or } \upsilon_0 = \frac{1}{2}\sqrt{\left(\frac{4a^2}{h}+9h\right)g}$$

2. Most important concept here is that man moves slowly. Slowly means, always in equilibrium

For the man,

$N + T\sin\theta - Mg = 0$ (vertical)

$F - T\cos\theta = 0$ (horizontal)



Maximum extension is obtained when static friction on man is maximum

For maximum extension, $f = \mu N$

For spring, $T = \cos\theta - kx = 0$ (horizontal)

Solve for T : $T = \cos\theta = kx \Rightarrow T = kx/\cos\theta$

Substitute for F and solve for N

$\mu N - T\cos\theta = 0$

Or $N = T\cos\theta/\mu = kx/\mu$

$$\frac{kx}{\mu} + \frac{kx\sin\theta}{\cos\theta} = Mg$$

$$kx(1+\mu\tan\theta) = \mu Mg$$

$$x = \frac{\mu Mg}{k(1+\mu\tan\theta)}$$

3. $W = \int F.dx = \int\left(y\hat{i} + x\hat{j}\right).\left(dx\hat{i} + dy\hat{j}\right) = \int(ydx + xdy) = \int d(xy)$

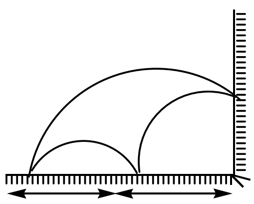
$$W = \int_{(0,0)}^{(1,1)} d(xy) = [xy]_{0,0}^{1,1} = 1$$

4. $R = \frac{2\upsilon_x\upsilon_y}{g}, T = \frac{2\upsilon_y}{g}$

After first collision

$$\upsilon'_x = e\upsilon_x$$

$$\upsilon'_y = \upsilon_y$$



Distance covered before 2nd collision

$$d_1 = \upsilon'_x.\frac{T}{2} = e\upsilon_x.\frac{T}{2} = \frac{e\upsilon_x\upsilon_y}{g}$$

After second collision

$$\upsilon''_x = \upsilon'_x$$

$$\upsilon''_y = e\upsilon'_y$$

$$d_2 = \frac{2\upsilon''_x\upsilon''_y}{g} = \frac{2e\upsilon_x e\upsilon_y}{g}$$

$$d_1 + d_2 = \frac{e\upsilon_x\upsilon_y}{g}(1+2e)$$

But $C_2 = C_2E = 4\mu F \times 3V = 12\mu C$

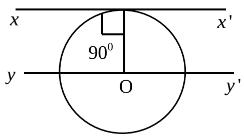
$$e(1+2e) = 1; \qquad 2e^2 + e - 1 = 0$$

$$e = \frac{-1 \pm \sqrt{1+8}}{4} = \frac{-1\pm 3}{4}$$

Rejecting-ve value e=1/2

5. The moment of inertia about an axis passing through the centre is

$$I' = \frac{1}{2}MR^2$$



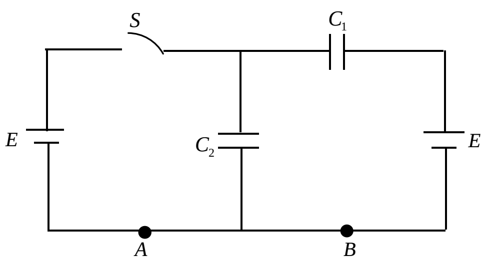
The moment of inertia about the XX' axis is

$$I = \frac{1}{2}MR^2 + MR^2 = \frac{3}{2}MR^2 = \frac{3}{2}(\rho L)R^2 = \frac{3}{2}(\rho L)(L/2\pi)^2 = \frac{3\rho L^3}{8\pi^2}$$

6. When switch S is open, the equivalent capacitance is

$$C = \frac{C_1C_2}{C_1+C_2} = \frac{2\times 4}{(2+4)} = \frac{4}{3}\mu F$$

Charge on the R.H.S. plate of C_1 and upper plate of C_2 is



$$Q = CE = \frac{4}{3}\mu F \times 3V = 4\mu C$$

When switch S is closed, the potential difference across C_1 is zero, because the batteries in opposition. Therefore, charge on the R.H.S. plate of $C_1 = 0$. If the charge flowing through B is q, then

$$Q + q = 0 \Rightarrow q = -Q = -4\mu C$$

Now the charge on the upper plate of $C_2 = C_2E = 4\mu F \times 3V = 12\mu C$, which is the charge flowing through A.

7. Time period $T = \frac{2\pi r}{\upsilon}$.

The particle passes through a given point on the circle after one complete revolution. Hence the current round the circle is $I = \frac{q}{T} = \frac{q\upsilon}{2\pi r}$

Magnetic moment M= current x area enclosed by the circular current

Or $M = I \times \pi r^2 = \frac{q\upsilon}{2\pi r} \times \pi r^2 = \frac{q\upsilon r}{2}$

Angular momentum $L = m\upsilon r$

$$\therefore \frac{M}{L} = \frac{q\upsilon r}{2} \times \frac{1}{m\upsilon r} = \frac{q}{2m}$$

8. Mutual inductance $M = \frac{\mu_0 A N_1 N_2}{l} = \frac{4\pi \times 10^{-7} \times \pi (0.025)^2 \times 700 \times 50}{1.0} = 8.6\times 10^{-5} H$

$$|e| = M\frac{dI}{dt} = 8.6\times 10^{-5} \times \frac{5-0}{0.01} = 4.3\times 10^{-2} V$$

9. The critical angle is given by

$$\sin i_c = \frac{\mu_c}{\mu_g} = \frac{1.5}{\sqrt{3}} \Rightarrow \sin i_c = \frac{\sqrt{3}}{2} \Rightarrow i_c = 60^0$$

For total internal reflection, the angle of incident at B must be greater than 60^0. Angle r which is $\left(90^0 - i_c\right)$ must be less than 30^0, i.e. $r_{\max} = 30^0$. Applying Snell's law at A, we have

$$1 \times \sin i_{\max} = \sqrt{3} \sin r_{\max} \quad = \sqrt{3} \sin 30^0 \quad = \frac{\sqrt{3}}{2}$$

Which gives $i_{\max} = 60^0$.

10. Given $T_A = 1$ hour and $T_B = 2$ hours. At t = 0 , number of atoms of A = number of atoms of $B = N_0$.

$\therefore$ Number of atoms of A after 2 hours (i.e. after 2 half lives of A) is

$$N_A = N_0 \left(\frac{1}{2}\right)^2 = \frac{N_0}{4}$$

Number of atoms of B after 2 hrs (i.e. after 1 half life of B) is

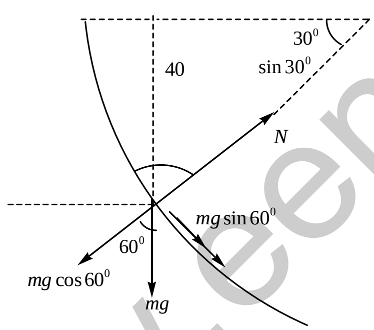
$$N_B = \frac{N_0}{4}$$

Now $\left|R\right| = \lambda N = \frac{0.696N}{T}$. Therefore.

$$R_A = \frac{0.693N_A}{T_A} \; and \; R_B = \frac{0.693N_B}{T_B}$$

$$\therefore \quad \frac{R_A}{R_B} = \frac{N_A}{N_B} \times \frac{T_B}{T_A} = \frac{N_0/4}{N_0/2} \times \frac{2}{1} = 1$$

11.



$$N - mg\cos 60^0 = \frac{mv^2}{r} \qquad \therefore N = mg\cos 60^0 + \frac{mv^2}{r} ....(1)$$

Loss in P.E.= $mg \times 40 \sin 30^0 = 200J$

Work done in over coming friction = 150 J

$\therefore$ K.E. possessed by the particle = 50 J

$$\therefore \; \frac{1}{2}mv^2 = 50J$$

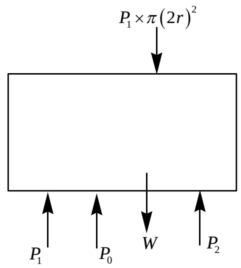
$\therefore \; mv^2 = 100J$ ……………….(2)

From (1) and (2), $N = 1 \times 10 \times \frac{1}{2} + \frac{100}{40} = 5 + 2.5 = 7.5N$

12. From (2), $mv^2 = 100J$

$\therefore v = 10ms^{-1}$

13. Consider The equilibrium of wooden block . Forces acting in the downward direction are



Weight of wooden cylinder

$= \pi(2r)^2 \times h \times \frac{\rho}{3} \times g = \pi \times 4r^2 \frac{h\rho}{3} g$

Force due to pressure (P_1) created by liquid of height h_1 above the wooden block is

$= P_1 \times \pi(2r)^2 = [P_0 + h_1\rho g] \times \pi(2r)^2$

Force acting on the upward direction due to pressure P_2 exerted from below the wooden block and atmospheric pressure is

$= P_2 \times \pi\left[(2r)^2 - r^2\right] + P_0 \times \pi(r)^2$

$= \left[P_0 + (h_1 + h)\rho g\right] \times \pi \times 3r^2 + P_0\pi r^2$

At the verge of rising

$\left[P_0 + (h_1 + h)\rho g\right] \times \left(\pi \times 3r^2\right) + \pi r^2 P_0$

$= [P_0 + h_1\rho g] \times 4\pi r^2 + \frac{\pi \times 4r^2 h\rho g}{3}$ Or $h_1 = \frac{5h}{3}$

14. Considering equilibrium of wooden block. Total downward force = Total force upwards Wt. of block + force due to atmospheric pressure = Force due to pressure of liquid + Force due to atmospheric pressure

$\pi\left(16r^2\right)\frac{\rho}{3} \times g + P_0\pi \times 16r^2 = [h_2\rho g + P_0]\pi\left[(16-4)r^2\right] + P_0 \times 4r^2 \Rightarrow \frac{4}{9}h = h_2$

15. We know that $P = V \times 1$

$\therefore I = \frac{P}{V} = \frac{600 \times 1000}{4000}$ $\therefore I = 150A$

Total resistance = $0.4 \times 20 = 8\Omega$

$\therefore$ Power dissipated as heat $= I^2R = (150)^2 \times 8 = 180,000W$

$\therefore \%\text{loss} = \frac{180}{600} \times 100 = 30\%$

16. For step up transformer $\frac{N_s}{N_p} = \frac{V_s}{V_p} \Rightarrow \frac{10}{1} = \frac{V_s}{4000}$

$\therefore V_s = 40,000V$

For step down transformer $\frac{N_p}{N_s} = \frac{V_p}{V_s} = \frac{40,000}{200} = \frac{200}{1}$

17. A) As the ideal gas expands in vacuum, no work is done (W=0). Also the container is insulated therefore no heat is lost or gained (Q=0). According to first law of thermodynamics

$\Delta U = Q + W$

$\therefore \Delta U = 0 \Rightarrow$ There is no change in the temperature of the gas

B) Given $PV^2 =$ constant………(i)

Also for an ideal gas $\frac{PV}{T} =$ constant

From (i) & (ii) $V \times T =$ constant

As the gas expands its volume increases and temperature decreases

$\therefore (p)$ is the correct option

To find whether heat is released or absorbed let us find a relationship between Q and change in temperature ΔT.

We know that $Q = nC\Delta T$..............(i)

Where C = molar specific heat

Also for a polytripic process we have

$C = C_v + \frac{R}{1-n}$ and $PV^n =$ constant

Here $PV^2 =$ Constant. Therefore n =2

$\therefore C = C_v + \frac{R}{1-2} = C_v - R$

For mono atomic gas

$C_v = \frac{3}{2}R$

$\therefore C = \frac{3}{2}R - R = \frac{R}{2}$

Substituting this value in (1) we get

$Q = n \times \frac{R}{2} \times \Delta T$.

In this case the temperature decreases i.e. ΔT is negative. Therefore Q is negative. This in turn means that heat is lost by the gas during the process. (r) is the correct option.

C) Proceeding in the same way we get in this case $V^{1/3} \times T =$ constant

$\Rightarrow$ As the gas expands and volume increases, the temperature decreases. Therefore (p) is the correct option

In this process, $x = \frac{4}{3}$.

$\therefore C = C_v + \frac{R}{1-\frac{4}{3}} = \frac{3}{2}R + \frac{3R}{-1} = \frac{3}{2}R - 3R = \frac{-3R}{2}$ $\therefore Q = n\left(\frac{-3R}{2}\right)\Delta t$

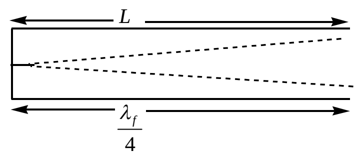
As ΔT is negative, Q is positive. This in turn means that heat is gained by the gas during the process (s) is the correct option.

D) Also $\Delta T = \dfrac{\Delta(PV)}{nR}$

Here $\Delta(PV)$ is positive $\therefore \Delta T$ is positive $\therefore$ temperature increase increases(q) is the correct option From the graph it is clear that during the process the pressure of the gas increases which shows that the internal energy of the gas has increased. Also the volume increases which means work is done by the system which needs energy. From these two interpretation we can comfortably conclude that the gas gains heat during the process. (s) is the correct option.

18. A) Pipe closed at one end

Waves produced are longitudinal (sound waves)

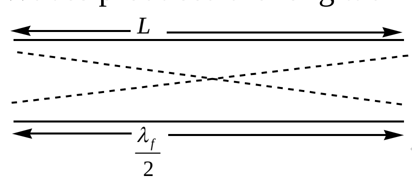


$$\frac{\lambda f}{4} = L \quad \therefore \lambda_f = 4L$$

(p, t) are correct matching

A) Pipe open at both ends

Waves produced are longitudinal (sound waves)

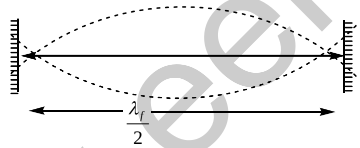


$$\frac{\lambda f}{2} = L \quad \therefore \lambda_f = 2L$$

(p, s) are correct matching

B) Stretched wire clamped at both ends

Waves produced are transverse in nature. (waves on string)

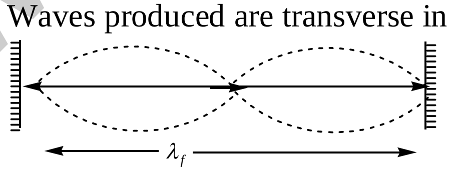


$$\frac{\lambda f}{2} = L \quad \therefore \lambda_f = 2L$$

(q, s) are correct matching

C) Stretched wave clamped at both ends & mid point

Waves produced are transverse in nature (waves on string)



$$\lambda_f = L$$

(q, r) are correct matching

19. A) For the ray to bend towards the normal at the prism surface $\mu_2 > \mu_1$. The ray then moves away from the normal when it emerges out of the rectangular block. Therefore $\mu_2 > \mu_3$.

B) As there is no deviation of the ray as it emerges out of the prism, $\mu_2 = \mu_1$.

C) As the ray emerges out of prism, it moves away from the normal. Therefore $\mu_2 < \mu_1$. As the ray moves away from the normal as it emerges out of the rectangular block, therefore $\mu_2 > \mu_3$.

D) At the prism surface, total internal reflection has taken place. For this $\sin 45^0 > \frac{h_2}{h_1}$

$\therefore\ \mu_1 > \sqrt{2}\mu_2$.

20. p) When an uncharged capacitor is connected to a battery, it becomes charged and energy is stored in the capacitor. (A) is the correct option.

q) When a gas in an adiabatic container fitted with an adiabatic piston is compressed by pushing the piston

i) the internal energy of the system increases

$\Delta U = Q - W = 0 - (-PdV) = +PdV$

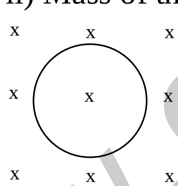
ii) Mechanical energy is proceeded to the piston which is converted into kinetic energy of the gas molecules.

r) None of the options in column I matches. As the gas in a rigid container gets cooled, the internal energy of the system will decrease. The average kinetic energy per molecule will decrease.

s) When a heavy nucleus initially at rest splits into two nuclei of nearly equal masses and some neutrons are emitted then

i) Internal energy of the system is converted into mechanical energy (precisely speaking kinetic energy) and

ii) Mass of the system decreases which converts into energy



t) When a resistive wire loops is placed in a time varying magnetic field perpendicular to its plane.

i) Induced current shows in the loop due to which the energy of system is increased.

MATHEMATICS

21. $I_1 = 1, I_2 = \frac{\sqrt{2}}{2}$

22. $\int_{-a}^{a} f(x) = 0, f(x) \, is \ odd$

23. $f(a) + f(-a) = 1, f(a+b-x) = f(x)$

24. $f(x) = co3x, \int \cos 3x \, dx = \frac{\sin 3x}{3}$

25. $[\cot x] + [-\cot x] = -1$

26. $use \ f(x)$

27. $1 \le x < 2, [x] = 1$

28. $x + \tan^{-1} x = t$

29. Image of $(0,0) \, in \, x + y + 4 = 0 \quad (-4,-4)$

30. $x + z - 1 + \lambda y = 0$

31. Conceptual (I.P.E)

32. L (1, 2), L"= (1,-2), x+y=3 and x-y=3, distance = radius

33. Cosine rule

34. $|z_1 - z_2| =$ Distance between points

35. $b = \frac{2ac}{a+c}$

36. F (-1)

37. Conceptual

38. N(S) =n! N (E) = (n-r+1)!

39. Compound theorem

40. det(A- λ I)=0

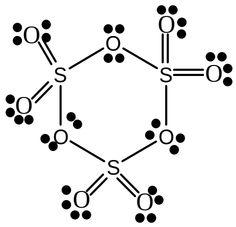
$\lambda^3 - 18\lambda^2 + 99\lambda - 162 = 0$

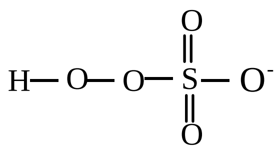
CHEMISTRY

41. % s-character $\alpha \dfrac{1}{Basicity}$

42. P>R>Q>S

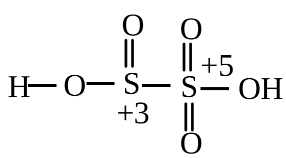
43. Due to pyramidal inversion, Nitrogen compound is optically inactive.

44. 

45. 

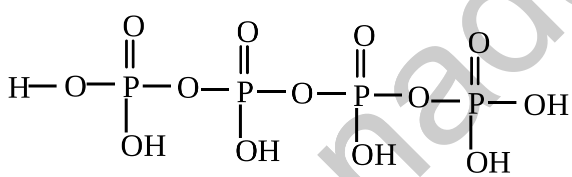
no.of B – O – B linkages 5 in borax

no. of P – O – P linkages 6 in P_4O_{10}



both 'S' are Sp^3

Tetra polyphosphoric acid $H_6P_4O_{13}$



no. of P – O – P linkages 3

46. Order of electron gain enthalpy : Cl>F>O

Second EA always +Ve

47. 20 milli moles of NaOH = 20 milli moles of $NaHSO_3$

= 40 milli equivalent of $NaHSO_3$

$\because$ x grams of $NaHSO_3$ = 40 meq (or) 0.04 equivalents.

2x grams of $NaHSO_3$ = 0.08 equivalents

Hence $0.08 = V \times 0.1 \times 6\left(of\ \ K_2Cr_2O_7\right)$

$\therefore\ V = \dfrac{0.08}{0.6} L = 133.3mL$

48. $\dfrac{\alpha_1}{\alpha_2} = \sqrt{\dfrac{C_2}{C_1}} \Rightarrow \dfrac{4.24}{\alpha_2} = \sqrt{\dfrac{0.1}{0.01}}$ (or) $\dfrac{4.24}{\alpha_2} = 3.162$ or $\alpha = \dfrac{4.24}{3.162} = 1.34\%$

49. Energy = Power × time = $500\times12\times60$=3,60,00 Joules

= 360 kJ per 100 gm of water.

$\therefore$ For 18gm of water = 64.8 kJ.

50. $48(mL)\times0.25N\ Na_2S_2O_3 = 12 meq. of\ Na_2S_2O_3$

= 12 meq. of I_2

= 12 meq. of Cl_2

= 12 meq. of house hold bleach

Hence normality of house hold bleach = $\frac{12}{25} = 0.48N = 0.24M$

51. CH_3-CH_2-Cl & $H_3C-O-CH_3$ do not have acid-base reaction with Grighard reagent.

52. Only $Ph-\overset{\overset{O}{\|}}{C}-H$ with CH_3mgBr forms Racemic mixture.

53-54. $H_2SO_5 \xleftarrow{O} H_2SO_4 \xrightarrow[-H_2O]{+H_2SO_4} H_2S_2O_7 \xrightarrow{-O} H_2S_2O_6$

$H_2SO_4 \xrightarrow{-H_2O} SO_3$

$H_2S_2O_7 \xrightarrow{+O} H_2S_2O_8$

55. $\Delta U = q + w = -(300+50)+150 = -200 = -2\times10^2$

$\therefore\ x = 2$

56. $\Delta U = q + w \quad = -(300+50)-150 = -500 = -5\times10^2$

$\therefore\ y = 5$

57. Conceptual

58. Conceptual

59. $CaH_2 \xrightarrow{H_2O} Ca(OH)_2 + H_2$

$POCl_3 \xrightarrow{H_2O} H_3PO_4 + HCl$

$NCl_3 \xrightarrow{H_2O} NH_3 + HOCl$

$B_2H_6 \xrightarrow{H_2O} H_3BO_3 + H_2$

$R_2SiCl_2 \xrightarrow{H_2O} R_2Si(OH)_2 + HCl$

60. Conceptual

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