# MasterJEE

IIT-JEE | Medical | Foundations

## Master JEE CLASSES

**Kukatpally, Hyderabad.**

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**JEE-ADVANCED-2014-P2-MODEL** **Max. Marks: 180**

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# PAPER-II

**IMPORTANT INSTRUCTIONS:**

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

**OPTICAL RESPONSE SHEET:**

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

**DARKENING THE BUBBLES ON THE ORS**

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

**IMPORTANT INSTRUCTIONS** **Max Marks: 180**

## PHYSICS:

| Section | Question Type | +Ve Marks | - Ve Marks | No. of Qs | Total marks |
|---|---|---|---|---|---|
| Sec – I(Q.N : 1 – 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** |

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## 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

1. A body of mass 'm' is hauled from the earth's surface by applying a variable force F varying with height 'h' as $\vec{F} = 2(ah-1)m\vec{g}$ where a is a +ve constant. For first half of the height ascended, choose the correct statement: (Neglect variations of g with height)

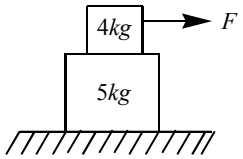
   A) Work done by F is $\frac{5mg}{2a}$

   B) Increase in gravitational potential energy is $\frac{mg}{2a}$

   C) Data insufficient

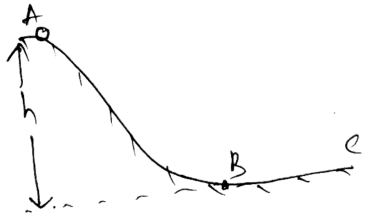
   D) Kinetic energy of the body is $\frac{3mg}{4a}$

2. A large slab of mass 5kg lies on a smooth horizontal surface with a block of mass 4kg lying on top of it, $\mu$ between block and slab is 0.25.If the block is pulled horizontally by a force of F=6N. The work-done by a force of friction on the slab, between the instants t=2s and t=3s is $\left(g = 10ms^{-2}\right)$ (Initial speeds is 0)



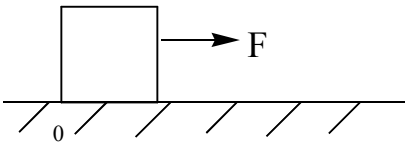

A) 2.4 J B) 5.55 J C) 4.44 J D) 10 J

3. A small object of mass m slides down very slowly along a rough uneven hilly plane from a height h and stops after travelling a certain distance BC on a horizontal surface. The work needed to be done to return the object to its initial position along the same path very slowly would be




A) zero B) mgh C) 2mgh D) cannot be found

4. A block of mass 'm' is kept at point O on a rough horizontal surface whose coefficient of friction varies from O as $\mu = 0.5 + \frac{1}{5-x}[\forall x < 3m]$



If the block is moved by an external force F, the work done by frictional forces during the first 3m is (neglect the size of the block)

A) $-mg\left[\frac{3}{2}-\ln\left(\frac{5}{2}\right)\right]$ B) $-mg\left[\frac{2}{3}-\ln\left(\frac{2}{5}\right)\right]$

C) $-mg\left[\frac{3}{2}-\ln\left(\frac{2}{5}\right)\right]$ D) $-mg\left[\frac{3}{2}-\ln\left(\frac{2}{3}\right)\right]$

5. A book of mass m is projected with a speed V across a horizontal surface. The book slides until it stops due to frictional force between book and surface. The surface is now tilted $30^0$ and the book is projected up the surface with the same initial speed V. When the book has come to rest, how does the decrease in mechanical energy of the book-earth system compare to that when the book slide over the horizontal surface?

A) It is the same B) It is larger

C) It is smaller D) The relationship can't be determine

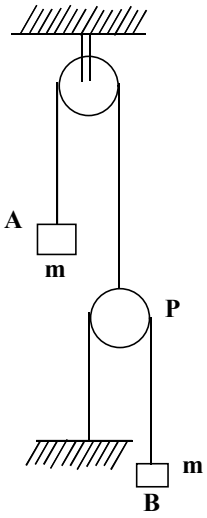
6. The force exerted by a compression device is given by $F(x)=kx(x-l)$ for $0\le x\le l$ where $l$ is maximum possible compression and $k$ is a constant. The work required to compress the device a distance d is maximum when

A) $d=l/4$ B) $d=\frac{l}{\sqrt{2}}$ C) $d=\frac{l}{2}$ D) $d=l$

7. The potential energy of a 1 kg particle free to move along the X-axis is given by $v(x)=\left(\frac{x^4}{4}-\frac{x^2}{2}\right)J$. The total mechanical energy of the particle is 2J. Then, the maximum speed(in $ms^{-1}$) is

A) $\frac{1}{\sqrt{2}}$ B) $\sqrt{2}$ C) $\frac{3}{\sqrt{2}}$ D) 2

8. In the figure shown the system is released from rest. Find the velocity of block A when block B has fallen a distance $l$. Assume all pulleys to be mass less and frictionless.




A) $\sqrt{\frac{gl}{2}}$ B) $\sqrt{\frac{gl}{3}}$ C) $\sqrt{\frac{4gl}{5}}$ D) $\sqrt{\frac{gl}{5}}$

9. Consider the following statements regarding potential energy.

(i) Potential energy can be positive or negative.

(ii) A moving body may or may not have potential energy.

(iii) Potential energy can be defined for any type of force.

(iv) Potential energy depends on frame of reference.

( v) Potential energy corresponding to an internal conservative force will increase when the particle moves opposite to the direction of that conservative force

(vi) Potential energy can be defined as a scalar function of position whose negative derivative (gradient) gives force

No. of correct statements

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

10. Which of the following forces is a conservative force.

A) $\vec{F} = (xyz)\hat{i} + (x^2z)\hat{j} + (x^2y)\hat{k}\ N$ B) $\vec{F} = (2xyz)\hat{i} + (x^2z)\hat{j} + (x^2y)\hat{k}\ N$

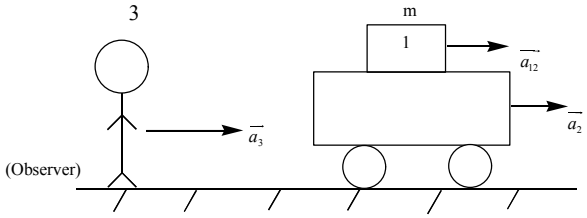
C) $\vec{F} = (xyz)\hat{i} + (xz^2)\hat{j} + (x^2y)\hat{k}\ N$ D) $\vec{F} = (xyz)\hat{i} + (xz^2)\hat{j} + (xy^2)\hat{k}\ N$

## Section-2
## (Paragraph Type)

This section contains 3 paragraphs each describing theory, experiment, data etc. Six questions relate to three paragraphs with two questions on each paragraph. Each question pertaining to a particular paragraph should have **only one correct answer** among the four choices A, B, C and D.

**PASSAGE: 01**

A block of mass $m_1$ moves with an acceleration $a_{12}$ relative to the plank 2 as shown in figure. Assume zero initial velocities of the bodies and observer (assume all accelerations are along the same direction)




11. What is the work done by the pseudo force as observed by the man on the block during time t?

A) $\frac{+ma_3(a_{12}+a_2-a_3)t^2}{2}$ B) $\frac{-ma_3(a_{12}-a_2-a_3)t^2}{2}$

C) $\frac{-ma_3(a_{12}+a_2-a_3)t^2}{2}$ D) $\frac{+ma_3(a_{12}+a_2+a_3)t^2}{2}$

12 The work done by the inertial force on the block relative to the observer on the ground during time t.

A) $-\frac{1}{2}ma_3t^2$ B) $-\frac{1}{2}ma_3a_{12}t^2$ C) 0 D) $\frac{1}{2}m(a_{12}+a_2)t^2$

**PASSAGE : 02**

A particle A is fixed at origin of a fixed coordinate system. Another particle B which is free to move experiences an force $\vec{F}=\left(\frac{-2\alpha}{r^3}+\frac{\beta}{r^2}\right)\hat{r}$ due to particle A where $\vec{r}$ is the position vector of particle relative to A. It is given that the force is conservative in nature and potential energy at $\infty$ is zero. If has to be removed from the influence of A, energy has to be supplied for such a process. The ionisation energy $E_0$ is work that has to be done by an external agent to move the particle from a distance $r_0$ very slowly. Here $r_0$ is the equilibrium of the particle

13. The potential energy of particle as a function of r

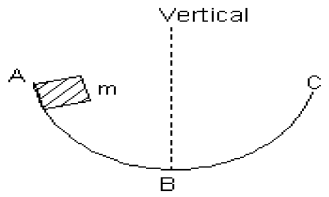
A) $\frac{\alpha}{r^2}-\frac{\beta}{r}$ B) $\frac{-\alpha}{r^2}+\frac{\beta}{r}$ C) $\frac{-\alpha}{r^2}-\frac{\beta}{r}$ D) $\frac{\alpha}{r^2}+\frac{\beta}{r}$

14. The ionisation energy $E_0$ of the particle B (magnitude)

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

**PASSAGE : 03**

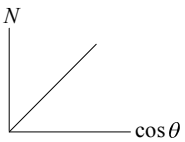
A fixed hemispherical bowl is arranged as shown. A and C are points at the same horizontal level. B is the bottom most point. A small block of mass m is initially placed at A. R is the radius of the bowl. (If necessary take g = 10m/s$^2$)

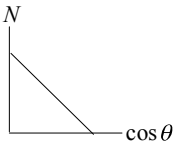


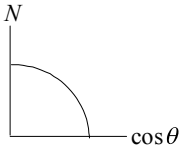

15. If bowl is considered as rough and when block is released from A, it comes to rest at B. The work done by the friction as it moves from A to B is

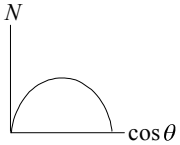
A) – mgR  B) $\frac{mgR}{2}$  C) -2mgR  D) $-\frac{mgR}{2}$

16 Now consider that bowl is completely smooth and block is released from A. If N is the normal reaction and $\theta$ is the angle made by the radius vector at any instant with the vertical axis, which of the following graphs represent the graph of N versus , as it moves from A to B ?

A) 


B) 


C) 


D) 

**Matching - 1**

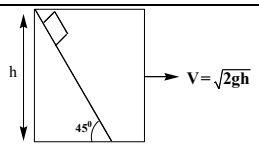
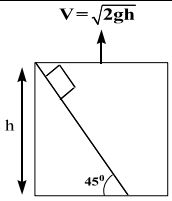
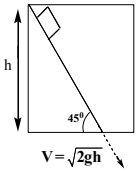
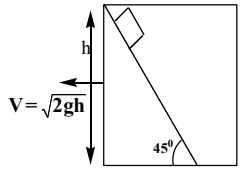
17. In column-I a force $\vec{F}$ is given and in column-II work done by that force between two specified points A and B is given. Match the appropriate column.

| Column – I | Column-II |
|---|---|
| A) $\vec{F}=\left(3x^2y\right)\hat{i}+\left(x^3\right)\hat{j}$ From A(0,0,0) to B(1,1,1) | P) $2\pi Rk$ |
| B) $\vec{F}=-k\left(y\hat{i}+x\hat{j}\right)$ From A(0,0) to B(a, a) | Q) -9 |
| C) $\vec{F}=k\left(\frac{-y\hat{i}}{\sqrt{x^2+y^2}}+\frac{x\hat{j}}{\sqrt{x^2+y^2}}\right)$ moves from A(0,0) to B(0,0) along a circular path of radius R in xy plane centered at origin in anti clockwise direction. | R) $-ka^2$ |
| D) $\vec{F}=k\left(\frac{x\hat{i}}{\left(x^2+y^2\right)^{3/2}}+\frac{y\hat{j}}{\left(x^2+y^2\right)^{3/2}}\right)$ A(0,0) to B(0,a) along a circular arc of radius R centered at origin. | R) zero |

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

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

18. Figure shows four situations in which a small block of mass 'm' is released from rest (with respect to smooth fixed wedge) as shown in figure. Column –II shows work done by normal reaction on the block (with respect to an observer who is stationary on ground) till block reaches at the bottom of inclined wedge, match the appropriate column.

| **Column – I** | **Column-II** |
|---|---|
| A)   | P) positive |
| B)   | Q) negative |
| C)   | R) equal to mgh in magnitude |
| D)   | S) equal to zero |

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

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

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

D) A-P; B-P; C-P; D

19 A chain of length $l$ and mass $m$ lies on the surface of a smooth sphere of radius $R > l$ with one end tied to the top of the sphere

| Column I | | Column II | |
|---|---|---|---|
| A) | Gravitational potential energy of the chain with reference level at the centre of the sphere | P) | $\frac{Rg}{l}\left(1-\cos\left(\frac{l}{R}\right)\right)$ |
| B) | The chain is released and slides down, its KE when it has slid by an angle $\theta$ | Q) | $\frac{2Rg}{l}\left(\sin\left(\frac{l}{R}\right)+\sin\theta-\sin\left(\theta+\frac{l}{R}\right)\right)$ |
| C) | The initial tangential acceleration (just after it is released) | R) | $\frac{mR^2g}{l}\sin\left(\frac{l}{R}\right)$ |
| D) | The magnitude of radial acceleration $a_r$ of any element of the chain when it had slid down by angle $\theta$ | S) | $\frac{mR^2g}{l}\left(\sin\left(\frac{l}{R}\right)+\sin\theta-\sin\left(\theta+\frac{l}{R}\right)\right)$ |

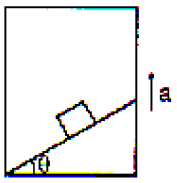
A) A – S, B – R , C – P, D – Q  B) A – Q, B – S, C – P, D – R

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

20. A block of mass m is stationary with respect to a rough wedge as shown in figure.

Starting from rest work done on block in time t :

If $m = 1kg,\ \theta = 30^0,\ a = 2m/s^2, t = 4s\ and\ g = 10\,m/s^2$




| **Column - I** | **Column - II** |
|---|---|
| A) By gravity | P) 144 J |
| B) By normal reaction | Q) 32 J |
| C) By friction | R) 56 J |
| D) By all the forces | S) 48 J |
| | T) none |

A) A - T; B - P; C - Q; D – S

B) A - Q; B - P; C - S; D – T

C) A - T; B - Q; C - S; D – P

D) A - T; B - P; C - S; D – Q

## Section-1
## (One or more options 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

21. The statement that is not true for the long form of the periodic table:

A) It reflects the sequence of filling electrons in the order of sublevels s, p, d and f.

B) It helps to predict the stable valence states of elements

C) It reflects trends in physical and chemical properties of elements

D) It helps to predict the relative ionicity of bond between any two elements

22. Which of the following represent correct order of first ionization enthalpy for Ca, Ba, Se, S and Ar?

A) Ca < Ba < S < Se < Ar B) Ca < S < Ba < Se < Ar

C) S < Se < Ca < Ba < Ar D) Ba < Ca < Se < S < Ar

23. If $1.96\times10^{4}\,kJ$ energy is supplied to 1 mole $Li_{(g)}$ it ionises to $Li^{+3}$. If $\text{I.E}_1$ for $Li$ is $520\text{kJ mol}^{-1}$ and IE for H is $2.18\times10^{-18}\text{J atom}^{-1}$. The $\text{IE}_2$ for Li will be

A) $7270\,\text{kJ mol}^{-1}$ B) $11.81\times10^{3}\,\text{kJ mol}^{-1}$

C) $6.54\times10^{-3}\,\text{kJ mol}^{-1}$ D) $3.32\times10^{4}\,\text{kJ mol}^{-1}$

24. The correct order of decreasing electronegativities values among Be(I), oxygen (II), Nitrogen(III) and magnesium (IV) is:

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

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

25. The first and second ionization potentials of an element M (atomic weight = 25) are 800 and 1500 kJ $mol^{-1}$ respectively. Calculate the percentage of $M^{+2}$ (g) ions formed if 5 g of M(g) absorbs 250 kJ of energy.

A) 70 B) 40 C) 60 D) 30

26. Which of the following order is correct regarding the atomic radii?

A) Cr > Mn > Fe B) V < Nb < Ta

C) Sc < Y < La D) Ce < Eu < Lu

27. The correct order of size is:

A) $Cr^{+3} < Cr^{+4} < Cr^{+5}$ B) $C^{4-} < N^{3-} < O^{2-}$

C) Fe> $Fe^{+2}$ > $Fe^{+3}$ D) $He^{+} < Li^{+2} < Be^{+3}$

28. Given that

i) $IP_2$ order of $C < N < F < O$

ii) First negative electron gain enthalpy of $S > Se > Te > O$

iii) First ionisation enthalpy of $Sc > Y > La$

iv) Electron gain enthalpy with sign $Ne > Ar > Kr > Xe$

Number of correct statements are

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

29. In which of the following the order is not correct, according to the property indicated against it?

A) Na>Mg>Al – Second ionization potential

B) $P < S < Cl$ non metallic character

C) $F_2 > Cl_2 > Br_2 > I_2$ Oxidising power

D) $P_2O_5 < SO_3 < Cl_2O_7 \rightarrow$ Acidic nature

30. Linus Pauling wanted to determine the electron gain enthalpy (electron affinity) of an unknown element **X**. He took one mole of atoms of **X** and found that on absorption of 410 kJ of energy half of **X**-atoms transfer one electron to the other half. To convert all the resulting $\mathbf{X}^-$ ions to $\mathbf{X}^+$ ions, an additional energy of 735 kJ was required. What was the electron gain enthalpy of **X** as obtained by Linus Pauling?

A) $-270\,kJ\,mol^{-1}$ B) $-325\,kJ\,mol^{-1}$ C) $-540\,kJ\,mol^{-1}$ D) $-650\,kJ\,mol^{-1}$

## Section-2
## (Paragraph Type)

This section contains 3 paragraphs each describing theory, experiment, data etc. Six questions relate to three paragraphs with two questions on each paragraph. Each question pertaining to a particular paragraph should have **only one correct answer** among the four choices A, B, C and D.

**Comprehension: 1**

The first $(\Delta_i H_1)$ and the second $(\Delta_i H_2)$ ionisation enthalpies in kJ $mol^{-1}$ and the electron gain enthalpy in kJ $mol^{-1}$ of a few elements (two metals of same group and two non-metals of same group along with a another non metal) are given below:

| Elements | $\Delta_i H_1$ | $\Delta_i H_2$ | $\Delta_{eg} H$ |
|---|---|---|---|
| (P) | 520 | 7300 | -60 |
| (Q) | 419 | 3051 | -48 |
| (R) | 1681 | 3374 | -333 |
| (S) | 1008 | 1846 | -295 |
| (T) | 2372 | 5251 | +48 |

Answer the following questions.

31. Which one of the above elements is least reactive non metal and most reactive metal respectively?

A) (R) and (Q) B) (S) and (T) C) (T) and (Q) D) (T) and (P)

32. Which one of the above elements is most reactive non metal and least reactive metal respectively?

A) (P) and (Q) B) (R)and (P) C) (R) and (T) D) (S) and (P)

**Comprehension: 2**

E.N is the tendency of an atom to attract the shared electron pair towards it in a covalent bond. Since it is a relative property it has no units. Hence various scales are proposed such as Mullikan scale, Pauling scale, Allred-Rochowe scale. The most accepted is of Pauling based on bond energy data and more particularly on Ionic-covalent bond resonance energy .While Mulliken scale is applicable to mono valent elements says that E.N is the average of I.P and E.A. Electro negativity on Mulliken scale is 2.8 times more than that of calculated from Pauling scale.

33. H – H, X – X, and H – X bond energies are 104 kcal/mol 38 kcal/mol and 135 kcal/mol respectively. Electro negativity of 'X' is.

A) 3.76 B) 3.21 C) 2.85 D) 1.72

34. If electron affinity of 'X' is 333 kJ/mol then Ionization energy of 'X' is:

A) 1712 kJ/mol B) 874 kJ/mol

C) 1012 kJ/mol D) 2045 kJ/mol

**Comprehension: 3**

In an universe other than earth all the quantum numbers have same value as on earth except '$\ell$' and '**s**'. Azimuthal quantum number can have values from 0 to (n + 1) in integral step and s (spin quantum no.) has values of $\left(-\frac{1}{2}, 0 \& +\frac{1}{2}\right)$. If all rules like Aaufbau rule, Hund's rule and Paulis exclusion rule follow in other universe also.

35. Configuration of element with atomic number 29 will be

A) $1s^3, 1p^9, 2s^3, 1d^{14}$ B) $1s^3, 2s^3, 2p^9, 3s^3, 3p^9, 4s^2$

C) $1s^2, 1p^6, 2s^2, 1d^{10}, 2p^9$ D) $1s^3, 1p^6, 2p^9, 2s^2, 1d^{10}$

36. No. of elements in third period of another universe will be

A)27 B)12 C)36 D)42

## Section-3

### (Matching List Type)

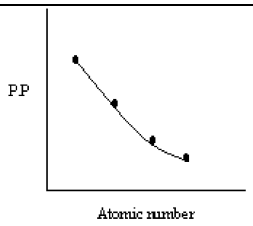
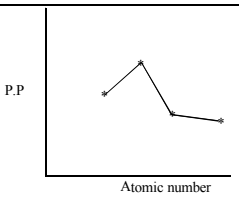
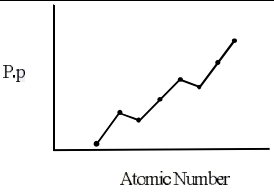
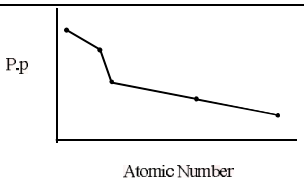
This section contains four questions, each having two matching lists (**List-1** & **List-II**). The options for the correct match are provided as (A), (B),(C) and (D) out of which **ONLY ONE** is correct.

37. Consider Slater rules for given code type question

| | **Column -1** | | **Column -2** |
|---|---|---|---|
| P) | Screening constant for Na | 1) | 8.8 |
| Q) | Screening constant for $Na^+$ | 2) | 2.2 |
| R) | $Z_{eff}$ for Na | 3) | 4.15 |
| S) | $Z_{eff}$ for $Na^+$ | 4) | 6.85 |

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

38. Match the column -1 with column-2

| Column-1 | | Column-2 | |
|---|---|---|---|
| P |  | 1 | Magnitude of Electron gain enthalpy for halogens |
| Q |  | 2 | First ionisation enthalpy order for second period elements of long form of periodic table. |
| R |  | 3 | Electro negativity order for halogens |
| S |  | 4 | First ionisation enthalpy of alkali metals |

(P.P=Periodic property, Graphs are not up to the scale, use them to predict order)

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

39.

| | Column-1 | | Column-2 |
|---|---|---|---|
| P | (Xe) $4f^{2}5d^{0}6s^{2}$ | 1 | d-block $6^{th}$ group |
| Q | (Rn) $5f^{3}6d^{1}7s^{2}$ | 2 | f-block-$6^{th}$ period |
| R | (Kr) $4d^{10}5s^{2}$ | 3 | Radioactive element |
| S | (Ar) $3d^{5}4s^{1}$ | 4 | d-block- $5^{th}$ period |

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

40. Match the elements with respective periodic property given in the column-1 with their gradation given in column-2

| | **Coloumn-I** | | **Coloumn-II** |
|---|---|---|---|
| P | $Li \xrightarrow{(i)\,Basic\ nature\ of\ their\ oxides} Be \xrightarrow{(ii)\,Metallic\ character} B \xrightarrow{(iii)\,atomic\ radius} C$ | 1 | (i)Increases<br>(ii)Increases<br>(iii)Decreases |
| Q | $Na \xrightarrow{(i)\,Electro\ positive\ character} Mg \xrightarrow{(ii)\,IP_1} Al \xrightarrow{non\ metallic\ character} Si$ | 2 | (i)Decreases<br>(ii)Decreases<br>(iii)Increases |
| R | $F \xrightarrow{(i)\,magnitude\ of\ electron\ gain\ enthalpy} Cl \xrightarrow{(ii)\,Atomic\ size} Br \xrightarrow{(iii)\,oxidising\ power} I$ | 3 | (i)Increases<br>(ii)Decreases<br>(iii)Decreases |
| S | $O \xrightarrow{(i)\,magnitude\ of\ electron\ gain\ enthalpy} S \xrightarrow{(i)\,Acidic\ nature\ of\ oxides} Se \xrightarrow{(iii)\,Electro\ negetivity} Te$ | 4 | (i)Decreases<br>(ii)Decreases<br>(iii)Decreases |

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

## 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

41. The number of value(s) of '$a$' for which the function $f(x)=\sin(ax)+\tan(\sqrt{2}ax)$ will not be a periodic will be ___

A) 0 B) 1 C) 2 D) None of These

42. If fractional part of $\frac{1}{x}$ and $x^2$ for some $x\in\left(\sqrt{2},\sqrt{3}\right)$ are equal then the value of $x^4-\frac{3}{x}$ is

A) 3 B) 7 C) 5 D) 0

43. The function $f(x)=x^{\frac{1}{\ln x}}$ is

A) a constant function in its domain

B) has domain $(0,\infty)$

C) a periodic function in its domain

D) All of the above

44. The fundamental period of $f(x)=\sin^{96}x+\cos^{96}x$ is

A) $\frac{\pi}{2}$ B) $2\pi$ C) $\pi$ D) None of these

45. If $f(x)=\frac{xe^x}{e^x-1}-\frac{x}{2}$, then $f(x)$ is

A) an even function B) an odd function

C) neither odd nor even function D) both odd and even function

46. If domain of f(x) is [1, 3], then the domain of $f\left(\log_2\left(x^2+3x-2\right)\right)$ is

A) $[-5,-4]\cup[1,2]$ B) $[-13,-2]\cup\left[\frac{3}{5},5\right]$

C) $[-4,1]\cup[2,7]$ D) $[-3,2]$

47. The fundamental period of $f(x)=(\sin x)^0+(\cos x)^0+(\tan x)^0$ is

A) $2\pi$ B) $\pi$ C) $\pi/2$ D) Indeterminate

48. If $f(x)=\sqrt{-\sqrt{-x}}$, then domain of $f(x)$ is

A) $[0,\infty)$ B) $(-\infty,0]$ C) $\{0\}$ D) None of these

49. The domain of $f(x)=\frac{3}{4-x^2}+\log_{10}\left(x^3-x\right)$ is

A) (1, 2) A) $(-1,0)\cup(1,2)$ C) $(-1,0)\cup(2,\infty)$ D) $(-1,0)\cup(1,2)\cup(2,\infty)$

50. The domain of the function $f(x)=\log_{10}\left\{1-\log_{10}\left(x^2-5x+10\right)\right\}$ is

A) $(0,\infty)$ B) (0, 5) C) $(-\infty,0)$ D) None of these

## Section-2
## (Paragraph Type)

This section contains 3 paragraphs each describing theory, experiment, data etc. Six questions relate to three paragraphs with two questions on each paragraph. Each question pertaining to a particular paragraph should have **only one correct answer** among the four choices A, B, C and D.

**Paragraph for Question Nos. 51 & 52**

Let us define a new function of $Rg(x)$ or $R_g(x)=\begin{cases} x, \ if\ x<2013 \\ 4026-x, if\ x\geq 2013 \end{cases}$, then

51. The solution of the equation $R_g(x-2013)=2014x+2013$ is

A) 0 B) $-2$ C) 5 D) None of These

52. The maximum value of $R_g(x)$ is

A) 0 B) 2013 C) 1 D) Can't Say

**Paragraph for Question Nos. 53 & 54**

Any function $f(x)$ is said to be an EVEN FUNCTION, if $f(-x)=f(x)$.

Any function $f(x)$ is said to be an ODD FUNCTION, if $f(-x)=-f(x)$.

Any function $f(x)$ can be expressed as the sum of an even and an odd function

as $f(x)=\left(\frac{f(x)+f(-x)}{2}\right)+\left(\frac{f(x)-f(-x)}{2}\right)$,

Where $\left(\frac{f(x)+f(-x)}{2}\right)$ is EVEN and $\left(\frac{f(x)-f(-x)}{2}\right)$ is ODD.

53. If $f(x) = ae^{x} + be^{-x} + c$ is an even function, then the best possible relation between $a$, $b$, $c$ can be

A) $a + b = 0$ B) $a = b$ C) $a = b + c\,(c \neq 0)$ D) $b = a + c\,(c \neq 0)$

54. The function $f(x) = x\left(\dfrac{2018^{x} - 1}{2018^{x} + 1}\right)$ is

A) Odd B) Even C) Both (A) & (B) D) Neither (A) nor (B)

**Paragraph for Question Nos. 55 & 56**

An even periodic function $f : R \to R$ with period 4 is such that

$$f(x) = \begin{cases} \max.(|x|, x^{2}) & 0 \le x < 1 \\ x & 1 \le x \le 2 \end{cases}$$

55. The value of $\{f(5.12)\}$ is (where $\{.\}$ denotes fractional part of x) is:

A) $\{f(3.26)\}$ B) $\{f(7.88)\}$ C) $\{f(2.12)\}$ D) $\{f(5.88)\}$

56. The number of solutions of $f(x) = |3\sin x|$ for x∈ (-6,6) are

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

## 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.

57. Here [ ] represents Greatest Integer Function, { } denote fractional part Function

| Column – I (Function) | | Column – II (fundamental Period) | |
|---|---|---|---|
| P | $f(x)=e^{\cos^4 \pi x}+x-[x]+\cos^2 \pi x$ | 1 | $\frac{1}{3}$ |
| Q | $f(x)=\cos(2\pi\{2x\})+\sin(2\pi\{2x\})$ | 2 | $\frac{1}{4}$ |
| R | $f(x)=\sin(3\pi\{x\})+\tan(\pi[x])$ | 3 | $\frac{1}{2}$ |
| S | $f(x)=3x-[3x+a]-b$ where $a,b\in R^+$ | 4 | 1 |

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

58. Match the following

Here [ ] represents Greatest Integer Function

| | COLUMN – I | | COLUMN - II |
|---|---|---|---|
| P | Odd function | 1 | $x-[x]\ \forall x \in R$ |
| Q | Even function | 2 | $\log\left(x+\sqrt{1+x^2}\right)\forall x \in R$ |
| R | Neither even nor odd | 3 | $x\log\left(\frac{1+x}{1-x}\right)\ \forall x \in (-1,1)$ |
| S | Periodic function | 4 | $\frac{2^{x/2}}{1+2^{x/2}}\ \forall x \in R$ |

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

59. Column-B discusses about the nature of functions given in Column-A.

| **Column-A** | **Column-B** |
|---|---|
| P) $f : R \to R,\ f(x) = \frac{e^{2x}+1}{e^x}$ | 1) Periodic Function |
| Q) $f : R \to R,\ f(x) = x + \sin x$ | 2) Even Function |
| R) $f : R \to R,\ f(x) = (\sin x + \cos x)$ | 3) Odd Function |
| S) $f : R \to R,\ f(x) = \sin^6 x + \cos^6 x$ | 4) Neither even nor odd function |

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

60. Column-B consists of period of functions given in Column-A.

| **Column-A** | **Column-B** |
|---|---|
| P) $f(x)=\sin^{2017}(2016x)+\cos^{2017}(2016x)$ | 1) $\frac{\pi}{2}$ |
| Q) $f(x)=\sin^{2016}(2017x)+\cos^{2017}(2016x)$ | 2) $\pi$ |
| R) $f(x)=\sin^{2017}(2016x)+\cos^{2016}(2017x)$ | 3) $2\pi$ |
| S) $f(x)=\sin^{2016}(2017x)+\cos^{2016}(2017x)$ | 4) $\frac{\pi}{3}$ |

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

# Master JEE CLASSES

## Kukatpally, Hyderabad.

**JEE-ADVANCED-2014-P2-MODEL**
**Max.Marks:180**

## KEY SHEET

## PHYSICS

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

## CHEMISTRY

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

## MATHS

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

# SOLUTIONS

## PHYSICS

1. $W_c + W_{nc} + W_{ext} = \Delta KE$

2. with F=6N both blocks more together, $W_f = f.S$

3. from A to C , $W_f = -mgh$

   From C to A , $-mgh + W_f + W_F = O$

4. $W_f = -fdr$

6. $\frac{dW}{dx} = 0$

7. Work done by conservative force is independent of path followed

10. Apply W-E theorem

12. Apply $W_{pseudo} concept$

14. $du = -\vec{F}.\vec{dr}$, *Apply work energy theorm*

15. When it moves from A to B and surface is rough from W - E theorem

    $W_{net} = \Delta KE$

    $W_f + W_g = W_{net}$

    $W_f + mgR = 0 \Rightarrow W_f = -mgR$

16. A to B surface is rough, B to C smooth let it reach a point P above C, when pushed from A. So from W - E theorem $W_{net} = \Delta KE = KE_f - KE_i$

motion from A to point (beyond C)

$$W_{f(AB)} + W_g = KE_P - KE_A = 0 - \frac{1}{2}mV_A^2$$

Hence $W_{f(AB)} = -mgR$

Given $\frac{1}{2}mv_A^2 = mgR$, let y be the position of point P above horizontal level $A_C$, where the body finally reaches

$\Rightarrow -mgR + mgy = -mgR$

$\Rightarrow y = 0$

$\therefore$ it reaches to a height of R above B

20. apply work energy theorm

    A - T; B - P; C - S; D – Q

23. Solution:

$Li_{(g)} \longrightarrow Li^{+3}_{(g)} + 3e^{-}$ $\quad \Delta H = 1.96 \times 10^{4}\ kJ\ mol^{-1}$

$Li_{(g)} \longrightarrow Li^{+}_{(g)} + e^{-}$ $\quad IE_1 = 520\ kJ\ mol^{-1}$

$Li^{+}_{(g)} \longrightarrow Li^{+2}_{(g)} + e^{-}$ $\quad IE_2 = a\ kJ\ mol^{-1}$

$Li^{+2}_{(g)} \longrightarrow Li^{+2}_{(g)} + e^{-}$ $\quad IE_3 = b\ kJ\ mol^{-1}$

also $b = E_1$ for $Li^{+2} = E_1$ for $H \times Z^2$

$= 2.18 \times 10^{-18} \times 3^2 \times 6.023 \times 10^{23}\ J\ mol^{-1}$

$= 11.81 \times 10^{+6}\ J\ mol^{-1} = 11.81 \times 10^{3}\ kJ\ mol^{-1}$

For the above eq

$1.96 \times 10^{4} = 520 + a + 11.81 \times 10^{3}$

$a = 7270\ kJ\ mol^{-1}$

24. Conceptual

25. $M \rightarrow M^{+} e^{\oplus}$

number of moles $\frac{5}{25} = 0.2$

Energy required to form $M^+$ ions

= 0.2 x 800

= 160 KJ $mol^{-1}$

Remaining energy = 90 KJ moles

This is used to convert $M^+$ to $M^{+2}$

Number of moles of $M^{+2}$ formed

$\frac{90}{1500} = 0.06$

% $M^{+2} = \frac{0.06}{0.2}$ x $100 = 30\%$

26. Conceptual

27. Conceptual

28. Conceptual

29. Ne> Ar> Kr>Xe>Rn>Ne (NCERT)

30. $\frac{1}{2}X \longrightarrow \frac{1}{2}X^{+} + e;\ \frac{1}{2}I.E...(a)$

$e + \frac{1}{2}X \longrightarrow \frac{1}{2}X^{-};\frac{1}{2}\Delta H_{eg}.....(b)$

$X \longrightarrow \frac{1}{2}X^{+} + \frac{1}{2}X^{-};\ \frac{1}{2}(I.E. + \Delta H_{eg}) = 410kJ$

$I.E. + \Delta H_{eg} = 820kJ$

$\frac{1}{2}X^{-} \longrightarrow \frac{1}{2}X^{+} + 2e;\ \Delta H = 735kJ$ **…..**(c)

(a)-(b) = (c)

$\frac{1}{2}I.E. - \frac{1}{2}\Delta H_{eg} = 735$

$\Rightarrow \quad I.E. - \Delta H_{eg} = 1470$

$I.E. + \Delta H_{eg} = 820kJ$

---

(-) $-2\Delta H_{eg} = 650 \Rightarrow \Delta H_{eg} = -325\ kJmol^{-1}$.

32. **Hint: (1)** The element (E) having very high ionisation enthalpy and positive electron gain enthalpy would be a noble gas, i.e., least reactive.

**(2)** The element (B) would be most reactive metal as it has low ionisation enthalpy and low negative electron gain enthalpy. Probably it is an alkali metal.

**(3)** The element (C) would be most reactive non-metal as it has high negative value of electron gain enthalpy. Probably it is a halogen.

**(4)** The element (D) would be least reactive non-metal.

**(5)** The element (A) has low first ionisation enthalpy but very high second ionisation enthalpy. It would be least reactive alkali metal, i.e., lithium which forms covalent $MX$]

33. $E^{1}_{H-X} = \frac{1}{2}\left(B.E\ H_2 + B.E\ of\ X_2\right)$

$= \frac{104 + 38}{2} = 71\ k.mol$

$\Delta = E_{H-X} - E^{1}_{HX}$

=135-71 = 64 k. mol

$$X_A - X_B = 0.208\sqrt{64} \times 8$$

$$X_A = 0.208 \times 8 + 2.1 = 3.764$$

34. $3.76 = \dfrac{333 + x}{544}$

$x = 1712 kJ$

**35 and 36.**

| n = 1 | n = 2 | N = 3 | n = 4 |
|---|---|---|---|
| $\ell = 0 \rightarrow 1s$ | $\ell = 0 \rightarrow 2s$ | $\ell = 0 \rightarrow 3s$ | $\ell = 0 \rightarrow 4s$ |
| $\ell = 1 \rightarrow 1p$ | $\ell = 1 \rightarrow 2p$ | $\ell = 1 \rightarrow 3p$ | $\ell = 1 \rightarrow 4p$ |
| $\ell = 2 \rightarrow 1\ d$ | $\ell = 2 \rightarrow 2\ d$ | $\ell = 2 \rightarrow 3d$ | $\ell = 2 \rightarrow 4d$ |
| | $\ell = 3 \rightarrow 2f$ | $\ell = 3 \rightarrow 3f$ | $\ell = 3 \rightarrow 4f$ |
| | | $\ell = 4 \rightarrow 3g$ | $\ell = 4 \rightarrow 4g$ |
| | | | $\ell = 5 \rightarrow 4\ h$ |

Electronic configuration $\rightarrow$ 1s, 1p, 2s, 1d, 2p, 3s, 3d, 3p, 4s, 3d

For third period $3s^3$, $3d^{15}$, $3p^9$

number of element = 27

(a)

$1s^3$, $1p^9$, $2s^3$, $1d^{14}$

37. $Z_{eff}\ for\ Na = 11 - (8 \times 0.85 + 2 \times 1)$

$Z_{eff}\ for\ Na^+ = 11 - (7 \times 0.35 + 0.85 \times 2)$

38. Conceptual

39. P= $Ce_{58}$ Q) $Pa_{91}$ R) $Cd_{48}$ S) $Cr_{24}$

40. Conceptual

## MATHS

42. $x = -1, 0, 1$

43. $f(x) = x^{\log_x e} = e$ Domain is $(0,1) \cup (1,\infty)$

44. Sol: For odd values of $n$, fundamental period is $2\pi$

For $n=2,$ fundamental period is indeterminate

For even values of $n(\neq 2),$ fundamental period is $\frac{\pi}{2}$

46. $f(x)=c$

47. $0^0$ is not defined

49. $f(x)=\frac{3}{4-x^2}+\log_{10}\left(x^3-x\right)$ is defined $\Rightarrow 4-x^2\neq 0, x^3-x>0 \Rightarrow x\neq \pm 2,(x+1)x(x-1)>0$

53. Sol: $f(x)=\frac{f(x)+f(-x)}{2}+\frac{f(x)-f(-x)}{2}$

$f(x)=\left[\left(\frac{a+b}{2}\right)\left(e^x+e^{-x}\right)+c\right]+\left(\frac{a-b}{2}\right)\left(e^x-e^{-x}\right)$

56. Conceptual

57. Conceptual

58. $x-[x]$ is neither even nor odd function. It is a periodic function with period '1'

$\log\left(x-\sqrt{1+x^2}\right)$ is odd function

$x\log\left(\frac{1+x}{1-x}\right), \frac{2^{\frac{x}{2}}}{1+2^{\frac{x}{2}}}$ are even functions