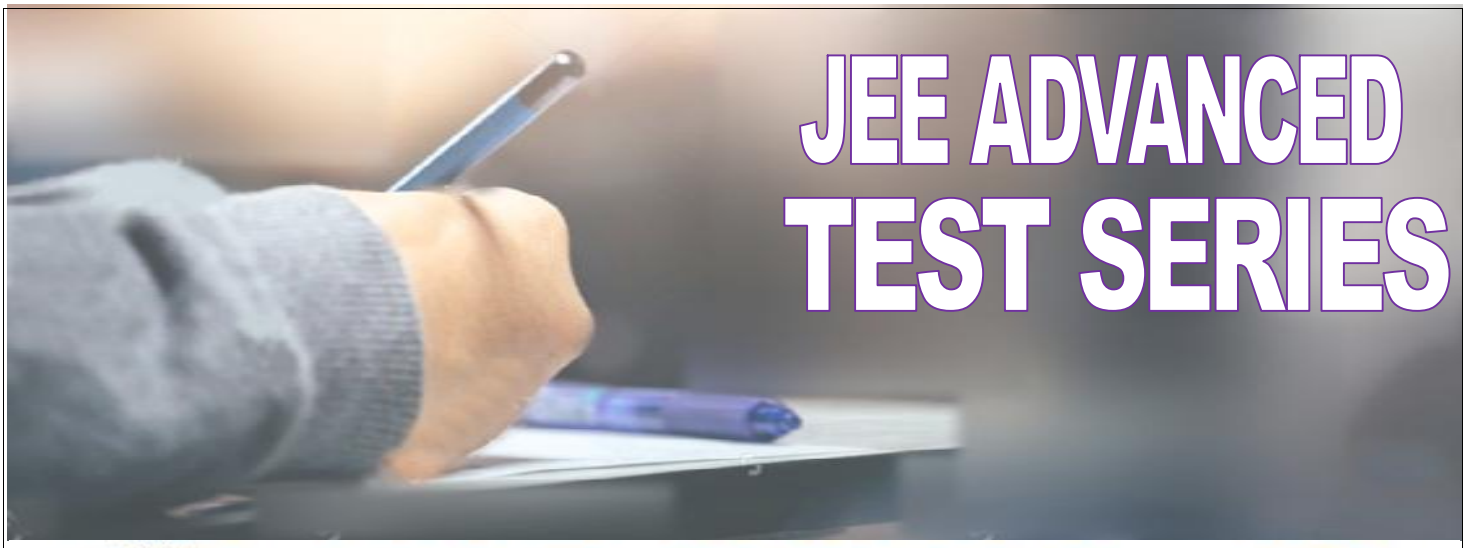


NARAYANA IIT ACADEMY INDIA

40+ YEARS OF EXCELLENCE

SEC: SR_*CO-SC(MODEL-B) **Date: 04-09-22**
Time: 3 Hrs **Max. Marks: 264**

04-09-22_SR.IIT_*CO-SC(MODEL-B)_JEE ADV_WAT-61_SYLLABUS

PHYSICS:

PRESENT WEEK (80%): Davisson - Germer experiment, Characterstic and continuous ,X-rays, Moseley's law

PREVIOUS WEEK (20%): Hertz and Lenard's observations, Atomic Physics

CHEMISTRY:

PRESENT WEEK (80%): **Metallurgy:** Commonly occurring ores and minerals of Iron, Copper, Tin, Lead, Magnesium, Aluminium, Zinc and Silver, Important terms used in metallurgy ,ore dressing methods ,calcination ,roasting, smelting, reduction methods , refining methods, Thermodynamic principles of metallurgy, ellingham diagram,electro chemical principles of metallurgy, Priciples and reactions involved in extraction of Ag, Au, Al

PREVIOUS WEEK (20%): Cation analysis - group-I & II (Excluding As-subgroup) Ag^+, Hg_2^{2+}, Cu^{2+}, Pb^{2+}, Group-III - Al^{3+}, Cr^{3+}, Fe^{3+}, group-IV - Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Group-V- Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}

MATHEMATICS:

PRESENT WEEK (80%): **Probability:** Classical definition of probability, types of events, Addition & Multiplication theorem, Problems based on P & C

PREVIOUS WEEK (20%): Number of functions, principle of inclusion and exclusion, Division of different things

(identical / distinct into different groups)

Time: 3:00 Hours **IMPORTANT INSTRUCTIONS** Max Marks: 264

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 8)	Questions with Integer Answer Type	4	0	8	32
Sec – II(Q.N : 9 – 18)	Questions with Multiple Correct Choice	4	-2	10	40
Sec – III(Q.N : 19 – 20)	Matrix Matching (+2/-1 for every match)	8	-4	2	16
Total				**20**	**88**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 28)	Questions with Integer Answer Type	4	0	8	32
Sec – II(Q.N : 29 – 38)	Questions with Multiple Correct Choice	4	-2	10	40
Sec – III(Q.N : 39 – 40)	Matrix Matching (+2/-1 for every match)	8	-4	2	16
Total				**20**	**88**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 48)	Questions with Integer Answer Type	4	0	8	32
Sec – II(Q.N : 49 – 58)	Questions with Multiple Correct Choice	4	-2	10	40
Sec – III(Q.N : 59 – 60)	Matrix Matching (+2/-1 for every match)	8	-4	2	16
Total				**20**	**88**

PHYSICS **Max Marks: 88**

SECTION – I
(SINGLE INTEGER ANSWER TYPE)

This section contains 8 questions. The answer is a single digit integer ranging from 0 to 9 (both inclusive).
Marking scheme +4 for correct answer, 0 if not attempted and 0 in all other cases.

1. An element of atomic number 9 emits k_{α} photon of wavelength a. If the atomic number of the element which emits K_{α} photon of wavelength $4a$ is Z. Find the value of Z. (Assume screening number for K_{α} transition is equal to 1)
2. In a Frank-Hertz experiment and electron of energy 5.6 eV passes through the mercury vapor and emerges with an energy 0.7 eVthe minimum wavelength of photon emitted by mercury atoms is $50x$ nm. Find x. $(hc = 12250\ eV - A^0)$
3. Find the number of elements, in a row between those elements whose wavelength of K_α lines are equal to 250 and 179 pm is….
   (Rydberg constant = $1.097 \times 10^7\ m^{-1}$)
4. The wavelength of K_{α} *X*-rays produced by an *X*-ray tube is 0.76 Å. If The atomic number of the anode material of the tube is Z, Write the value of $\frac{Z}{5}$ (to a nearest integer) in the OMR Sheet.
5. A neutron is moving with speed 'v' towards a hydrogen atom which is in ground state. If the hydrogen atom is also moving towards neutron with same speed, then minimum KE of each so that an inelastic collision may occur will be … eV. (Approx your answer to nearest integer)(Take masses of both are almost equal)
6. In a Coolidge tube the potential difference across the tube is 20 kV and 10 mA current flows through the voltage supply. Only 0.5% of the energy carried by the electrons striking the target is converted into X-rays. Then the X-ray beam carries a power of $x\ watt$. Find x
7. A gas of hydrogen atoms in its ground state, is excited by means of monochromatic radiation of wavelength $975\ \overset{0}{\text{A}}$. How many different spectral lines are possible in the resulting spectrum? $(hc = 12431.25\ eV - A^0)$

8. An electron beam with an energy of 75 eV falls naturally on the surface through the crystal in the Davisson-Germer experiment. What is the interatomic distance (in nearest integer) in the crystal lattice plane if the maxima of order one is obtained at an angle of 45° to the direction incident?

SECTION – II
(ONE OR MORE 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 ONE OR MORE than ONE option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and -2 in all other cases.

9. A beam of ultraviolet light of wavelength 100 nm – 200 nm is passed through a box filled with hydrogen gas in ground state. The light coming out of the box is split into two beams 'A' and 'B'. 'A' contains unabsorbed light from the incident light and 'B' contains the emitted light by hydrogen atoms. The beam 'A' is incident on the emitter in a photoelectric tube. The stopping potential in this case is 5 volts. In the second case the beam 'B' is incident on the same emitter. You can assume that the transition to higher energy states are not permitted from the excited states. Use hc = 12400 eVÅ.

A) The work function of the emitter = 1.4 eV.

B) The work function of the emitter = 7.4 eV.

C) The stopping potential in second case = 4.69 V.

D) The stopping potential in second case = 2.8 V.

10. When an electron moving at a high speed strikes a metal surface, which of the following are possible.

A) The entire energy of the electron may be converted into an x-ray photon.

B) Any fraction of the energy of the electron may be converted into x-ray photon.

C) The entire energy of the electron may get converted to heat.

D) The electron may undergo elastic collision with the metal surface.

11. An *X*-ray tube is operating at 50 *kV* and 20 *mA*. The target material of the tube has a mass of 1.0 *kg* and specific heat 495 $J\ kg^{-1}\ {}^{o}C^{-1}$. One percent of the supplied electric power is converted into *X*-rays and the entire remaining energy goes into heating the target. Then

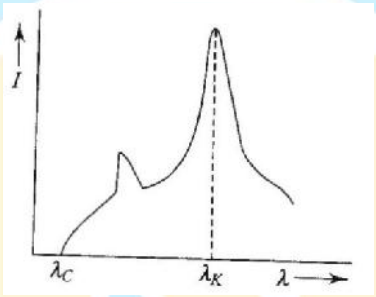
A)A suitable target material must have a high melting temperature

B)A suitable target material must have low thermal conductivity

C) The average rate of rise of temperature of target would be 2 °*C*/*s*

D)The minimum wavelength of the *X*-rays emitted is about $0.25\times10^{-10}\ m$

12. The intensity of X-rays from a Coolidge tube is plotted against wavelength as shown in figure. the minimum wavelength found is λ_c and the wavelength of K_α line is λ_k. If the accelerating voltage is increased



A) λ_C Decreases

B) λ_K increases

C) $(\lambda_K - \lambda_c)$ increases

D) λ_C and λ_K both decrease but $(\lambda_K - \lambda_C)$ remains unchanged

13. Electrons with energy 80 *keV* are incident on the tungsten target of an *X*-ray tube. *K* shell electrons of tungsten have ionization energy 72.5 *keV*. *X*-rays emitted by the tube contain only

A)Only a continuous *X*-ray spectrum (Bremsstrahlung) with a minimum wavelength of ≈ 0.155Å

B)A continuous *X*-ray spectrum (Bremsstrahlung] with all wavelengths

C)Only the characteristic *X*-rays spectrum of tungsten

D)A continuous *X*-ray spectrum (Bremsstrahlung) with a minimum wavelength of ≈ 0.155Å and the characteristic *X*-ray spectrum of tungsten

14. A beam of X-rays of wavelength 0.071 nm is diffracted by (1,1,0) plane of rock salt (FCC crystal) with lattice constant of 0.28 nm. The inter planer spacing 'd' for a cubic crystal of lattice constant 'a' and miller indices (h,k,l) is given by $d = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$, now answer the following questions

A)The maximum wavelength which can show x-ray diffraction with this crystal is nearly $4A^0$

B) The maximum wavelength which can show x-ray diffraction with this crystal is nearly $2A^0$

C) The glancing angle for the second-order diffraction is $\sin^{-1}(0.36)$

D) The glancing angle for the second-order diffraction is $\sin^{-1}(0.25)$

15. There is a substance of linear absorption coefficient « . If an X-ray of intensity I_0 is passed through it, then

A) if the intensity of X-ray decreases by 2 times in travelling through distance x, it will become $1/4^{th}$ of initial intensity in further travelling through distance x.

B) the intensity of X-ray decreases linearly with distance

C) the intensity of X-ray decreases exponentially with distance

D) sample thickness x required to reduce the amount of transmitted X-ray intensity by half will be $\frac{\ln 2}{«}$.

16. Which of the following statement(s) is/are true regarding Davisson-Germer experiment and experimental setup.

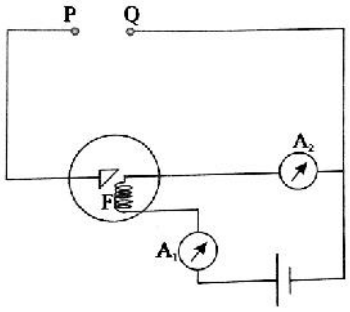
A) it proves that the electron has a wave like behavior.

B) electrostatic particle accelerators are used to accelerate the electrons.

C) electron beam is fired from the electron gun to nickel crystal.

D) movable detector is used to capture the electrons.

17. The diagram shows the basic setup for the production of X-rays. A_1 and A_2 are two ammeters, which have readings 2.55A and 2.566A respectively. F is a filament which is also the cathode. The potential difference applied between P and Q is 50000V. Assume that all X-ray photons have the maximum possible energy and that one X-ray photons is emitted for every 100 electrons incident on the target. You may assume that the kinetic energy of the other electrons reappear as heat in the tube.



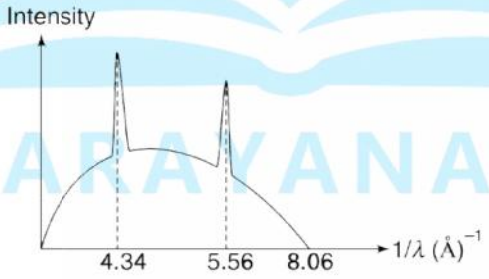
A) The number of X-ray photons produced per second is approximately 10^{15}

B) The number of X-ray photons produced per second is approximately 10^{12}

C) The momentum of each X-ray photon is approximately is $3\times10^{-23} kg\ ms^{-1}$

D) The rate at which heat is produced in the X-ray tube is a approximately is 792.

18. The X-ray spectrum of a metallic target is shown in figure showing two characteristic X-rays one of them is $k_{\sim}$ X-ray and the other one is k X-ray.(Use hc = 12420 eVÅ and screening constant for $K_{\sim}$ and K are taken same).



A) The acceleration potential difference for bombarding electrons is 10^5

B) The wavelength of $k_{\sim}$ X-ray is $0.23A^0$

C) The wavelength of k X-ray is $0.23A^0$

D) The atomic number of the target atom is 75

SECTION - III
(MATRIX MATCHINGANSWER TYPE)

This section contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and four statements (P, Q, Rand S) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II.

For example, if for a given question, statement B matches with the statements given in Q and R, then for the particular question darken the bubbles corresponding to Q and R in the OMR sheet. For each correct matching **will be awarded +2 marks ONLY and 0 if not attempted and -1 in all other cases.**

19. Match the following:

Column J 1		Column J 2	
A)	The voltage applied to as X–ray tube is increased.	(p)	The average kinetic energy of the electrons decreases.
(B)	In photoelectric effect work function of the target is increased.	(q)	The average kinetic energy of the electron increases.
(C)	The de-Broglie wavelength of β–rays is increased.	(r)	The intensity increases.
(D)	The de-Broglie wavelength of β–rays is decreased.	(s)	The cut–off wavelength decreases.

20. The energy, the magnitude of linear momentum, magnitude of angular momentum and orbital radius of an electron in a hydrogen atom corresponding to the quantum number n are E,p,L and r respectively. Then according to Bohr's theory of hydrogen atom, match the expressions in column-I with statement in column-II.

Match the following:

Column J 1		Column J 2	
(A)	$E \times p \times r$	(p)	is independent of n.
(B)	$\frac{p}{E}$	(q)	is directly proportional to n
(C)	$E \times r$	(r)	is inversely proportional to n
(D)	$p \times r$	(s)	is directly proportional to L

CHEMISTRY **Max Marks: 88**

SECTION – I
(SINGLE INTEGER ANSWER TYPE)

This section contains 8 questions. The answer is a single digit integer ranging from 0 to 9 (both inclusive).
Marking scheme +4 for correct answer, 0 if not attempted and 0 in all other cases.

21. Find total number of metal cations which are ppted. as metal sulphide on passing H_2S gas through metal salt solution.

$Pb^{2+}(aq.)$, $Mn^{2+}(aq.)$, $Sn^{2+}(aq.)$,

$Cr^{3+}(aq.)$, $Mg^{2+}(aq.)$ $Hg^{2+}(aq.)$, $Cu^{2+}(aq.)$,

$Ag^{+}(aq.)$, $Al^{3+}(aq.)$, $Ni^{2+}(aq.)$

22. Thermal decomposition of $AgNO_3$ produces two paramagnetic gases. The total number of electrons present in the antibonding molecular orbitals of the gas that has the higher number of unpaired electrons is _____.

23. $\underset{\text{Black}}{X(s)} \xrightarrow{dil.HCl} Y\uparrow \xrightarrow[NaOH]{Na_2[Fe(CN)5(NO)]}$ Purple solution Gas Y has been allowed to react with following species in neutral / acidic medium:

(a) $FeCl_3$ (b) $CuSO_4$ (c) $BaCl_2$ (d) SO_2 (e) $Cr_2O_7^{2-}$ (f) CH_3COONa (g) Hg^{2+}

Then calculate value of $(P+Q-R)$

P: Number of species which undergoes redox reaction with gas Y.

Q: Number of species with which gas Y undergoes precipitation.

R: Number of species with which gas Y produce no observable change.

24. Among the following statements no of correct statement(s) is/are:

a) Calamine and cerrusite are carbonate ores

b) Rutile and cuprite are oxide ores

c) Zinc blende and pyrites are sulphide ores

d) Malachite and azurite are sulphate ores of Cu

e) Every mineral is an ore but every ore is note mineral

f) Slag is product formed during extraction of metal by combination of flux and impurities.

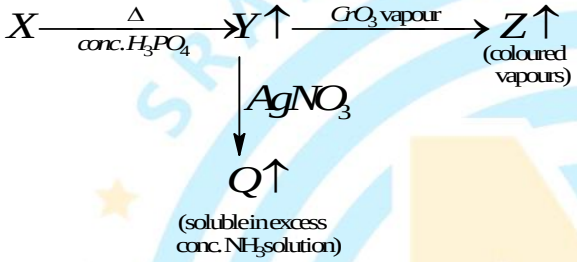
g) Highly pure semiconductor can be obtained by zone refining.

I) Carnallite is an ore of magnesium and sodium.

25. How many of the following metal sulphideundergo hydrolysis?

i) Cr_2S_3 ii) Al_2S_3 iii) MgS iv) FeS

26.



How many of the following anion can be in X?

i) F^- ii) Cl^- iii) Br^- iv) I^-

27. The no. of correct statements in the forth floatation process used for the concentration of sulphide ore:

a) is based on the difference in wettability of different minerals

b) uses sodium ethyl xanthate, $C_2H_5OCS_2Na$ as collector

c) usedNaCN as depressant in the mixture of ZnS and PbS when ZnS forms soluble complex.

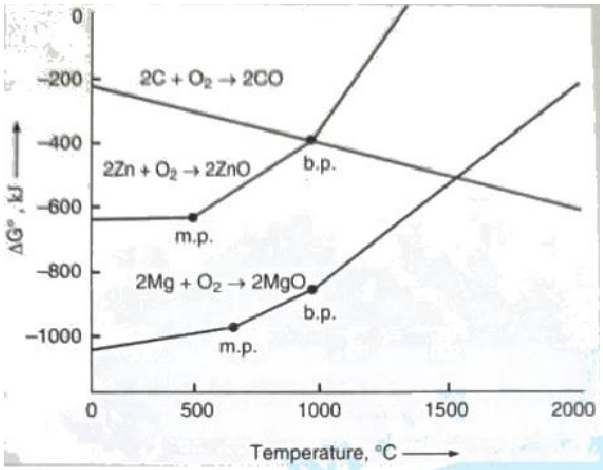
d) $Pb(CN)_2$ is precipitated while no effect of ZnS

e)ZnS forms soluble complex $Na_2\left[Zn(CN)_4\right]$

f) PbS forms soluble complex $Na_2\left[Pb(CN)_4\right]$

g) They cannot be separated by adding NaCN

28. The Eliingham diagram for zinc, magnesium and carbon converting into corresponding oxides is shown below.



At $\frac{k}{500}{}^{o}C$ temperature zinc and carbon have equal affinity for oxygen. Then the k is equal to___

SECTION – II
(ONE OR MORE 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 ONE OR MORE than ONE option can be correct.

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

29. Which of the following salts can decolourise the blood red colouration of $Fe(SCN)_3$?

A)NaF B) $Na_2C_2O_4$ C) $HgCl_2$ D) KF

30. The metal ion/s $\left(M^{2+}\right)$ in the following reaction is/are:

$$M^{2+} + S^{2+} \rightarrow \text{black precipitate} \xrightarrow[\Delta]{dil.HNO_3} \text{white precipitate}$$

A) Mn^{+2} B) Hg^{+2} C) Cu^{+2} D) Cd^{+2}

31. Which of the followings is/are correctly matched:

A) Xanthate salts – froth flotation

B) Carbonate ore-calcination

C) Anodization effect – Aluminum

D) Hydrometallurgy-leaching followed by addition of active metal

32. The electro chemical extraction aluminum from bauxite one involves

A) the reaction of Al_2O_2 with coke (C) at a temperature

B) the neutralization of aluminate solution by passing CO_2 gas to precipitate hydrate alumina ($Al_2O_3.3H_2O$).

C) the dissolution of Al_2O_3 in hot aqueous NaOH

D) the electrolysis of Al_2O_3 mixed with Na_3AlF_6 to give Al and CO_2

33. The correct option(s) related to the extraction of iron from its ore in the blast furnace operating in the temperature range 900 – 1500 K is(are)

A) Limestone is used to remove silicate impurity.

B) Pig iron obtained from blast furnace contains about 4% carbon.

C) Coke (C) converts CO_2 to CO.

D) Exhaust gases consist of NO_2 and CO.

34. The reaction of $Pb(NO_3)_2$ and NaCl in water produces a precipitate that dissolves upon the addition of HCl of appropriate concentration. The dissolution of the precipitate is due to the formation of

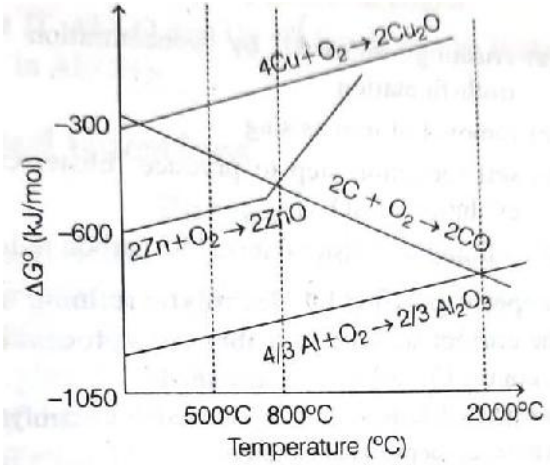
A) $PbCl_2$ B) $PbCl_4$ C) $[PbCl4]^{2-}$ D) $[PbCl6]^{2-}$

35. The cyanide process of gold extraction involves leaching out gold from its ore with CN^- in the presence of Q in water to form R. subsequently, R is treated with T to obtain Au and Z. Choose the correct option(s).

A) Q is O_2 B) Z is $\left[Zn(CN)_4\right]^{2-}$

C) T is Zn D) R is $\left[Au(CN)_4\right]^-$

36. The correct statement regarding the given Ellingham



A) At $800^{o}C$, Cu can be used for the extraction of Zn from ZnO

B) At $1400^{o}C$, Al can be used for the extraction of Zn from ZnO

C) At $500^{o}C$, coke can be used for the extraction of Zn from ZnO

D) Coke cannot be used for the extraction of Cu from Cu_2O

37. Oxidation states of the metal in the minerals haematiteand magnetite, respectively are

A) II, III in haematite and III in magnetite

B) II, III in haematite and II in magnetite

C) II in haematite and II, III in magnetite

D) III in haematite and II, III in magnetite

38. Extraction of copper from copper pyrite ($CuFeS_2$) involves

A) crushing followed by concentration of the ore by forth-floatation

B) removal of iron as slag

C) self reduction step to produce 'blister copper' following evolution of SO_2

D) refining of 'blister copper' by carbon reduction

SECTION - III
(MATRIX MATCHINGANSWER TYPE)

This section contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and four statements (P, Q, Rand S) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II.

For example, if for a given question, statement B matches with the statements given in Q and R, then for the particular question darken the bubbles corresponding to Q and R in the OMR sheet. For each correct matching **will be awarded +2 marks ONLY and 0 if not attempted and -1 in all other cases.**

39. Match the following:

Column I (Main ore of metal)		**Column II (process involved in commercial extraction pure metal)**	
A)	Cinnabar	P)	Forth floatation method
B)	Chalcopyrite	Q)	Roasting
C)	Bauxite	R)	Distillation
D)	Argentite	S)	Leaching
		T)	Calcination

40. Match the following:

Column I		**Column II**	
A)	Precipitate with KCN, which is soluble in excess of reagent	P)	Fe^{2+}
B)	Precipitate with NaOH and NH_4OH, which is insoluble in both excess of reagent	Q)	Hg^{2+}
C)	Coloured ppt. with KI, which is soluble in excess of reagent	R)	Pb^{2+}
D)	Black ppt. with H_2S, which is soluble in hot and dil. HNO_3	S)	Ag^{+}

MATHEMATICS **Max Marks: 88**

SECTION – I
(SINGLE INTEGER ANSWER TYPE)

This section contains 8 questions. The answer is a single digit integer ranging from 0 to 9 (both inclusive).
Marking scheme +4 for correct answer, 0 if not attempted and 0 in all other cases.

41. Three six-faced fair dice are thrown together let P(k) denote the probability that the sum of the numbers appearing on the dice is k $9 \le K \le 14$ then 54S-30 where $S = \sum_{k=9}^{14} P(k)$ is

42. Fifteen persons, among whom are A and B, sit down at random at a round table. p is the probability that there are exactly 4 persons between A and B then 14p is equal to

43. There are 10 pairs of shoes in a cupboard, from which 4 shoes are picked at random. If p is the probability that there is atleast one pair, then 323p -91 is equal to

44. If $\frac{1}{4}(1+4p), \frac{1}{4}(1-p)$ and $\frac{1}{2}(1-2p)$ are the probabilities of three mutually exclusive events, then maximum value of 2p is

45. The digits 1,2,3,4,5,6,7,8 and 9 are written in random order to form a nine digit number. Let p be the probability that this number is divisible by 36, then 9p is

46. Two persons each make a single throw with a pair of dice. If p denotes the probability that their throws are unequal, then $648p - 570$ is

47. Let $\{1,1,1,2,2,2,3,3,3\}$ forms a 3×3 matrix probability of no row (or) no column has two identical numbers is $\frac{p}{35q}$ then the value of $q-p$ is….. (GCD of $(p,q)=1$)

48. Let $\mu \neq 1$ be a cube root of unity. A fair die is rolled three times. If r_1, r_2 and r_3 are the numbers obtained on the die, then the probability that $\mu^{r1} + \mu^{r2} + \mu^{r3} = 0$ is 2/P then P =

SECTION – II
(ONE OR MORE 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 ONE OR MORE than ONE option can be correct.

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

49. Two numbers x and y are selected at random from $\{1,2,.....,5n\}$ without replacement. If p_n denote the probability that $\frac{1}{5}(x^2+y^2)$ is a natural number, then

A) $p_n=\frac{9n-1}{5(5n-1)}$ B) $p_n=\frac{4n}{5(5n-1)}$ C) $\lim_{n\to\infty} p_n=\frac{9}{25}$ D) $\lim_{n\to\infty} p_n=\frac{4}{25}$

50. A cubical die is thrown 9 times and the numbers obtained are written as a 9–digit number. The probability that the number

A) Begins with 246 is $1/6^3$

B) Ends with 135 is $1/6^3$

C) Begins with 246 and ends with 135 is $1/6^6$

D) Begins with 246 or ends with 135 is $431/6^6$.

51. A and B are two events. The probability that at most one of A,B occurs is

A) $1-P(A\cap B)$ B) $P(A')+P(B')-P(A'\cap B')$

C) $P(A')+P(B')+P(A'\cup B')-1$ D) $P(A\cap B')+P(A'\cap B)+P(A'\cap B')$

52. A number x is chosen at random from the first 100 natural numbers. The probability that it satisfies

A) $x^2-25x\le 150$ is 0.3

B) $x^2-17x+30\ge 0$ is 0.88

C) $30x-x^2$ is a perfect square of a natural number is 0.07

D) $30x-x^2<0$ is 0.7

53. Two fair dice are thrown. The probability that absolute difference between the numbers is

A) two is 2/9 B) three is 1/6 C) at least two is 1/2 D) at most one is 4/9

54. Three fair dice are thrown, the numbers appearing on them are respectively a, b and c. chance that the roots of the quadratic equation $ax^2+bx+c=0$

A) are real is $\frac{42}{216}$ B) are imaginary is $\frac{173}{216}$

C) are real and distinct is $\frac{38}{216}$ D) are real and equal is $\frac{5}{216}$

55. Given two events A and B, if the odds against A are 2 to 1, and those in favour of $A\cup B$ are 3 to 1, then

A) $\frac{1}{3}\le P(B)\le\frac{1}{2}$ B) $\frac{5}{12}\le P(B)\le\frac{3}{4}$ C) $\frac{11}{12}\le P(\overline{A})+P(\overline{B})\le\frac{5}{4}$ D) $P(A\cap B)\le\frac{1}{3}$

56. The probabilities that a student passes in mathematics, physics and chemistry are m, p and c respectively. Of these subjects, a student has a 75 % chance of passing in at least one, a 50% chance of passing in at least two, and a 40% chance of passing in exactly two subjects. Which of the following relations are true? (considering $P(A\cap B\cap C)$ as P(A). P(B). P(C))

A) $p+m+c=\frac{19}{20}$ B) $p+m+c=\frac{27}{20}$ C) $pmc=\frac{1}{10}$ D) $pmc=\frac{1}{4}$

57. If 5 red roses and 5 white roses of different sizes are used in preparing a garland, the probability that red and white roses come alternatively is

A) $\frac{1}{252}$ B) $\frac{1}{126}$ C) $\frac{1}{63}$ D) $\frac{5}{126}$

58. A bag contains b blue balls and r red balls. If two balls are drawn at random, the probability of drawing two red balls is five times the probability of drawing two blue balls. Further more, the probability of drawing one ball of each colour is six times the probability of drawing two blue balls. Then

A) $b+r=9$ B) $br=18$ C) $|b-r|=4$ D) $b/r=2$

SECTION - III
(MATRIX MATCHINGANSWER TYPE)

This section contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and four statements (P, Q, Rand S) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II.

For example, if for a given question, statement B matches with the statements given in Q and R, then for the particular question darken the bubbles corresponding to Q and R in the OMR sheet. For each correct matching **will be awarded +2 marks ONLY and 0 if not attempted and -1 in all other cases.**

59. A is a set containing n elements. A subset P of A is chosen at random. The set A is reconstructed by replacing the elements of P. A subset Q of A is again chosen at random. The probability that the number of ways of choosing P & Q such that

	Column – I		**Column – II**
A)	$P \cap Q = ¤$	P)	$\frac{n \times 3^{n-1}}{4^n}$
B)	$P \cap Q$ is a singleton set	Q)	$\left(\frac{3}{4}\right)^n$
C)	$P \cup Q = A$	R)	$\frac{^{2n}C_n}{4^n}$
D)	$n(P) = n(Q)$	S)	$\frac{n}{3} \times \left(\frac{3}{4}\right)^n$
		T)	$\left(\frac{2}{4}\right)^n$

60. Letters of the word INDIANOIL are arranged at random. Probability that the word formed, which

	Column – I		**Column – II**
A)	Contains the word INDIAN	P)	$\frac{1}{^9C_5}$
B)	Contains the word OIL	Q)	$\frac{3}{2 \times ^9C_2}$
C)	Begins with I and ends with L	R)	$\frac{1}{^7C_3 \times ^9C_2}$
D)	Has vowels at the odd places	S)	$\frac{1}{^9C_4}$
		T)	$\frac{7}{3 \times ^8C_3}$