FIITJEE FARIDABAD

MOCK PRACTICE PAPER FOR

JEE -Advance- 2020

MOCK PRACTICE PAPER-13

Time: 3 hours ***Maximum marks: 240***

INSTRUCTIONS

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains Three Parts.
3. **Part-1** is Chemistry, **Part-2** is Physics and **Part-3** is Mathematics.
4. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
5. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with HB pencil for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Sections.

(i) **Section-A (01 – 8)** contains **8** multiple choice questions which have **only one** correct answer. Each question carries **+3 marks** for correct answer and **-1** for incorrect answer.

(ii) **Section-A (09 – 12)** contains **4** multiple choice questions which have **one or more than one** correct answers. Each question carries **+4 marks** for correct answer and **-2** for incorrect answer.

(iii) **Section-C (01 – 6)** contains **6** questions. The answer to each question is a single –digit integer, ranging from **0 to 9** (both inclusive). Each question you will be awarded +**4** marks for correct answer and **No** negative marking in this section.

(iv) **Section-B (01 – 02)** contains **2** matrix match type questions. You will award 2 marks for each row matching. Thus, each question carries a maximum of **+8 marks** for correct answer and **No** negative marking in this section.

Name of the Candidate :____

Batch :____________________ **Date of Examination :**____________________________

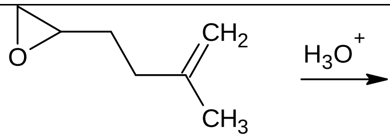
Enrolment Number :____

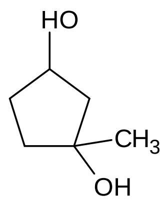
CHEMISTRY

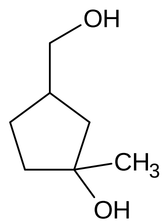
SECTION-1

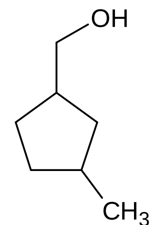
(SINGLE CORRECT CHOICE TYPE)

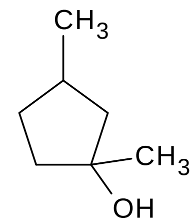
Section-I (Single Correct Answer Type, Total Marks: 24) contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1.  A(major product), A is

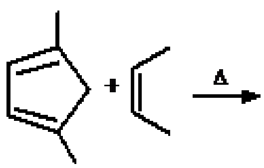
A) 

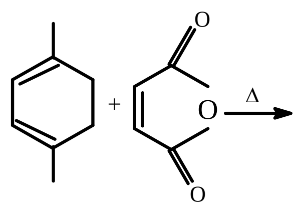
B) 

C) 

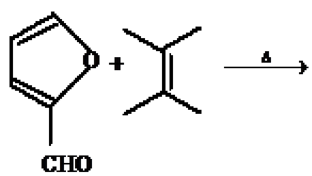
D) 

2. The reaction between diene and dienophile, (Diels Alder reaction) which occurs at a faster rate in comparison to others is

A) 

B) 

C) 

D) 

3. The Hinsberg test of a $C_5H_{14}N_2$ compound produces a solid that is insoluble in 10% aq. $NaOH$. This solid derivative dissolves in 10% aq. sulfuric acid. Which of the following would best fit these facts

A) $NH_2CH_2CH_2CH_2N(CH_3)_2$ B) $(CH_3)_2NCH_2CH_2NHCH_3$

C) $NH_2CH_2C(CH_3)_2CH_2NH_2$ D) $(CH_3)_2NCH_2N(CH_3)_2$

4. For the gaseous reversible conversion of ethylene to ethane at 25°C *ln* K is found to be 17.85. Standard Gibb's free energy change in kJ mol^{-1} will be

A) – 0.436 B) – 3.71 C) – 19.2 D) – 44.2

5. A compound $A_3B_{4(g)}$ dissociates as $A_3B_{4(g)} \rightleftharpoons 2AB_{(g)} + A_{(g)} + 2B_{(g)}$ with degree of dissociation α, which is negligible in comparison to unity. Expression of α in terms of K_P and total pressure P is

A) $\sqrt[5]{\frac{K_P}{16P^4}}$ B) $\sqrt[5]{\frac{16K_P}{P^4}}$ C) $\sqrt[5]{\frac{K_P}{P^4}}$ D) $\sqrt[3]{\frac{K_P}{P^3}}$

6. In Na_2O structure,

A) Cations from CCP and anions occupy octahedral voids

B) Anions from CCP and cations occupy tetrahedral voids

C) Cations from CCP and anions occupy tetrahedral voids

D) anions form CCP and cations occupy octahedral voids.

7. Which of the following statements is correct for the species H_2^+, H_2, He_2^+ and He_2?
A) He_2^+ is more stable than H_2^+
B) Bond dissociation energy of H_2^+ is more than Bond dissociation energy of He_2^+
C) Since bond order of He_2^+ and H_2^+ are equal both will have equal bond dissociation energies
D) Bond length of H_2^+ is less than bond length of H_2

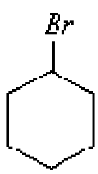
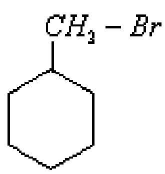
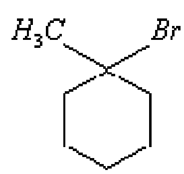
8. Which of the following order is incorrect for the indicated property?
A) NaF > KF > RbF > CsF (melting point)
B) BeO < MgO (basic strength)
C) $SO_2 > SeO_2 > TeO_2$ (acidic strength)
D) $Mg(OH)_2 > Ca(OH)_2 > Ba(OH)_2$ (solubility)

SECTION-2

(MORE THAN ONE TYPE)

Section - II contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE may be correct.

9. The incorrect order of reactivity of the following compounds towards SN^2 reaction is

(1)  (2)  (3)  (4) $CH_2 = CH - Br$

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

10 In a Daniel Cell, the EMF of the cell can be increased by

A) increasing the concentration of Zn^{2+} ions

B) increasing the concentration of Cu^{2+}

C) decreasing the concentration of Cu^{2+}

D) decreasing the concentration of Zn^{2+} ions

11. Which of the following are dissimilarities between $H_4P_4O_{12}$ and $H_4P_2O_7$?

A) Oxidation state of phosphorous

B) Number of P – O – P linkage

C) Basicity

D) Total number of atoms directly bonded to each phosphorous atom

12. Step(s) which is/are involved in the extraction of metal from zinc blende is/are:

A) froth floatation

B) roasting

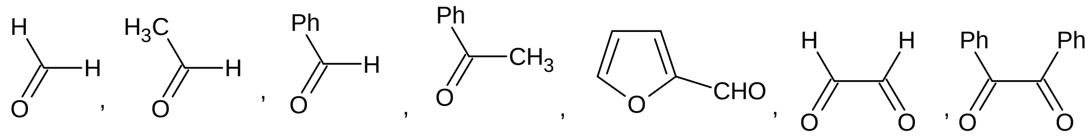
C) magnetic separation

D) carbon reduction

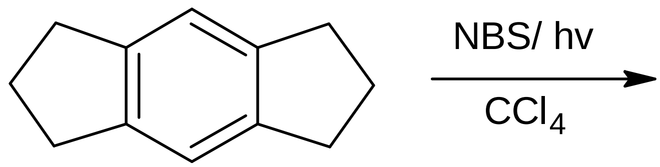
SECTION-3
[INTEGER TYPE]

Section-III contains 6 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9.

1. The number of compounds which usually do not undergo Cannizaro's reaction is:



2. Find the number of monobromo derivatives in the given reaction (including stereo isomers).



3. 29.2% (w/W) HCl stock solution has a density of 1.25 g mL^{-1}. The molecular weight of HCl is 36.5 g mol^{-1}. The volume (mL) of stock solution required to prepare a 200 mL solution of 0.4 M HCl is:

4. A weak base $BOH\left(K_b = 10^{-n}\right)$ is titrated with a strong acid, HCl. At $\frac{3}{4}^{th}$ of the equivalence point, P^H of the solution is $9-\log(3)$, then 'n' is___

5. Among the sulphides, HgS, SnS, CdS, SnS_2, $Bi_2S_3, As_2S_3, CuS, As_2S_5, PbS, Sb_2S_3$ and Sb_2S_5, the number of sulphides which are insoluble in Yellow ammonium sulphide(YAS) is:

6. Number of geometrical isomers for the complex $[CuCl_2Br_2]^{2-}$ is:

SECTION-4

[Matrix Matching Type]

Section-IV contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II.

1. Matching type question (where a is the unit cell edge length parameter)

	Column I		**Column II**
A)	ZnS crystal	**P)**	F.C.C.
B)	CaF_2 crystal	**Q)**	H.C.P
C)	NaCl crystal	**R)**	Distance between closest particles is $\frac{\sqrt{3}a}{4}$
D)	Diamond crystal	**S)**	Only one type of voids are occupied

2. Match the ores of Column-I with their composition in Column-II

COLUMN – I (Ore)	**COLUMN – II** (Composition)
A) Chalcopyrite	**P)** Cu_2O
B) Cuprite	**Q)** $Cu_2(OH)_3Cl$
C) Atacamite	**R)** $Cu_2(OH)_2CO_3$
D) Malachite	**S)** $CuFeS_2$

PHYSICS **Max.Marks:80**

SECTION-1
(SINGLE CORRECT CHOICE TYPE)

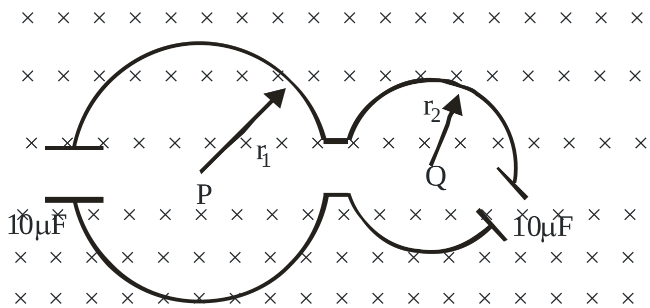
Section-I contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

1. The dimensions of P, Q and R in this expression for energy E, $E = [PM] + [QM^{-1}LT^{-2}] + [RMLT^{-1}]$, are

A) $[LT^{-1}], [M^2L], [L^2T^{-2}]$ B) $[L^2T^2], [M^2L], [LT^{-1}]$

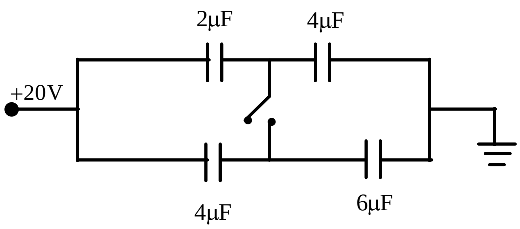
C) $[M^2L], [LT^{-1}], [LT^{-2}]$ D) $[LT^{-2}][LT^{-1}], [M]$

2. Two conducting plane loops P and Q are shaped in the form as shown in figure with radii $r_1 = 20\,cm$ and $r_2 = 10\,cm$.. The loops are placed perpendicular to a time varying magnetic field $B = (20 + 10t)\,wbm^{-2}$. The maximum charge on each capacitor (in micro coulomb) is



A) 4.7 B) 5.2 C) 6.7 D) 7.8

3. A capacitor circuit is shown in the figure. Initially switch is open. Find the charges flown through switch when it is closed.



A) $2.0\mu c$ B) $3.0\mu c$ C) $4.0\mu c$ D) $5.0\mu c$

4. A lens held directly above a coin placed on a table forms an image of the coin. After the lens is moved vertically a distance equal to it's focal length, it forms another image of the coin equal in size to the previous image. If diameter of the coin is 2.0 cm, what is the diameter of the image in first position of lens?

A) 3.0 cm B) 4.0 cm C) 5.0 cm D) 6.0 cm

5. A metal plate when exposed to light of wavelength λ photoelectrons are ejected. When a retarding electric field of intensity E is applied, non of the photoelectrons can move away from the plate farther than a distance d. Which of the following is a correct expression for the threshold wavelength λ_{th}

A) $\lambda_{th} = \frac{hc}{eEd}$ B) $\lambda_{th} = \lambda - \frac{hc}{eEd}$ C) $\lambda_{th} = \frac{hc}{2Ed}$ D) $\lambda_{th} = \left(\frac{1}{\lambda} - \frac{eEd}{hc}\right)^{-1}$

6. A moving neutron collides with another singly ionized helium atom in ground state at rest. What is the minimum speed of moving neutron for collision to be perfectly inelastic?

A) $2.50\times10^{4}\ \mathrm{m/sec}$ B) $4.25\times10^{4}\ \mathrm{m/sec}$ C) $6.25\times10^{4}\ \mathrm{m/sec}$ D) $9.89\times10^{4}\ \mathrm{m/sec}$

7. At present natural uranium contains 99.28% of uranium – 238 and 0.72% of uranium-235. The half life of uranium-238 and uranium-235 are, 4.56×10^{9} years and 0.71×10^{9} years respectively. Assuming concentrations of each of these uranium isotopes were identical at the time of birth of the earth, find the approximate age of the earth (Take $\ln(137.9)=4.93$)

A) 5.98×10^{9} years B) 3.98×10^{9} years C) 7.98×10^{9} years D) 4.35×10^{9} years

8. You are fishing from a dock and you see a fish in the water. For this purpose, you can use either a bow and arrow, or a laser gun. Which of the following strategy you must follow

A) Aim the arrow below the fish and laser gun above the fish

B) Aim the arrow above fish and laser gun below fish

C) Aim the arrow below the fish and the laser gun exactly at the fish

D) Aim the arrow exactly at the fish and laser gun below the fish

SECTION-2
(MORE THAN ONE TYPE)

Section - II contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE may be correct.

9. A capillary tube of radius 'r' is mounted vertically with it's bottom end inside water. The surface tension of water is σ and its density is ρ. Inside the capillary tube water rises upto a height h. Then

A) The potential energy of the liquid column is $\frac{1}{2}\pi r^2 h^2 \rho g$

B) The work done by the surface tension of water is $\frac{4\pi\sigma^2}{\rho g}$

C) The work done by gravity is $\frac{2\pi\sigma^2}{\rho g}$

D) The quantity of heat energy liberated is $\frac{2\pi\sigma^2}{\rho g}$

10. The temperature of an isotropic cubical solid of length L, density ρ and co-efficient of linear expansion $\propto$ per Kelvin is heated to $20^0 C$. Then at this temperature to a good approximation.

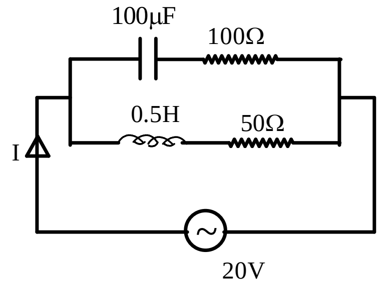
A) Length of cubical solid is $L(1+20\propto)$

B) total surface area is $L^2(1+40\propto)$

C) Density of cubical solid is $\rho(1+60\propto)$

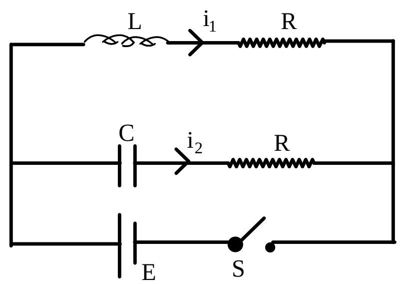
D) Density of cubical solid is $\rho(1-60\propto)$

11. In the given circuit the A.C source has $\omega = 100\,\text{rad}\,\text{s}^{-1}$. Considering the inductor and capacitor to be ideal, the correct choice(s) is or are



A) The current through the circuit I is 0.3 A
B) The current through the circuit I is $0.3\sqrt{2}\text{A}$
C) The voltage across 100Ω resistor is $10\sqrt{2}\text{V}$
D) The voltage across 50Ω resistor is $10\,\text{V}$

12. In the circuit shown the switch S is closed at t = 0 and $i_1 \text{ and } i_2$ are the instantaneous currents. Then choose correct statement(s)

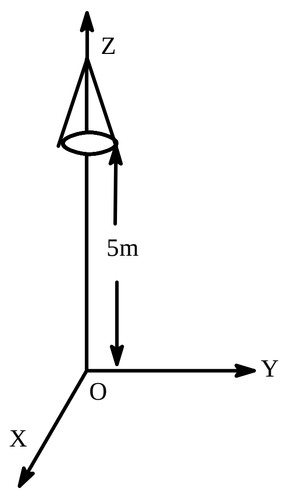


A) i_1 is maximum at $t = \infty$, and i_2 is maximum at t = 0
B) i_1 at t = 0 is equal to i_2 at $t = \infty$
C) $i_1 \text{ and } i_2$ are equal only at one instant $0 < t < \infty$
D) $i_1 \text{ and } i_2$ will never be equal

SECTION-3
[INTEGER TYPE]

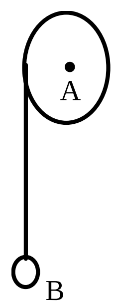
Section-III contains 6 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9.

1. The upper end of the thread of a simple pendulum is fixed to a vertical z axis and set in motion such that the pendulum bob moves along a horizontal circular path of radius 1m, parallel to xy plane, 5m above the origin. The bob has a speed of 3m / sec. The string breaks when the bob is vertically above the x axis and lands on the x-y plane. Find the magnitude of 'y' co-ordinate in meteres of the landing point $\left(g = 10 m/sec^2\right)$

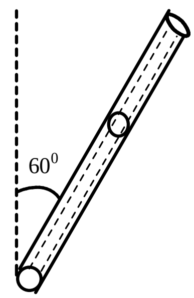


2. A particle is travelling with uniform acceleration g. If p, q and r are the distances travelled by the body during x^{th}, y^{th} and z^{th} seconds of it's motion respectively then value of $p(y-z)+q(z-x)+r(x-y)$ is__

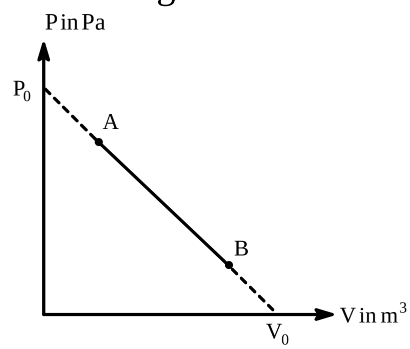
3. A light string of length 2.5m attached to a nail driven on the surface of a fixed cylinder A of radius $\frac{\pi}{3}$m. The cylinder is fixed near earth surface with it's axis in horizontal position. The nail is at same horizontal level as center of cylinder. A small ball B of mass 50 gm is attached to the other end of the thread. What minimum horizontal velocity (in m/sec) must be imparted to the ball towards so that the string will remain taut during the ball is at its highest altitude. (Take $g=10\,m/sec^2$ and $\pi^2=10$)



4. A closed tube of length 3m completely filled with water has a small air bubble trapped in it. When tube is held at angle 60^0 with vertical and rotated at constant angular velocity $\frac{\pi}{\sqrt{3}} \text{rad/s}$ about the vertical axis passing through it's lower end, the bubble settle down at a distance x metres from it's lower end. Find the value of x. (Take $g = 10 \, m/sec^2$ and $\pi^2 = 10$)

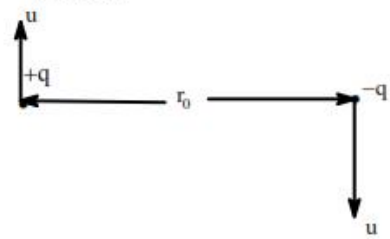


5. One mole of an ideal monoatomic gas undergoes a process A – B shown by a straight line in P – V indicator diagram



The volume of the gas when the process turns from an endothermic to exothermic one is $\frac{5}{x} V_0$. Find 'x'

6. In free space two particles of equal unknown masses and known charge $+q$ and $-q$ are simultaneously projected with equal speeds 'u' in opposite directions perpendicular to line joining them. Their initial separation is r_0. During the subsequent motion, the minimum speed is observed to be $\frac{u}{4}$. If the masses of the particles is given by $m = \frac{q^2}{\pi \in_0 x r_0 u^2}$, then find x.

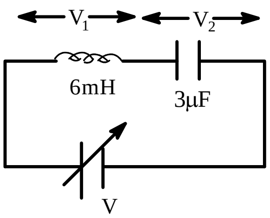
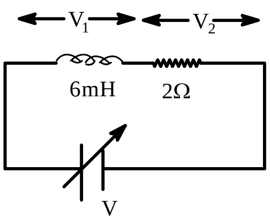
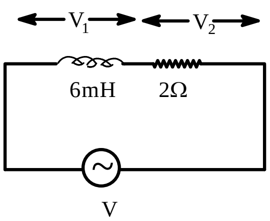
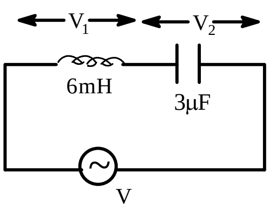
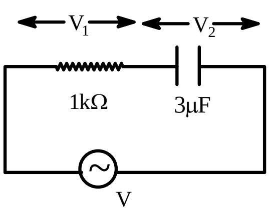


SECTION-4

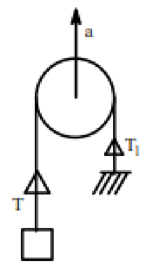
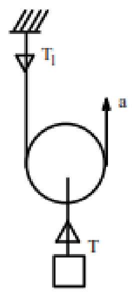
[Matrix Matching Type]

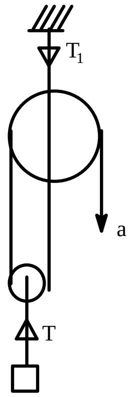
Section-IV contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II.

1. You are given many resistors, capacitors and inductors. These are connected to a variable D.C voltage source (the first two circuits) or an A.C. voltage source of 50 HZ frequency (the next three circuits) in different ways in Column II. When a current I (steady state for D.C and r.m.s for A.C) flows through the circuits, the corresponding voltages V_1 and V_2 (indicated in circuits) are related as shown in column I. Match the two

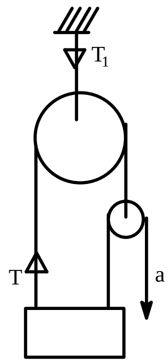
Column I	Column II
A) $I \neq 0, V_1$ is proportional to I	**P)** 
B) $I \neq 0, V_2 > V_1$	**Q)** 
C) $V_1 = 0, V_2 = V$	**R)** 
D) $I \neq 0, V_2$ is proportional to I	**S)** 
	t) 

2. See the diagrams carefully in Column I and match each with the obeying relation(s) in Column II. The string is massless and pulley is frictionless in each case. Here $a = \frac{g}{3}$, m = mass of block, T = tension in the given string a_{pulley} = acceleration of given pulley in each case, acceleration due to gravity is g, T_1 = Force on fixed support.

Column I	Column II
A) 	**P)** $a_{block} \le a$
B) 	**Q)** $a_{pulley} \le a$

C) 

R) T > mg

D) 

S) $T_1 > \frac{3}{2}mg$

T) $T_1 < \frac{3}{2}mg$

MATHS

SECTION-1

(SINGLE CORRECT CHOICE TYPE)

Section-I contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

1. If $4\bar{a}+5\bar{b}+9\bar{c}=\bar{0}$ then $(\bar{a}\times\bar{b})\times\left[(\bar{a}\times\bar{b})\times(\bar{c}\times\bar{a})\right]$ is equal to

A) $\lambda\left(\bar{b}.(\bar{c}\times\bar{a})\right),\lambda\in R$

B) $\bar{0}$

C) $\lambda\left(\bar{c}.(\bar{a}\times\bar{b})\right),\lambda\in R$

D) None

2. Absolute maximum value of the function $f(x)=\frac{1}{|x-4|+1}+\frac{1}{|x+8|+1}$ is

A) $\frac{3}{2}$

B) $\frac{5}{4}$

C) $\frac{13}{14}$

D) $\frac{14}{13}$

3. Let $f(x)$ be a monotonic polynomial of 2m-1 degree where $m\in N$, then the equation $f(x)+f(3x)+.....+f((2m-1)x)=2m-1$ has

A) At least one real root

B) $(2m-1)$ real roots

C) Exactly one real root

D) None of these

4. Area of the region bounded by the curves $|y| = e^{-|x|} - \frac{1}{2}$ and $\frac{|x|+|y|}{2} + \left|\frac{|x|-|y|}{2}\right| = 2$ is

A) $16 - \ln 4$ B) $14 - \ln 4$ C) $16 + \ln 4$ D) $14 + \ln 4$

5. The ratio of the area enclosed by the locus of mid-point of PS and area of the ellipse where P is any point on the ellipse and S is the focus of the ellipse, is

A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{1}{5}$ D) $\frac{1}{4}$

6. Number of ordered triplets (p, q, r) where $1 \le p, q, r \le 10$. Such that $2^p + 3^q + 5^r$ is a multiple of 4 is $(p, q, r \in N)$

A) 1000 B) 500 C) 250 D) 125

7. The coefficient of x^5 in the expansion of $(x^2 - x - 2)^5$ is

A) – 83 B) – 82 C) – 86 D) – 81

8. If $0<\alpha<\beta<\gamma<\frac{\pi}{2}$, then $\frac{\sin\alpha+\sin\beta+\sin\gamma}{\cos\alpha+\cos\beta+\cos\gamma}$ lies between

A) $\sin\alpha$ and $\sin\gamma$ B) $\tan\alpha$ and $\tan\gamma$

C) $\cos\alpha$ and $\cos\gamma$ D) $\cot\alpha$ and $\cot\gamma$

SECTION-2

(MORE THAN ONE TYPE)

Section - II contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE may be correct.

9. Three parallel chords of a circle having lengths 2, 3, 4 units, subtend angles α,β,γ respectively at the center, then

A) $\cos\alpha=\frac{17}{32}$ B) $\cos\alpha=\frac{7}{8}$ C) $\cos\beta=\frac{17}{35}$ D) $\alpha+\beta=\gamma$

10. If the roots of the equation $x^2+ax+b=0$ are c and d then the roots of the equation $x^2+(2c+a)x+c^2+ac+b=0$ are

A) c B) 2c C) d – c D) 0

11. If the equation $x^5-10a^3x^2+b^4x+c^5=0$ has three equal roots, then

A) $2b^2-10a^3b^2+c^5=0$
B) $6a^5+c^5=0$
C) $2c^5-10a^3b^2+b^4c^5=0$
D) $b^4=15a^4$

12. Let $s(n)$ denotes the number of ordered pairs satisfying $\frac{1}{x}+\frac{1}{y}=\frac{1}{n}$ where $n>1,\ x,y,n\in N$. Then

A) $S(6)=9$
B) $S(5)=3$
C) $S(3)=5$
D) $S(7)=3$

SECTION-3
[INTEGER TYPE]

Section-III contains 6 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9.

1. Let $f(x)=(x+1)(x+2)(x+3)(x+4)+5$ where $x\in[-6,6]$. If the range of the function is $[a,b]$ where $a,b\in N$, then the value of $\frac{a+b}{1683}$ is…..

2. Let $f(x)=a_1\sin x+a_2\sin 2x+.....+a_n\sin nx$, where $a_i\in R$,and $n\in N$. If $|f(x)|\le|\sin x|, \forall x\in R$, then maximum value of $|a_1+2a_2+.....+na_n|$ is…..

3. If ω is the imaginary cube roots of unity, then no. of pairs of integers (a,b) such that $|a\omega+b|=1$ is.

4. If 1 lies between the roots of the equation $p^2-mp+1=0$ and $[x]$ denotes the greatest integer function then the value of $\left[\left(\frac{4|x|}{|x|^2+16}\right)^m\right]$ is…..

5. Given $\bar{A}=2i+3j+6k, \bar{B}=i+j-2k$ and $\bar{C}=i+2j+k$. If $\left|\bar{A}\times\left(\bar{A}\times\left(\bar{A}\times\bar{B}\right)\right).\bar{C}\right|=abc$, a,b,c are digits from 1 to 9 then $a+b-c$ equals…..

6. Suppose that u, v, w, t are complex numbers for which $u+v+w+t=0=u^2+v^2+w^2+t^2$ then $\frac{\left(u^4+v^4+w^4+t^4\right)^2}{u^8+v^8+w^8+t^8}=$

SECTION-4

[Matrix Matching Type]

Section-IV contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II.

1. Match the following

	Column I		Column II
A)	$f: R \to [\pi/4, \pi)$ and $f(x) = \cot^{-1}(2x - x^2 - 2)$ then $f(x)$ is	**P)**	One - one
B)	$f: R \to R$ and $f(x) = e^{ax} \sin bx,$, where $a, b \in R^+$,then $f(x)$ is	**Q)**	Into
C)	$f: R^+ \to [2, \infty)$ and $f(x) = 2 + 3x^2,$ then $f(x)$ is	**R)**	Many one
D)	$f: X \to X$ and $f(f(x)) = x, \forall x \in X,$ then $f(x)$ is	**S)**	onto

2. Match the following

	Column I		Column II
A)	If α,β,γ be lengths of medians of $\Delta ABC,$ then $\frac{\alpha^2+\beta^2+\gamma^2}{a^2+b^2+c^2}$ is equal to	**P)**	1
B)	Let the point P lies in the interior of an equilateral ΔABC of side length 2 and its distances from the sides, BC, CA and AB are respectively x,y,z then x + y + z is equal to	**Q)**	$\sqrt{3}$
C)	In ΔABC A, B, C are in A.P. and a, b, c are in G.P. then $\frac{a^2b+b^2c+c^2a}{a^3+b^3+c^3}$ is equal to	**R)**	$\frac{3}{4}$
D)	In $\Delta ABC,$ the least value of $\frac{\sqrt{abc(a+b+c)}}{\Delta}$ is (where Δ is area of ΔABC)	**S)**	4
		T)	$\sqrt{2}$

ANSWER KEY

CHEMISTRY		PHYSICS		MATHEMATICS	
1	B	1	B	1	B
2	C	2	D	2	D
3	B	3	D	3	C
4	D	4	B	4	D
5	A	5	D	5	D
6	B	6	D	6	B
7	B	7	A	7	D
8	D	8	C	8	B
9	ABC	9	ABD	9	AD
10	BD	10	AD	10	CD
11	B	11	AC	11	BD
12	ABD	12	ABC	12	ABD
1	3	1	3	1	3
2	2	2	0	2	1
3	8	3	5	3	6
4	5	4	2	4	0
5	5	5	8	5	4
6	0	6	5	6	4
1	A – PQRS B – PRS C – PS D – PRS	1	A –RST B – QRST C – PQ D – QRST	1	A – QR B – RS C – PS D – PS
2	A –S B – P C – Q D – R	2	A –QRS B – PQR C – PQRS D – PS	2	A –R B – Q C – P D – S

CHEMISTRY

2. –I effect at dienophile favour Diels

3. Methyl orange indicator

4. B

$E_{af} - E_{ab} = \Delta h$

7. $He_2 : \sigma_{1s^2}\sigma^*_{1s^2}$ **;** $He_2^+ : \sigma_{1s^2}\sigma^*_{1s^1}$

$H_2 : \sigma_{1s^2} ; H_2^+ : \sigma_{1s^1}$

8. $BeF_2 > BaF_2 > SrF_2 > CaF_2 > MgF_2$ - solubility

9. Edmans reagent used for N-Terminal

12. $\underset{(\text{impure})}{ZnS} \xrightarrow{\text{froth floatation}} ZnS \xrightarrow{\text{roasting}} ZnO \xrightarrow{\text{carbon reduction}} Zn$

13. Conceptual

14. PTC are used in Riemer tiemann

15. Conceptual

16. 5

At $\frac{3}{4}^{th}$ of the equivalence point,

$P^{OH} = P^{Kb} + \log\frac{[5]}{[3]}$

$P^{OH} = P^{Kb} + \log\frac{(3/4)}{(1/4)}$

$P^{OH} = P^{Kb} + \log(3)$

$P^{H} = 14 - P^{OH}$

$= 14 - P^{Kb} - \log(3)$

$\Rightarrow 14 - P^{K_b} = 9 \quad \Rightarrow P^{K_b} = 5$

$\therefore P^{Kb} = 5$

$\therefore K_b = 10^{-5} \qquad \therefore n = 5$

17. Sulphides of Sn,As and Sb are soluble in YAS

18. $[CuCl_2Br_2]^{2-}$ is a tetrahedral complex

21. Dimension of Energy is $\left[ML^2T^{-2}\right]$

So, $[PM]=\left[ML^2T^{-2}\right]$, Hence $P=\left[L^2T^{-2}\right]$

$\left[QM^{-1}LT^{-2}\right]=\left[ML^2T^{-2}\right]$, Hence $Q=\left[M^2L\right]$

$\left[RMLT^{-1}\right]=\left[ML^2T^{-2}\right]$, Hence $R=\left[LT^{-1}\right]$

Hence option (B) is correct

22. Here induced emf's are opposite of each other and capacitors connected in series

So $Q=(\varepsilon_1-\varepsilon_2)c_{eq}$

$=\pi\left(r_1^2-r_2^2\right)\frac{C}{2}\frac{dB}{dt}$

$=\left[\pi(400-30)\times10^{-4}\times5\times10^{-6}\times10\right]C$

$=1.5\pi\mu C$

$=4.7\mu c$

23. When switch is open

Hence, charge flown through switch is $5\mu C$

24. $m=\frac{f}{u+f}$

Here object is real, so we can imagine a situation like this with a converging lens say object is placed at a distance 'x' from focus towards pole in first position and at a distance y from focus away from pole is 2nd position one image is virtual and other is real.

So, $\frac{f}{-(f-x)+f}=-\frac{f}{-(f+y)+f}$

Hence, $x=y$

And $x+y=f$

$\Rightarrow x=\frac{f}{2}$

Hence, $x=\pm2$

So diameter of coin is 4 cm

25. The maximum kinetic energy electrons can reach a maximum distance of d

Hence, $\frac{hc}{\lambda}-\frac{hc}{\lambda_{th}}=eEd$

$\Rightarrow \lambda_{th}=\left(\frac{1}{\lambda}-\frac{eEd}{hL}\right)^{-1}$

26. Mass of helium atom is 4 times mass of neutron (approx). If collision is perfectly in elastic the energy lost is completely utilized for excitation of He^{+} atom, $mu=5mv \Rightarrow v=\frac{4}{5}$

$\Delta E=\frac{1}{2}mu^2-\frac{1}{2}mv^2=\frac{2}{5}mu^2$

For minimum energy of neutron $\frac{2}{5}mu^2=40+8cm$

Here $u=9.89\times10^4 m/sec$

27. Say initially concentration of $U-238 \& U-235 is 2No$

Then, $N_1=N_oe^{-\lambda_1 t}$ and $N_2=N_oe^{-\lambda_2 t}$

Hence, $\frac{N_1}{N_1+N2}=9928 and \frac{N_2}{N_1+N_2}=0072$

$\Rightarrow \frac{N_1}{N_2}=\frac{9928}{.0072}$

$\Rightarrow \frac{e^{-\lambda_1 t}}{e^{-\lambda_1 t}}=\frac{9928}{0072}$

$\Rightarrow (\lambda_2-\lambda_1)t=\ln\frac{9928}{0072}$

$\Rightarrow t=\ln\frac{.9928}{.0072}/\ln 2\left(\frac{1}{.71\times10^9}-\frac{1}{4.56\times10^9}\right)$

$=5.98\times10^9$ years

29. P.E. of liquid column $=\frac{mgh}{2}=\frac{\pi r^2 h.g.h}{2}$

$=\frac{1}{2}\pi r^2h^2g$

As $h=\frac{2\sigma}{r\rho g}=$ we will get $P.E.=\frac{2\pi\sigma^2}{\rho g}$

Work done by surface tension $\sigma.2\pi r.h$

$$= \frac{4\pi\sigma^2}{\rho g}$$

Working done by gravity $\frac{-2\pi\sigma^2}{\rho g}$

Heat liberated is $= W_{\text{surface tension}}$ - change in P.E.

$$= \frac{2\pi\sigma^2}{\pi g}$$

30. Conceptual

31. Current through RC circuit $= I_1 = \frac{20}{100\sqrt{2}} \text{Amp} = .141\text{Amp}$

Current through RL circuit $= I_2 = \frac{20}{50\sqrt{2}} \text{Amp} = .282\text{Amp}$

So current $I = \sqrt{I_1 2 + I_2^2} = .3\text{Amp}$

Voltage across 100Ω resistor $= I_1 \times 10 = 10\sqrt{2}\text{ V}$

Voltage across 50Ω resistor $= I_2 \times 100 = 10\sqrt{2}\text{ V}$

32. Conceptual

33. At the moment of breaking of string velocity is along +ve y-axis. Hence, it will be a projectile is YZ plane time of flight $= \sqrt{\frac{2\times 5}{10}} = 1\text{sec}$

Y co-ordinate $= v \times t = 3\text{m}$

34. $p = u + \frac{g}{2}(2x-1)$

$q = u + \frac{g}{2}(2y-1)$

$r = u + \frac{y}{2}(2z-1)$

So $q - r = g(y-z)$

Hence, $y - z = \frac{q-r}{g}$

Similarly $z - x = \frac{r-p}{g}$ and $x - y = \frac{p-q}{g}$

So, $p(y-z)+q(z-n)+r(x-y)=\frac{p(q-r)+q(r-p)+r(p-q)}{q}=0$

35. The string must be taut at highest position

So, $v=\sqrt{g(\ell-\pi r)}$

Conserving energy we will get

$$\frac{1}{2}mu^2-\frac{1}{2}mv^2=mg(\ell+\ell-\pi r)$$

$$\Rightarrow u^2=v^2+2g(2\ell-\pi r)$$

$$\Rightarrow u^2=g(\ell-\pi r)+2g(2\ell-\pi r)$$

$$\Rightarrow u^2=g(5\ell-3\pi r)$$

$$\Rightarrow u=\sqrt{g(5\ell-3\pi r)}=\sqrt{10\left(12.5-3\times\pi\times\frac{\pi}{3}\right)}$$

$$=\sqrt{10\times 2.5}=5m/sec$$

36. The bubble will settle at that position where rate of change of pressure is zero

37. The equation of the process is

$$P=\frac{-P_0}{V_0}.V+P$$

$$\Rightarrow RT=\frac{-P_0}{V_0}.V^2+P_0V$$

$$\Rightarrow R\,dT=\frac{-P_0}{V_0}.2V.dV+P_0dV$$

$$\Rightarrow dV=\frac{R}{-\frac{P_0}{V_0}.2V+P_0}$$

When process changes form exdothermic to exothermic rate of heat exchange become zero.

Hence, $\frac{\Delta H}{\Delta T}=0\Rightarrow C=0$

Again $c=C_v+\frac{PdV}{dT}=\frac{\left(-\frac{P_0}{V_0}V+P_0\right)dV.R}{\left(\frac{-P_0}{V_0}.2V+P_0\right)dV}+C_v$

When C = 0

$$\Rightarrow \frac{R}{\gamma - 1} = C_v = \frac{-\left(-\frac{v}{V_0} + 1\right)R}{-\frac{2V}{V_0} + 1}$$

$$\Rightarrow \frac{-2V}{V_0} + 1 = (\gamma - 1)\left(\frac{V}{V_0} - 1\right)$$

$$\Rightarrow \frac{V}{V_0}(\gamma - 1 + 2) = \gamma$$

$$\Rightarrow V = V_0 \frac{\gamma}{\gamma + 1} = \frac{5}{8} V_0$$

38. Centre of mass of the system is at rest. w.r.t. centre of mass momentum as well as energy is conserved.

$$\frac{mur^0}{2} = \frac{mu}{4}.r \Rightarrow r = 2r_0$$

$$mu^2 - \frac{Kq^2}{r_0} = \frac{mu^2}{16} - \frac{Kq^2}{r}$$

Solving we will get $m = \frac{q^2}{\pi_0 5 r_0 u^2}$

39. Conceptual

40. Conceptual

MATHS

41. $\bar{a}, \bar{b}, \bar{c}$ are coplanar $\Rightarrow \bar{b} \times \bar{c} \,\&\, \bar{c} \times \bar{a}$ are collinear.

42. $\because f(x)$ is increasing in $(-\infty, -8)$ and decreasing $(4, \infty)$

$$\therefore f(x) = \frac{1}{x+9} + \frac{1}{5-x} \quad \forall x \in [-8, 4]$$

$= \frac{14}{(9+x)(5-x)}$, minimum of $(9+x)(5-x)$

Occurs at $x = -8 \,\&\, x = 4$

$\therefore$ Maximum of $f(x) = 1 + \frac{1}{13} = \frac{14}{13}$

43. $f'(px) > 0 \text{ r or } f'(px) < 0 \;\; \forall p, x \in R$

$\Rightarrow f(px)$ is monotonic

$\therefore\ f(x)+f(3x)+.....+f((2m-1)x)$ is monotonic polynomial of degree $2m-1$

44. $|f(x)+g(x)|+|f(x)-g(x)|$

$= 2\max\{|f(x)|,|g(x)|\}$

45. Ellipse equation is $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, Area = πab

Let $P=(a\cos\theta, b\sin\theta)$ $S=(ae,0)$

M(h,k) mid point of PS $\Rightarrow h=\frac{ae+a\cos\theta}{2}; k=\frac{b\sin\theta}{2}$

$=\frac{h-\frac{ae}{2}}{a/2}+\frac{k^2}{(b^2/4)}=1$, locus of (h,k) is ellipse Area $=\pi\left(\frac{a}{2}\right)\left(\frac{b}{2}\right)=\frac{1}{4}\pi ab$

46. $2^p+3^q+5^r=2^p+(4-1)^q+(4+1)^r$

$=2^p+4m+(-1)^q+4n+1$

Case (i) $P=1, q$ is even, r can be any thing

No. of triplets $=1\times5\times10=50$

Case (ii) $p\neq1, q$ is odd, r can be any thing

No. of triples $=9\times5\times10=450$

47. $(x-2)^5(1+x)^5$

$=\left[{}^5C_0x^5-2\times{}^5c_1.x^4+.....\right]\left[{}^5C_0+{}^5C_1x+.....\right]$

$\Rightarrow$ coeff.of $x^5=-81$

48. $3\sin\alpha<\sin\alpha+\sin\beta+\sin\gamma<3\sin\gamma$

$3\cos\alpha>\cos\alpha+\cos\beta+\cos\gamma>3\cos\gamma$

$\Rightarrow\frac{1}{3\cos\alpha}<\frac{1}{\cos\alpha+\cos\beta+\cos\gamma}<\frac{1}{3\cos\gamma}$

$\Rightarrow\tan\alpha<\frac{\sin\alpha+\sin\beta+\sin\gamma}{\cos\alpha+\cos\beta+\cos\gamma}<\tan\gamma$

49. Construct a triangle ABC with sides 2, 3, 4. Then construct a circle circumscribing triangle ABC

$\cos\frac{\alpha}{2}=\frac{7}{8}\Rightarrow\cos\alpha=\frac{17}{32}$

(Equal chords subtends equal angle)

50. $f(x) = x^2 + ax + b$

$\Rightarrow x^2 + (2c+a)x + c^2 + ac + b = f(x+c)$

$\therefore$ Roots are 0, d – c

51. $f(x) = x^5 - 10a^3x^2 + b^4x + c^5$

$f'(x) = 5x^4 - 20a^3x + b^4$

$f''(x) = 20x^3 - 20a^3$

$f(\alpha) = f'(\alpha) = f''(\alpha) = 0 \Rightarrow \alpha = a$

and $5a^4 - 20a^4 + b^4 = 0 \Rightarrow b^4 = 15a^4$

Also, $\alpha^5 - 10a^3\alpha^2 + b^4\alpha + c^5 = 0$

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

$\Rightarrow 6a^5 + c^5 = 0$

52. Given expression is $(x-n)(y-n) = n^2$

No. of solutions $= S(n) = \text{No.}$ of factors of n^2

$S(6) = \text{No.}$ of factors of $6^2 \text{ i.e., } 2^2.3^2 = 3\times3 = 9$

If n is prime i.e., n= p, no. of factors of $p^2 \text{is } 3.(1.p.p^2)$

53. $f(x) = (x^2 + 5x + 5)^2 + 4$

$\therefore a = 4,$ max. of $f(x)$ will be at x = 6

$b = (36+30+5)^2 + 4 = 71^2 + 4 = 5045$

54. $f'(x) = \lim\limits_{h\to0} \frac{f(x+h) - f(x)}{h} \Rightarrow f'(0) = \lim\limits_{h\to0} \frac{f(h)}{h}$

Also, $\left|\frac{f(h)}{h}\right| \le \left|\frac{\sin h}{h}\right| \Rightarrow |f'(0)| \le 1$

55. $(a\omega + b)(a\overline{\omega} + b) = 1 \Rightarrow (a-b)^2 + ab = 1$

Case (i) $(a-b)^2 = 0 \text{ and } ab = 1$ then solutions are $\{(1,1),(-1,-1)\}$

Case (ii) $(a-b)^2 = 1$ and $ab = 0$ then solutions are

$\{(0,1),(1,0),(-1,0),(0,-1)\}$

56. Let $f(p)=p^2-mp+1, \because f(1)<0 \Rightarrow 2-m<0 \Rightarrow m>2$

Also, $\frac{|x|^2+16}{2} \geq 4|x| \Rightarrow 0 \leq \frac{4|x|}{|x|^2+16} \leq \frac{1}{2}$

$\Rightarrow 0 \leq \left(\frac{4|x|}{|x|^2+16}\right)^m < 1$

57. $\because \overline{A} \times (\overline{A} \times (\overline{A} \times \overline{B})).\overline{C} = -|\overline{A}|^2 [\overline{A}\overline{B}\overline{C}]$

$|\overline{A}|^2 = 49 \text{ and } [\overline{A}\overline{B}\overline{C}] = 7$

58. $(u+v+w+t)^2 = \Sigma u^2 + 2\Sigma uv \Rightarrow \Sigma uv = 0$ [using given condition]

So, let the quartic equation whose roots are u, v, w, t be

$f(x) = x^4 - ax - b$ so, $x^{n+4} - ax^{n+1} - bx^n = 0$

$\Rightarrow s_{n+4} - as_{n+1} - bs_n = 0$

Where $s_n = u^n + v^n + w^n + t^n$

Required is $\frac{(s_4)^2}{s_8}$ $s_1 = 0$, $s_2 = 0$

59. A) $f'(x)$ changes sign in the neighbourhood of $x = 2, 2x - x^2 - 2 = -1 - (x-1)^2 \leq -1$

$\Rightarrow R_f \equiv [3\pi/4, \pi)$

B) $-e^{ax} \leq e^{ax} \sin bx \leq e^{ax}$

C) $f'(x) > 0 \ \forall\, x \in R^+, R_f \equiv (2, \infty)$

D) Let $X \equiv \{x_1, x_2, ..., x_n\}$

Let $f(x_1) = x_2 \Rightarrow ff(x_1) = f(x_2) \Rightarrow f(x_2) = x_1$

60. A) $\alpha^2 = \frac{1}{4}(2b^2 + 2c^2 - a^2), \beta^2 = \frac{1}{4}(2c^2 + 2a^2 - b^2)$

$\gamma^2 = \frac{1}{4}(2a^2 + 2b^2 - c^2)$

$\Rightarrow \alpha^2 + \beta^2 + \gamma^2 = \frac{3}{4}(a^2 + b^2 + c^2)$

B) $\frac{1}{2}(x+y+z)\times 2=\frac{\sqrt{3}}{4}\times 2^2$

$\Rightarrow x+y+z=\sqrt{3}$

C) $\angle B=60^0 \Rightarrow \angle A+\angle C=120^0$

$b^2=ac \Rightarrow \sin^2 B=\sin A.\sin C$

$\Rightarrow \frac{3}{4}=\sin A \sin C$

$\Rightarrow \frac{3}{2}=\cos(A-C)-\cos(A+C)$

$\Rightarrow \cos(A-C)=1 \Rightarrow \angle A=\angle C$

Δ is equilateral

D) $\frac{\sqrt{abc(a+b+c)}}{\Delta}=\frac{1}{\Delta}\sqrt{4R\Delta.2S}=\sqrt{\frac{8RS}{\Delta}}$

$=\sqrt{\frac{8R}{r}}\geq\sqrt{8\times 2}=4$