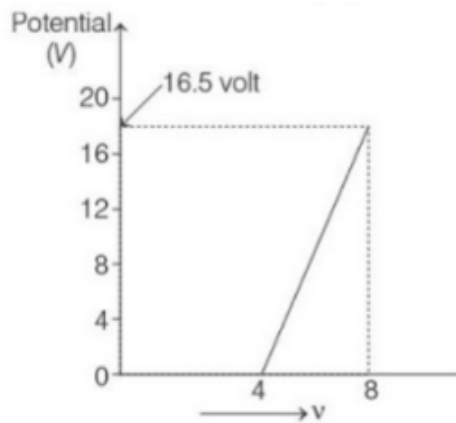


BITSAT QUESTION PAPER 2022

1. The stopping potential (V_0) versus frequency (ν) of a graph for the photoelectric effect in a metal is given. From the graph, the Planck's constant (h) is:



- (A) $6.60 \times 10^{-34} \text{ J}\cdot\text{s}$
 - (B) $6.69 \times 10^{-34} \text{ J}\cdot\text{s}$
 - (C) $6.62 \times 10^{-34} \text{ J}\cdot\text{s}$
 - (D) $6.63 \times 10^{-34} \text{ J}\cdot\text{s}$
-

2. In a resonance column, the first and second resonance are obtained at depths 24 cm and 78 cm. The third resonance will be obtained at what depth?

- (A) 160 cm
 - (B) 132 cm
 - (C) 131 cm
 - (D) 152 cm
-

3. A submarine A, traveling at 17 m/s, is being chased along the line of its velocity by another submarine B, traveling at 34 m/s. Submarine B sends a sonar signal of 600 Hz to detect A and receives a reflected sound of frequency v . The value of v is:

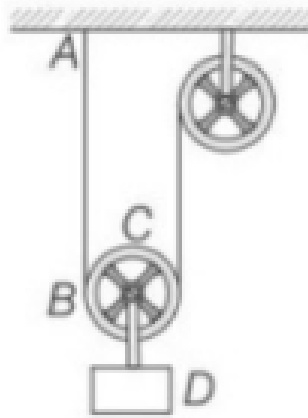
[Speed of sound in water = 1500 m/s]

- (A) 613.7 Hz
- (B) 6137 Hz
- (C) 62 Hz
- (D) 539 Hz

4. Transverse waves of the same frequency are generated in two steel wires A and B. The diameter of A is twice that of B, and the tension in A is half that in B. The ratio of the velocities of the waves in A and B is:

- (A) 1 : 2
 - (B) 1 : $\sqrt{2}$
 - (C) 1 : $2\sqrt{2}$
 - (D) 3 : $2\sqrt{2}$
-

5. In the diagram shown below, both the strings AB and CD are made of the same material and have the same cross-section. The pulleys are light and frictionless. If the speed of the wave in string AB is v_1 and in CD is v_2 , then the ratio $\frac{v_1}{v_2}$ is:



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

6. What will be the acceleration due to gravity at a depth d , where g is the acceleration due to gravity on the surface of the Earth?

- (A) $\frac{g}{\left(1+\frac{d}{R}\right)^2}$
- (B) $g \left[1 - \frac{2d}{R}\right]$
- (C) $\frac{g}{\left(1-\frac{d}{R}\right)^2}$
- (D) $g \left[1 - \frac{d}{R}\right]$

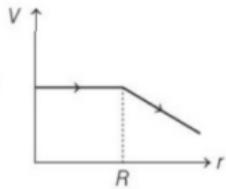
7. A direct current of $6A$ is superimposed on an alternating current given by

$I = 10 \sin \omega t$ flowing through a wire. The effective value of the resulting current will be:

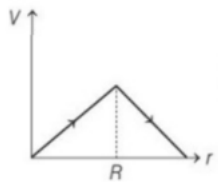
- (A) $5\sqrt{2}$
 - (B) $5\sqrt{3}$
 - (C) 9.27
 - (D) 8.37
-

8. Which one of the following graphs represents the variation of electric potential with distance r from the center of a non-conducting charged sphere of radius R ?

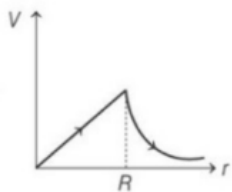
(A)



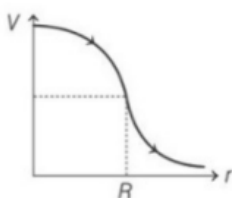
(B)



(C)



(D)



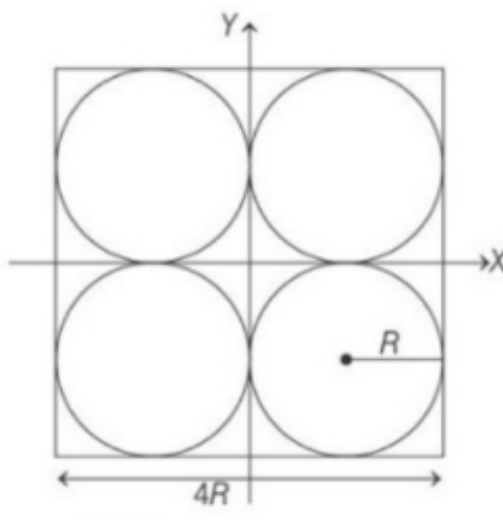
9. For an insulator, the forbidden energy gap is:

- (A) Zero
 - (B) 1 eV
 - (C) 2 eV
 - (D) 5 eV
-

10. A machine gun fires 300 bullets per minute. If the mass of each bullet is $10g$ and the velocity of the bullets is 600 m/s , the power (in kW) of the gun is:

- (A) 43200
 - (B) 9
 - (C) 72
 - (D) 7.2
-

11. Four holes of radius 5 cm are cut from a thin square plate of 20 cm side and mass 1 kg. The moment of inertia of the remaining portion about the Z -axis is:



- (A) $15\text{ kg} \cdot \text{m}^2$
 - (B) $0.37\text{ kg} \cdot \text{m}^2$
 - (C) $0.0017\text{ kg} \cdot \text{m}^2$
 - (D) $0.08\text{ kg} \cdot \text{m}^2$
-

12. A particle of mass m is projected with velocity v at an angle θ with the horizontal. At its highest point, it explodes into two pieces of equal mass. One of the pieces continues to move on the original trajectory. The velocity of the second piece is:

- (A) $2v \cos \theta$
- (B) $v \cos \theta$
- (C) $3v \cos \theta$
- (D) $\frac{v}{2} \cos \theta$

13. In the circuit shown, assume the diode to be ideal. When V_i increases from $-2V$ to $6V$, the change in current is (in mA):

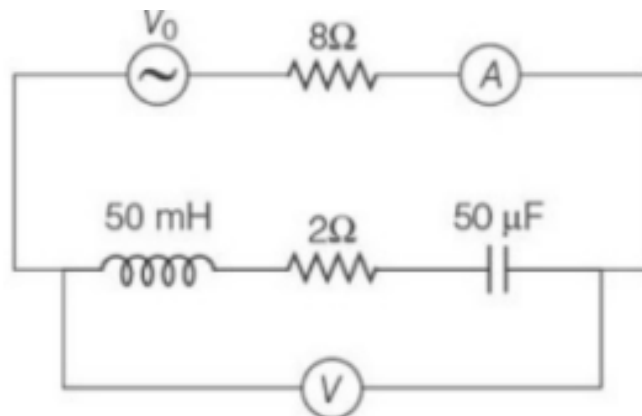


- (A) Zero
- (B) 20
- (C) $\frac{25}{8}$
- (D) 32

14. The de-Broglie wavelength of an electron moving with a velocity $\frac{c}{3}$ (where $c = 3 \times 10^8$ m/s) is equal to the wavelength of a photon. The ratio of the kinetic energies of the electron and the photon is:

- (A) 1 : 4
- (B) 1 : 3
- (C) 1 : 2
- (D) 2 : 1

15. In the circuit shown in the figure, the AC source gives a voltage $V = 20 \cos(2000t)$. Neglecting source resistance, the voltmeter and ammeter readings will be:

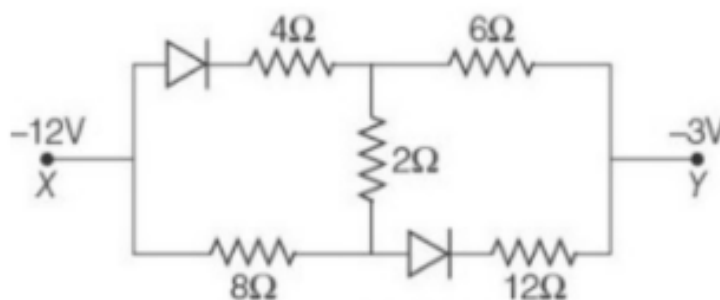


- (A) 0 V, 0.47 A
- (B) 2.82 V, 1.41 A
- (C) 1.41 V, 0.47 A
- (D) 1.5 V, 8.37 A

16. An electromagnetic wave is propagating along the X-axis. At $x = 1 \text{ cm}$ and $t = 18 \text{ s}$, its electric vector $|E| = 8 \text{ V/m}$. Then the magnitude of its magnetic vector is:

- (A) 2.66×10^{-8}
- (B) 3×10^{-7}
- (C) 3.14×10^{-8}
- (D) 3.16×10^{-7}

17. In the following circuit, the equivalent resistance between X and Y is Ω :



- (A) 5 Ω
- (B) 12 Ω
- (C) 16 Ω
- (D) 20 Ω

18. A monoatomic gas of molar mass m is kept in an insulated container. The container is moving with velocity v . If the container is suddenly stopped, then the change in the temperature of the gas is:

- (A) $\frac{mv^2}{4R}$
- (B) $\frac{mv^2}{2R}$
- (C) $\frac{mv^2}{R}$
- (D) $\frac{mv^2}{3R}$

19. A projectile is projected with the velocity of $3\hat{i} + 4\hat{j}$ m/s. The horizontal range of the projectile will be:

- (A) 1.2 m
 - (B) 2.4 m
 - (C) 3.6 m
 - (D) 4.5 m
-

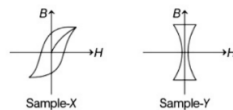
20. A transistor is connected in common-emitter (CE) configuration. The collector supply is 8V and the voltage drop across a resistor of $500\ \Omega$ in the collector circuit is 0.6V. If the current gain factor α is 0.96, find the base current.

- (A) $25\ \mu A$
 - (B) $50\ \mu A$
 - (C) $20\ \mu A$
 - (D) $35\ \mu A$
-

21. A solid sphere of 80 kg and radius 15 m moving in a space becomes a circular disc of radius 20 m in 1 hour. The rate of change of moment of inertia in this process is:

- (A) $\frac{30}{9}\text{ kg m}^2\text{ s}^{-1}$
 - (B) $\frac{25}{9}\text{ kg m}^2\text{ s}^{-1}$
 - (C) $\frac{10}{9}\text{ kg m}^2\text{ s}^{-1}$
 - (D) $\frac{22}{9}\text{ kg m}^2\text{ s}^{-1}$
-

22. If the B – H curves of two samples of X and Y of iron are as shown below, then which one of the following statement is correct?



- (A) Both X and Y are suitable for making electromagnets.
- (B) Both X and Y are suitable for making permanent magnets.
- (C) X is suitable for making permanent magnet and Y for making electromagnet.
- (D) X is suitable for making electromagnet and Y is suitable for permanent magnet.

23. In a radioactive material, the activity at time t_1 is A_1 and at a later time t_2 , it is A_2 .

If the decay constant of the material is λ , then:

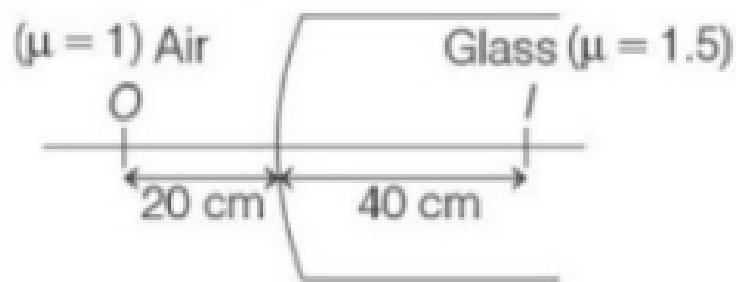
(A) $A_1 = A_2 e^{-\lambda(t_1 - t_2)}$

(B) $A_1 = A_2 e^{\lambda(t_1 - t_2)}$

(C) $A_1 = A_2 \frac{t_2}{t_1}$

(D) $A_1 = A_2$

24. A mosquito O is sitting in front of a glass rod having a spherical end of radius of curvature 40 cm. The image would be formed at:



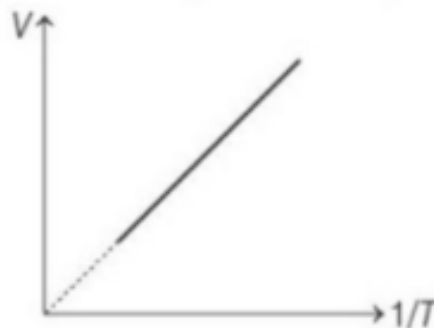
(A) 40 cm left

(B) infinity

(C) 20 cm to the right

(D) 15 cm to the left

25. One mole of an ideal diatomic gas undergoes a process as shown in the figure. The molar specific heat of the gas in the process is:



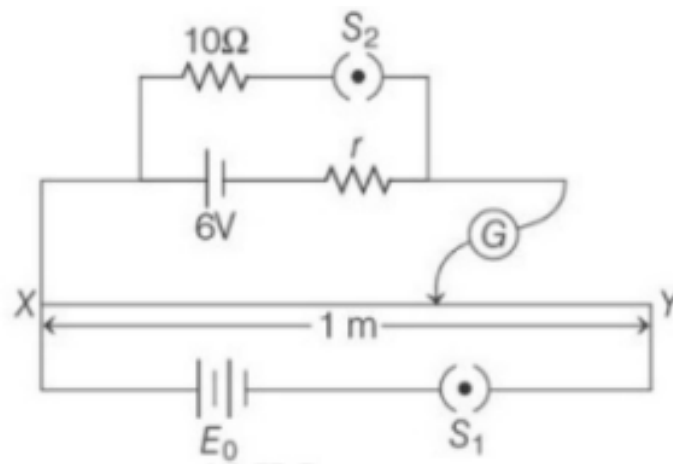
(A) $\frac{3R}{2}$

- (B) $\frac{R}{2}$
 (C) $\frac{5R}{2}$
 (D) $\frac{7R}{2}$

26. A capillary tube is attached horizontally to a constant heat arrangement. If the radius of the capillary tube is increased by 25 % , then the rate of flow of liquid will change nearly by:

- (A) 100 %
 (B) 112 %
 (C) 124 %
 (D) 144 %

27. In the arrangement shown in the figure, when the switch S_2 is open, the galvanometer shows no deflection for $l = 50$ cm. When the switch S_2 is closed, the galvanometer shows no deflection for $l = 0.416$ m. The internal resistance r of the 6V cell is:



- (A) 2Ω
 (B) 3Ω
 (C) 5Ω
 (D) 9Ω

28. In a Young's double slit arrangement, fringes are produced using light of wavelength $4000\text{ \AA}$. One slit is covered by a thin plate of glass of refractive index 1.4 and the other

with another glass plate of the same thickness but of refractive index 1.7. By doing so, the central bright fringe shifts to the original sixth fringe from the center. The thickness of the glass plates is:

- (A) $2\ \mu m$
 - (B) $8\ \mu m$
 - (C) $11\ \mu m$
 - (D) $16\ \mu m$
-

29. An electric current I enters and leaves a uniform circular wire of radius r through diametrically opposite points. A charged particle q moves along the axis of the circular wire and passes through its center at speed v . The magnetic force on the particle when it passes through the center has a magnitude of:

- (A) $\frac{qv\mu_0 I}{2\pi r}$
 - (B) $\frac{qv\mu_0 I}{\pi r}$
 - (C) $\frac{qv\mu_0 I}{r}$
 - (D) 0
-

30. An achromatic convergent doublet of two lenses in contact has a power of +5D. The power of the converging lens is +6D. The ratio of the dispersive power of the converging and divergent lenses is:

- (A) 3 : 7
 - (B) 2 : 3
 - (C) 1 : 5
 - (D) 5 : 3
-

31. Which one of the following is the correct order of given isotopes?

- I. $T_2 > D_2 > P_2$ (order of boiling point)
 - II. $T_2 > D_2 > P_2$ (order of bond energy)
 - III. $T_2 = D_2 = P_2$ (order of bond length)
 - IV. $T_2 < D_2 < P_2$ (order of reactivity with Cl_2)
- (A) I and II

- (B) III and IV
 - (C) II, III and IV
 - (D) All of these
-

32. Ninhydrin gives a yellow color in paper chromatography with which amino acid?

- (A) Tryptophan
 - (B) Proline
 - (C) Alanine
 - (D) Tyrosine
-

33. How will a rise in temperature affect the viscosity of liquids and gases?

- (A) Both increases
 - (B) Both decreases
 - (C) In case of liquids, decreases and in case of gases, increases.
 - (D) In case of liquid, increases and in case of gases, decreases.
-

34. Which of the following compounds is thermodynamically the most stable?

- (A) BaCO_3
 - (B) MgCO_3
 - (C) SrCO_3
 - (D) CaCO_3
-

35. Glucose reacts with X number of molecules of phenylhydrazine to yield osazone.

The value of X is:

- (A) three
 - (B) two
 - (C) one
 - (D) four
-

36. Nylon-6,6 is obtained from:

- (A) adipic acid and hexamethylene diamine
- (B) tetrafluoroethylene

- (C) vinyl cyanide
(D) vinyl benzene
-

37. What is the hybridization of $[\text{CrF}_6]^{3-}$?

- (A) sp^3d
B. sp^3d^2
(C) $d^2\text{sp}^3$
(D) $d^2\text{sp}$
-

38. OF and F_2 can be compared in terms of:

- (A) OF is paramagnetic while F_2 is diamagnetic
(B) OF is more stable towards dissociation into atoms
(C) Both (a) and (b) are correct
(D) None of the above is correct
-

39. Ortho and para forms of hydrogen have:

- (A) different physical and chemical properties
(B) identical physical properties but different chemical properties
(C) identical chemical properties but different physical properties
(D) identical chemical and physical properties
-

40. The structure of H_2O_2 is:

- (A) planar, linear
(B) non-planar, linear
(C) planar, non-linear
(D) non-planar, non-linear
-

41. Match the species in Column I with their types in Column II.

Column I

Column II

- | | |
|---------------------|-----------------------|
| A. DDT | 1. Photochemical smog |
| B. NaClO_3 | 2. Disinfectant |

- C. Cl_2 3. Herbicides
D. PAN 4. Pesticides

- (A) $A \rightarrow 4, B \rightarrow 3, C \rightarrow 2, D \rightarrow 1$
(B) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 1$
(C) $A \rightarrow 2, B \rightarrow 1, C \rightarrow 4, D \rightarrow 3$
(D) $A \rightarrow 3, B \rightarrow 1, C \rightarrow 2, D \rightarrow 4$
-

42. In which pair or pairs is the stronger bond found in the first species?

- I. $\text{O}_2^{2-}, \text{O}_2$
II. N_2, N_2^+
III. NO^+, NO^-

- (A) I only
(B) II only
(C) I and II only
(D) II and III only
-

43. Select the correct statement about the complex $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$.

- (A) Its ionisation isomer is $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$.
(B) It gives a yellow precipitate with AgNO_3 .
(C) Its ionisation isomer gives a white precipitate with BaCl_2 .
(D) All the above are correct statements.
-

44. A certain metal sulphide, M_2S_2 , is used extensively as a high temperature lubricant.

If M_2S_2 is 40.06 % by mass sulphur, the atomic mass of metal M is:

- (A) 160 u
(B) 64 u
(C) 40 u
(D) 96 u
-

45. X reacts with chlorine (Cl_2) under boiling conditions to form Benzotrichloride,

which further reacts with H_3O^+ to form Y. Identify X and Y.



- (A) Benzene, Benzaldehyde
 - (B) Toluene, Benzaldehyde
 - (C) Toluene, Benzoic Acid
 - (D) Benzene, Benzoic Acid
-

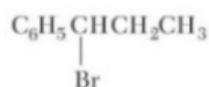
47. Which compound has antifluorite structure?

- (A) MnO_4
 - (B) Na_2O
 - (C) Na_2O_2
 - (D) Li_2O_2
-

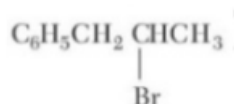
48. 100 mL of 2M formic acid ($pK_a = 3.74$) is neutralized by NaOH. At the equivalence point, the pH is:

- (A) 7
 - (B) 6
 - (C) 9.5
 - (D) 8.87
-

49. The reaction of $C_6H_5CH=CHCH_3$ with HBr produces:

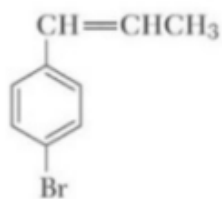


- (A)
- (B)



- (C) $C_6H_5CH_2CH_2Br$

D.

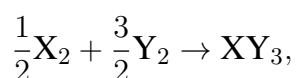


50. The number of $3C - 2e^-$ bonds present in diborane is:

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

51. Standard entropy of X_2 , Y_2 , and XY_2 are 60, 40, and $50 \text{ J K}^{-1} \text{ mol}^{-1}$, respectively.

For the reaction,



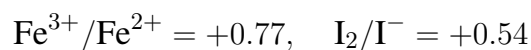
with $\Delta H = -30 \text{ kJ}$, to be at equilibrium, the temperature will be:

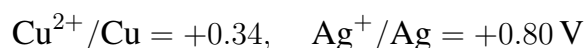
- (A) 1250 K
- (B) 500 K
- (C) 750 K
- (D) 1000 K

52. The total number of $P - OH$ bonds for pyrophosphoric acid is:

- (A) 4
- (B) 5
- (C) 6
- (D) 8

53. Using the standard electrode potential, find out the pair between which redox reaction is not feasible. The E° values are:





- (A) Fe^{3+} and I^-
 - (B) Ag^+ and Cu
 - (C) Fe^{3+} and Cu
 - (D) Ag and Fe^{3+}
-

54. What is

$[\text{NH}_4^+]$ in a solution that is 0.02 M NH_3 and 0.01 M KOH ? $K_b(\text{NH}_3) = 1.8 \times 10^{-5}$

- (A) $3.6 \times 10^{-5} \text{ M}$
 - (B) $1.8 \times 10^{-5} \text{ M}$
 - (C) $0.9 \times 10^{-5} \text{ M}$
 - (D) $7.2 \times 10^{-5} \text{ M}$
-

55. For an isomerization reaction $A \rightleftharpoons B$, the temperature dependence of the equilibrium constant is given by:

$$\log_e K = 4.0 - \frac{2000}{T}$$

The value of ΔS° at Hook is, therefore:

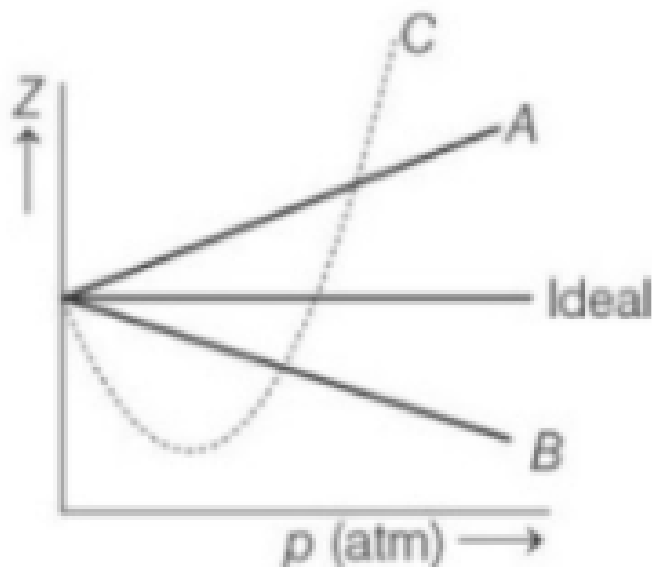
- (A) $4R$
 - (B) $5R$
 - (C) $400R$
 - (D) $2000R$
-

56. In an adiabatic process, no transfer of heat takes place between the system and surroundings. Choose the correct option for free expansion of an ideal gas under adiabatic conditions from the following:

- (A) $q = 0, \Delta T \neq 0, W = 0$
 - (B) $q \neq 0, \Delta T = 0, W = 0$
 - (C) $q = 0, \Delta T = 0, W = 0$
 - (D) $q = 0, \Delta T < 0, W \neq 0$
-

57. The given graph represents the variation of compressibility factor $Z = \frac{pV}{nRT}$, for

three real gases A, B, and C. Identify the only incorrect statement:



- (A) For gas A, $a = 0$ and its dependence on p is linear at all pressures.
- (B) For gas B, $b = 0$ and its dependence on p is linear at all pressures.
- (C) For gas C, which is a typical real gas for which neither a nor $b = 0$. By knowing the minima and point of intersection with $Z = 1$, a and b can be calculated.
- (D) At high pressure, the slope is positive for all real gases.

58. Which one of the following statements in relation to the hydrogen atom is correct?

- (A) 3s, 3p, and 3d orbitals all have the same energy.
- (B) 3s and 3p orbitals are of lower energy than 3d orbital.
- (C) 3p orbital is lower in energy than 3d orbital.
- (D) 3s orbital is lower in energy than 3p orbital.

59. In the molecules CH_4 , NF_3 , NH_4^+ and H_2O ,

- (A) The number of lone pairs are the same.
- (B) All have the same hybridization of the central atom.
- (C) The bond angles are the same.
- (D) The number of bond pairs are the same.

60. 0.20 g of an organic compound gave 0.12 g of AgBr. By using Carius method, the % of bromine in the compound will be:

- (A) 34.06 %
 - (B) 44.04 %
 - (C) 54 %
 - (D) 25 %
-

61. Forthrightness in speech may not always be a desirable quality.

- (A) Outspokenness
 - (B) Obliqueness
 - (C) Mendacity
 - (D) Equivocation
-

62. The inexorable demands of the workers brought the company to a closure.

- (A) Unreasonable
 - (B) Relentless
 - (C) Monetary
 - (D) Violent
-

63. Select the one which best expresses the same sentence in Passive/Active voice.

Then her face was bowed.

- (A) Then she was being bowed her face.
 - (B) Her face was bowed by them.
 - (C) Then she bowed her face.
 - (D) Then her face has been bowed.
-

64. The complex form of the sentence given below would be:

Spare the rod and spoil the child.

- (A) The child is spoiled if the rod is spared.
 - (B) The child becomes spoiled when the rod is spared.
 - (C) The child is spoiled whenever the rod is spared.
 - (D) The child is spoiled when the rod is spared.
-

65. The attack on the freedom of the press is a retrograde step.

- (A) Progressive
 - (B) Stubborn
 - (C) Punitive
 - (D) Aggressive
-

66. The leader might have had some covert reason for the change of his political affiliations.

- (A) Unjustifiable
 - (B) Obvious
 - (C) Inexplicable
 - (D) Flimsy
-

67. Regard for others as a principle of action or selflessly.

- (A) Gynicism
 - (B) Nepotism
 - (C) Philanthropy
 - (D) Altruism
-

68. Code of diplomatic etiquette and precedence is:

- (A) Formalism
 - (B) Statesmanship
 - (C) Protocol
 - (D) Hierarchy
-

69. Arrange the following sentences to form a coherent paragraph:

- (A) Now under liberated economy they are learning to compete domestically and globally.
- (B) In India corporations until recently achieved success by avoiding competition, using protected and regulated domestic markets.
- (C) The trend is irreversible.
- (D) Business leaders are preparing themselves to meet competitive challenges, and to avoid being swept away.

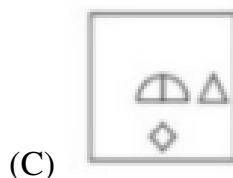
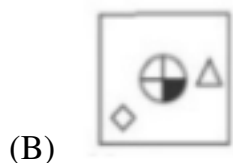
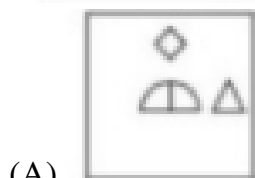
- (A) BADC
- (B) BDCA
- (C) BDAC
- (D) CDBA

70. Arrange the following sentences in a coherent order:

- (A) Recovery was given inadequate attention and consequently some bank branches regularly incurred losses
- (B) As a result, banks indulged in extensive lending to borrowers who had little or no potential to make repayments
- (C) To fulfil the social objectives laid down by the masters of nationalisation, banks were asked to lend to the priority sectors
- (D) 1992-93 results showed that the loss making branches of public sector banks increased from 10,000 in 1982-83 to 15,000 in 1992-93

- (A) BACD
- (B) DABC
- (C) CBAD
- (D) BCAD

71. Select the figure that can replace the question mark (?) in the following series.





(D)

72.

'A + B' means 'A is the mother of B'.

'A - B' means 'A is the brother of B'.

'A × B' means 'A is the father of B'.

'A ÷ B' means 'A is the daughter of B'.

Given the relationship:

$$P - KY - JS + R$$

Which of the following statements is not correct?

(A) K is husband of S

(B) Y is son of S

(C) J is daughter of P

(D) P is paternal uncle of R

73. Three different positions of the same dice are shown, the six faces of which are numbered from 1 to 6. Select the number that will be on the face opposite to the one showing '6'.



(A) 2

(B) 4

(C) 5

(D) 3

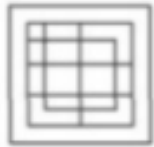
74. Select the option in which the given figure X is embedded (rotation is not allowed).



Figure X



(A)



(B)



(C)



(D)

75. Select the letter-cluster that can replace the question mark (?) in the following series: TULG, WRPC, ZOTY, CLXU, ?

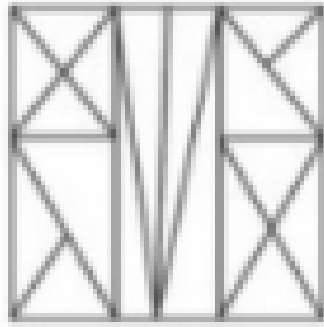
(A) FIBQ

(B) FICR

(C) FJCQ

(D) GIAQ

76. How many triangles are there in the given figure?

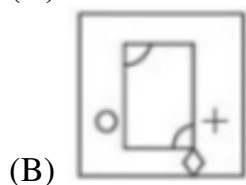
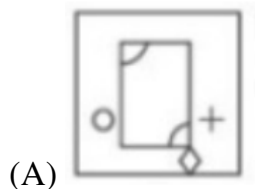
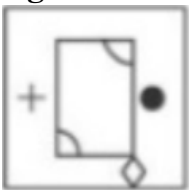


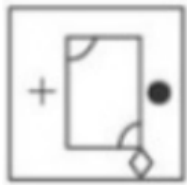
- (A) 33
- (B) 18
- (C) 31
- (D) 29

77. The average marks of 50 students in a class was found to be 64. If the marks of two students were incorrectly entered as 38 and 42 instead of 83 and 24, respectively, then what is the correct average?

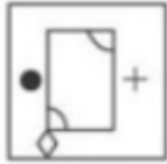
- (A) 64.54
- (B) 62.32
- (C) 61.24
- (D) 61.86

78. Select the correct mirror image of the given figure when the mirror is placed on the right of the figure.





(C)



(D)

79. Six friends A, B, C, D, E, and F are sitting around a round table facing the centre.

The conditions are: - A sits second to the right of B. - E sits second to the left of C. - B doesn't sit adjacent to E. - D does not sit opposite to E or C.

Who sits to the immediate left of E?

(A) A

(B) D

(C) B

(D) C

80. Five friends A, B, C, D, and E bought cars which were priced differently.

The conditions are: - B's car was costlier than C's car but was less costly than E's car. - A's car was costlier than D's car but less costly than C's car.

Whose car was the 2nd costliest?

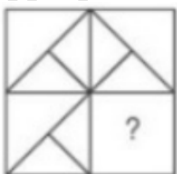
(A) E

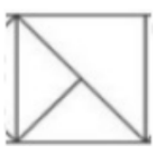
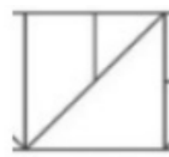
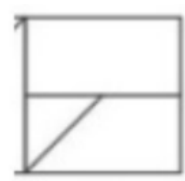
(B) A

(C) B

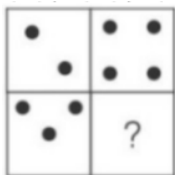
(D) C

81. In the following question, complete the missing segment by selecting the appropriate figure from the given alternatives, (a), (b), (c), and (d).

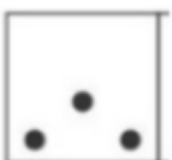
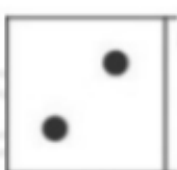
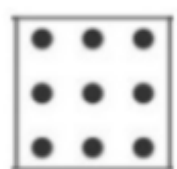


- (A) 
- (B) 
- (C) 
- (D) 

82. In each of the following question, find out which of the answer figures (a), (b), (c), and (d) completes the figure matrix?



Options:

- (A) 
- (B) 
- (C) 



(D)

83. Statements 60% of government employees went on strike.

Mr. Gopal is a government employee.

Conclusions:

I. Mr. Gopal went on strike.

II. Mr. Gopal did not participate in the strike.

(A) Only conclusion I follows

(B) Only conclusion II follows

(C) Both conclusions I and II follow

(D) Either conclusion I or II follows

84. Statements:

- Lawyers marry only fair girls.

- Shobha is very fair.

Conclusions:

I. Shobha is married to a lawyer.

II. Shobha is not married to a lawyer.

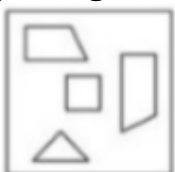
(A) Only conclusion I follows.

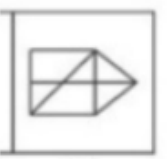
(B) Only conclusion II follows.

(C) Both conclusions I and II follow.

(D) Either conclusion I or II follows.

85. In the question given below, find out which of the figures can be formed from the pieces given in the problem figure.



- (A) 
- (B) 
- (C) 
- (D) 

86. Select the option in which the words share the same relationship as that shared by the given pair of words. Barometer : Pressure

- (A) Ammeter : Current
- (B) Thermometer : Volume
- (C) Voltmeter : Heat
- (D) Scale : Seconds

87. Select the option in which the words share the same relationship as that shared by the given set of words.

Cat : Lion : Jaguar

- (A) Shark : Dolphin : Bat
- (B) Sports : Athlete : Javelin
- (C) Monkey : Chimpanzee : Gorilla
- (D) Reptile : Snake : Toad

88. 'Needle' is related to 'Sew' in the same way as 'Microscope' is related to

- (A) Laboratory

- (B) Lens
 - (C) Science
 - (D) Magnify
-

89. Select the option that is related to the fifth number in the same way as the second number is related to the first number and the fourth number is related to the third number. $14 : 289 :: 17 : 400 :: 21 : ?$

- (A) 576
 - (B) 504
 - (C) 570
 - (D) 441
-

90. Select the letter-cluster that can replace the question mark (?) in the following series. TXB, QWE, NVH, KUK, ?

- (A) ITM
 - (B) JTM
 - (C) HTN
 - (D) HSN
-

91. If α be a root of the equation $4x^2 + 2x - 1 = 0$, then the other root of the equation is

- (A) $4\alpha^3 + 2\alpha$
- (B) $4\alpha^2 - 2\alpha$
- (C) $4\alpha^3 - 3\alpha$
- (D) $4\alpha^3 + 3\alpha$

92. If $A = \{x : x \text{ is a multiple of } 4\}$ and $B = \{x : x \text{ is a multiple of } 6\}$, then $A \cap B$ consists of multiples of:

- (A) 16
 - (B) 12
 - (C) 8
 - (D) 4
-

93. If $|w| = 2$, then the set of points $z = w - \frac{1}{w}$ is contained in or equal to the set of points z satisfying:

- (A) $\text{Im}(z) = 0$
 - (B) $|\text{Im}(z)| \leq 1$
 - (C) $|\text{Re}(z)| \leq 2$
 - (D) $|z| \leq 3$
-

94. The value of

$$\lim_{x \rightarrow 0} \frac{1 - \cos(1 - \cos x)}{x^4}$$

is:

- (A) $\frac{1}{6}$
 - (B) $\frac{1}{8}$
 - (C) $\frac{1}{10}$
 - (D) $\frac{1}{12}$
-

95. Let $a_1, a_2, \dots, a_{40}$ be in AP and $h_1, h_2, \dots, h_{10}$ be in HP. If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3$, then $a_4 h_7$ is:

- (A) 2
 - (B) 3
 - (C) 5
 - (D) 6
-

96. The number of terms in the expansion of $(1 + 5\sqrt{2}x)^9 + (1 - 5\sqrt{2}x)^9$ is:

- (A) 5
 - (B) 7
 - (C) 9
 - (D) 10
-

97. The number of different seven-digit numbers that can be written using only the digits 1, 2, and 3 with the condition that the digit 2 occurs twice in each number is:

- (A) ${}^7C_2 \times 5$

- (B) ${}^7P_2 \times 5$
(C) ${}^7C_2 \times 2$
(D) None of these
-

98. Given

$$2x - y + 2z = 2, \quad x - 2y + z = -4, \quad x + y + \lambda z = 4,$$

then the value of λ such that the given system of equations has no solution is:

- (A) -3
(B) 1
(C) 0
(D) 3
-

99. Let

$$A = \begin{pmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{pmatrix}, \quad 10B = \begin{pmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{pmatrix}$$

If B is the inverse of A , then the value of α is:

- (A) 4
(B) -4
(C) 3
(D) 5
-

100. If $x \in (0, \frac{\pi}{2})$, then the value of $\cos^{-1} \left(\frac{7}{2}(1 + \cos 2x) + \sqrt{(\sin^2 x - 48 \cos^2 x) \sin x} \right)$ is equal to:

- (A) $x - \cos^{-1}(7 \cos x)$
(B) $x + \sin^{-1}(7 \cos x)$
(C) $x + \cos^{-1}(6 \cos x)$
(D) $x + \cos^{-1}(7 \cos x)$
-

101. A running track of 440 ft is to be laid out enclosing a football field, the shape of which is a rectangle with a semi-circle at each end. If the area of the rectangular

portion is to be maximum, then the lengths of its sides are:

- (A) 70 ft and 110 ft
 - (B) 80 ft and 120 ft
 - (C) 35 ft and 110 ft
 - (D) 35 ft and 120 ft
-

102. Given

$$\frac{dy}{dx} \tan x = y \sec^2 x + \sin x, \quad \text{find the general solution:}$$

- (A) $y = \tan x (\log |\csc x - \cot x| + \cos x + c)$
 - (B) $y = \sec^2 x + \tan x + c$
 - (C) $y = \log |\sec x + \tan x| + \csc x + c$
 - (D) $y = \tan^2 x + \sin x + c$
-

103. If the straight line $y = mx + c$ touches the parabola $y^2 - 4ax + 4a^3 = 0$, then c is:

- (A) $am + \frac{a}{m}$
 - (B) $am - \frac{a}{m}$
 - (D) $\frac{a}{m} + a^2m$
 - (D) $\frac{a}{m} - a^2m$
-

104. A normal is drawn at the point P to the parabola $y^2 = 8x$, which is inclined at 60° with the straight line $y = 8$. Then the point P lies on the straight line:

- (A) $2x + y - 12 - 4\sqrt{3} = 0$
 - (B) $2x - y - 12 + 4\sqrt{3} = 0$
 - (C) $2x - y - 12 - 4\sqrt{3} = 0$
 - (D) None of these
-

105. The value of

$$\int \frac{1}{x^1} dx, \text{ is } \left[\frac{(x-1)^3}{(x+2)^5} \right]_1^4$$

- (A) $\frac{4}{3} \frac{x+1}{x-2} \left(\frac{1}{4} \right) + C$
- (B) $\frac{3}{4} \frac{x-1}{x+2} \left(\frac{1}{4} \right) + C$
- (C) $\frac{4}{3} \frac{x-1}{x+2} \left(\frac{1}{4} \right) + C$

(D) $\frac{1}{3} \frac{2x-1}{4x-3} \left(\frac{1}{4}\right) + C$

106. The area of the region bounded by the parabola $(y - 2)^2 = (x - 1)$, the tangent to the parabola at the point $(2, 3)$, and the X-axis is:

- (A) 3
 - (B) 6
 - (C) 9
 - (D) 12
-

107. If $\hat{u}$ and $\hat{v}$ are two non-collinear unit vectors such that $\left| \frac{\hat{u} + \hat{v}}{2} + \hat{u} \times \hat{v} \right| = 1$, then the value of $|\hat{u} \times \hat{v}|$ is equal to:

- (A) $\left| \frac{\hat{u} + \hat{v}}{2} \right|$
 - (B) $|\hat{u} + \hat{v}|$
 - (C) $|\hat{u} - \hat{v}|$
 - (D) $\left| \frac{\hat{u} - \hat{v}}{2} \right|$
-

108. A six-faced die is a biased one. It is three times more likely to show an odd number than an even number. It is thrown twice. The probability that the sum of the numbers in two throws is even is:

- (A) $\frac{5}{9}$
 - (B) $\frac{5}{8}$
 - (C) $\frac{1}{2}$
 - (D) None of these
-

109. The sum of all the solution of the equation $\cos \theta \cos \left(\frac{\pi}{3} + \theta\right) \cos \left(\frac{\pi}{3} - \theta\right) = \frac{1}{4}$, for $\theta \in [0, 6\pi]$ is:

- (A) 15π
 - (B) 30π
 - (C) $\frac{100\pi}{3}$
 - (D) None of these
-

110. Let α be the solution of the equation

$$16 \sin^2 \theta + 16 \cos^2 \theta = 10, \quad \theta \in \left(0, \frac{\pi}{4}\right)$$

If the shadow of a vertical pole is $\frac{1}{\sqrt{3}}$ of its height, then the altitude of the sun is:

- (A) α
 - (B) $\frac{\alpha}{2}$
 - (C) 2α
 - (D) $\frac{\alpha}{3}$
-

111. For each parabola $y = x^2 + px + q$, meeting the coordinate axes at three distinct points, if circles are drawn through these points, then the family of circles must pass through:

- (A) $(1, 0)$
 - (B) $(0, 1)$
 - (C) $(1, 1)$
 - (D) (p, q)
-

112. The number of ways of arranging the letters of the word HAVANA so that V and N do not appear together is:

- (A) 40
 - (B) 60
 - (C) 80
 - (D) 100
-

113. Let $a_1, a_2, a_3, \dots$ be a harmonic progression with $a_1 = 5$ and $a_{20} = 25$. The least positive integer n for which $a_n < 0$ is:

- (A) 22
 - (B) 23
 - (C) 24
 - (D) 25
-

114. If the plane $3x + y + 2z + 6 = 0$ is parallel to the line

$$\frac{3x - 1}{2b} = \frac{3 - y}{1} = \frac{z - 1}{a},$$

then the value of $3a + 3b$ is:

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

115. Let a, b be the solutions of $x^2 + px + 1 = 0$ and c, d be the solution of $x^2 + qx + 1 = 0$. If $(a - c)(b - c)$ and $(a + d)(b + d)$ are the solution of $x^2 + ax + \beta = 0$, then β is equal to:

- (A) $p + q$
 - (B) $p - q$
 - (C) $p^2 + q^2$
 - (D) $q^2 - p^2$
-

116. If $\begin{bmatrix} 1 & -\tan(\theta) \\ \tan(\theta) & 1 \end{bmatrix} \begin{bmatrix} 1 & \tan(\theta) \\ -\tan(\theta) & 1 \end{bmatrix}^{-1} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$, then:

- (A) $a = 1, b = 1$
 - (B) $a = \sin 2\theta, b = \cos 2\theta$
 - (C) $a = \cos 2\theta, b = \sin 2\theta$
 - (D) None of these
-

117. The value of $\lim_{x \rightarrow 0} \frac{(1+x)^{\frac{1}{x}} - e + \frac{1}{2}e^x}{x^2}$ is:

- (A) $\frac{11}{24e}$
 - (B) $-\frac{11}{24e}$
 - (C) $\frac{e}{24}$
 - (D) None of these
-

118. The locus of the mid-point of the chord of contact of tangents drawn from points

lying on the straight line

$$4x - 5y = 20$$

to the circle

$$x^2 + y^2 = 9 \text{ is:}$$

- (A) $20(x^2 + y^2) - 36x + 45y = 0$
 - (B) $20(x^2 + y^2) + 36x - 45y = 0$
 - (C) $36(x^2 + y^2) - 20x + 45y = 0$
 - (D) $36(x^2 + y^2) + 20x - 45y = 0$
-

119. Let

$$f(x) = \int \frac{x^2 dx}{(1+x^2)(1+\sqrt{1+x^2})}$$

and $f(0) = 0$, then the value of $f(A)$ is:

- (A) $\log(1 + \sqrt{2})$
 - (B) $\log(1 + \sqrt{2}) - \frac{\pi}{4}$
 - (C) $\log(1 + \sqrt{2}) + \frac{\pi}{2}$
 - (D) None of these
-

120. The mean of five observations is 4 and their variance is 5.2. If three of these observations are 1, 2, and 6, then the other two are:

- (A) 2 and 9
 - (B) 3 and 8
 - (C) 4 and 7
 - (D) 5 and 6
-

121. In a sequence of 21 terms, the first 11 terms are in AP with common difference 2 and the last 11 terms are in GP with common ratio 2. If the middle term of the AP is equal to the middle term of the GP, then the middle term of the entire sequence is:

- (A) $-\frac{10}{31}$
- (B) $\frac{10}{31}$
- (C) $\frac{32}{31}$
- (D) $-\frac{31}{32}$

122. If $p \neq a$, $q \neq b$, $r \neq c$, and the system of equations

$$px + ay + az = 0$$

$$bx + qy + bz = 0$$

$$cx + cy + rz = 0$$

has a non-trivial solution, then the value of

$$\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c}$$

is:

(A) 1

(B) 2

(C) $\frac{1}{2}$

(D) 0

123. If

$$g(x) = x^2 + x - 2$$

and

$$\frac{1}{2}g \circ f(x) = 2x^2 - 5x + 2,$$

then $f(x)$ is equal to:

(A) $2x - 3$

(B) $2x + 3$

(C) $2x^2 + 3x + 1$

(D) $2x^2 - 3x + 1$

124. The smallest positive integral value of n such that

$$\left(\frac{1 + \sin \frac{\pi}{8} + i \cos \frac{\pi}{8}}{1 + \sin \frac{\pi}{8} - i \cos \frac{\pi}{8}} \right)^n$$

is purely imaginary, is equal to:

(A) 4

(B) 3

(C) 2

(D) 8

125. A house subtends a right angle at the window of the opposite house and the angle of elevation of the window from the bottom of the first house is 60° . If the distance between the two houses is 6m, then the height of the first house is:

(A) $8\sqrt{3}$ m

(B) $6\sqrt{3}$ m

(C) $4\sqrt{3}$ m

(D) None of these

126. A spherical balloon is filled with 4500π cubic meters of helium gas. If a leak in the balloon causes the gas to escape at the rate of 72π cubic meters per minute, then the rate (in meters per minute) at which the radius of the balloon decreases 49 minutes after the leakage began is:

(A) $\frac{9}{7}$

(B) $\frac{7}{9}$

(C) $\frac{2}{9}$

(D) 9

127. If in a $\triangle ABC$, $2b^2 = a^2 + c^2$, then

$\frac{\sin 3B}{\sin B}$ is equal to:

(A) $\frac{c^2 - a^2}{2ca}$

(B) $\frac{c^2 - a^2}{ca}$

(C) $\frac{(c^2 - a^2)^2}{(ca)^2}$

(D) $\left(\frac{c^2 - a^2}{2ca}\right)^2$

128. If the sum of the coefficients in the expansion of $(x + y)^n$ is 1024, then the value of the greatest coefficient in the expansion is:

(A) 356

- (B) 252
 - (C) 210
 - (D) 120
-

129. The area enclosed by the curves $y = \sin x + \cos x$ and $y = |\cos x - \sin x|$ over the interval $\left[0, \frac{\pi}{2}\right]$ is:

- (A) $4(\sqrt{2} - 1)$
 - (B) $2\sqrt{2}(\sqrt{2} - 1)$
 - (C) $2(\sqrt{2} + 1)$
 - (D) $2\sqrt{2}(\sqrt{2} + 1)$
-

130. If $\alpha, \beta, \gamma \in [0, \pi]$ and if α, β, γ are in AP, then

$$\frac{\sin \alpha - \sin \gamma}{\cos \gamma - \cos \alpha}$$

is equal to:

- (A) $\sin \beta$
 - (B) $\cos \beta$
 - (C) $\cot \beta$
 - (D) $2 \cos \beta$
-