NEW STANDARD ACADEMY

Test Type - 03

Do not open this Test Booklet until you are asked to do so. **11-11-2024**

JEE(MAIN): 11th Undergoing Students

Read carefully the Instructions on the Back Cover of this Test Booklet.

Important Instructions :

1. Immediately fill in the form number on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The candidates should not write their Form Number anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.
3. The Test Booklet consists of 90 questions.
4. There are three parts in the question paper 1,2,3 consisting of Physics, Chemistry and Mathematics having 30 questions in each subject and each subject having Two sections. (i) Section-I contains 20 multiple choice questions with only one correct option. Marking scheme : +4 for correct answer, 0 if not attempted and –1 in all other cases. (ii) Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking. Marking scheme : +4 for correct answer, 0 if not attempted and –1 in all other cases.
5. Use Blue/Black Ball Point Pen only for writting particulars/marking responses on Side –1 and Side–2 of the Answer Sheet. Use of pencil is strictly prohibited.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electronic device etc, except the Identity Card inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
8. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Room/ Hall. However, the candidate are allowed to take away this Test Booklet with them.

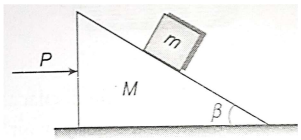
Name of the Candidate(In Capitals) _____

Date of Examintation _____

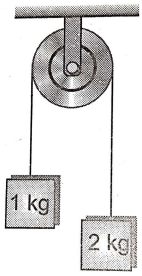
Candidate`s Signature:_____ Invigilator`s Signature: _____

Section-A
Physics

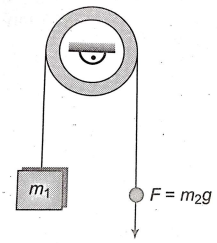
1. A balloon of mass M is descending at a constant acceleration a. When a mass m is released from the balloon it starts rising with the same acceleration a. Assuming that its volume does not change, what is the value of m?
   (a) $\alpha/(\alpha + g)$ M
   (b) $(2\alpha)/(\alpha + g)$ M
   (c) $(\alpha + g)/\alpha$ M
   (d) $(\alpha + g)/(2\alpha$ M
2. Two wooden blocks are moving on a smooth horizontal surface such that the mass ***m*** remains stationary with respect to block of mass *M* as shown in the figure. The magnitude of force P is



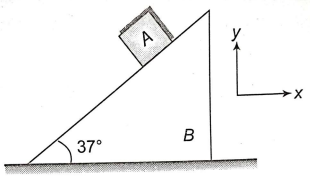
   (a) (M+m) g tan α
   (b) g tan α
   (c) mg cos α
   (d) (M+m) g cosec α
3. Two unequal masses are connected on two sides of a light string passing over a light and smooth pulley as shown in the figure. The system is released from rest. The larger mass is stopped 1.0 second after the system is set into motion and then released immediately. The time elapsed before the string is tight again is (Take g = 10 m/s²)



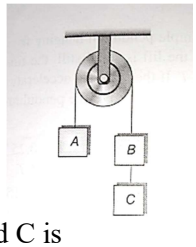
   (a) 1/4 s
   (c) 2/3 s
   (b) 1/2 s
   (d) 1/3 s
4. A plumb bob is hung from the ceiling of a train compartment. The train moves on an inclined track of inclination 30° with horizontal. Acceleration of train up the plane is a = g/2. The angle which the string supporting the bob makes with normal to the ceiling in equilibrium is
   (a) 30°
   (b) $\tan^{-1}(2/3)$
   (c) $\tan^{-1}(\sqrt{3}/2)$
   (d) $\tan^{-1}(2)$
5. A hanging body of mass m_1 is pulled by a force $F = m_2 g$ acting on the massless inextensible smooth string. The acceleration of m_1 is



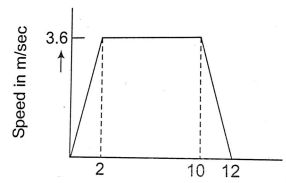
   (a) $(m_2 - m_1)/(m_1 + m_2)$ g
   (b) $(m_2 - m_1)/m_1$ g
   (c) $(m_1 m_2)/((m_1 + m_2)^2$ g)
   (d) m_2/m_1 g
6. In the figure shown the acceleration of A is $\vec{a}_A = 15\hat{\imath} + 15\hat{\jmath}$, then the acceleration of B is (A remains in contact 6 with B)



   (a) $6\hat{\imath}$
   (b) $-15\,\hat{\imath}$
   (c) $-10\hat{\imath}$
   (d) $-5\hat{\imath}$
7. A cork is submerged in water by a spring attached to the bottom of a pail. When the pail is kept in an elevator moving with an acceleration downwards, the spring length
   (a) increases
   (b) decreases
   (c) remains unchanged
   (d) data insufficient
8. Three equal weights A, B and C of mass 2 kg each are hanging on a string passing over a fixed frictionless pulley as shown in the figure The tension in the string connecting weights B

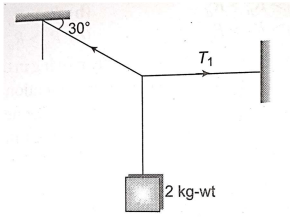


   and C is
   (a) Zero (b) 13N
   (c) 3.3N (d) 19.6 N
9. A lift is going up. The total mass of the lift and the passenger is 1500 kg. The variation in the speed of the lift is as given in the graph. The tension in the rope pulling the lift at 11th sec will be



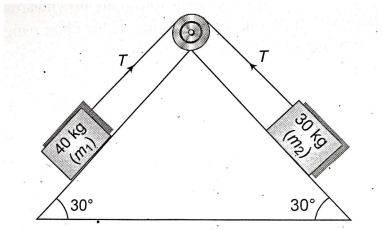
(a) 17400 N (b) 14700 N
(c) 12000 N (d) Zero

10. A body of weight 2 kg is suspended as shown in the figure. The tension T_1 in the horizontal string (in kg wt) is



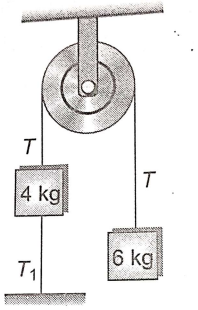
(a) $(2 / \sqrt{3})$ (b) $(\sqrt{3}/ 2)$
(c) $2\sqrt{3}$ (d) 2

11. Two masses 40 kg and 30 kg are connected by a weightless string passing over a frictionless pulley as shown in the following figure. The tension in the string will be



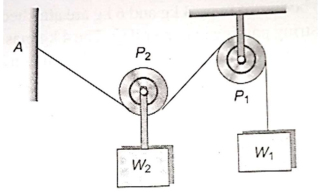
(a) 188N (b) 900/7N
(c) 288N (d) 1200/7N

12. Two bodies of mass 4 kg and 6 kg are attached to the ends of a string passing over a pulley. The 4 kg mass is attached the table top by another string. The tension in this string T_1 is equal to (Take g = 10m / s^2)



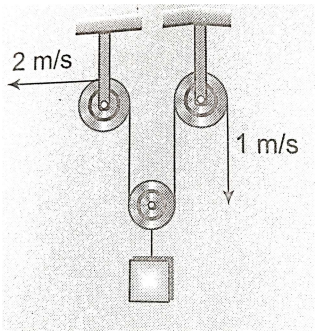
(a) 20 N
(b) 25 N
(c) 10.6 N
(d) 10 N

13. In the following figure, the pulley P_1 is fixed and the pulley P_2 is movable. If $W_1 = W_2 =$ 100N what is the angle AP_2P_1? The pulleys are frictionless



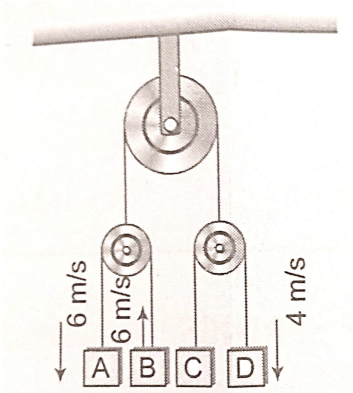
(a) 30^0 (b) 60^0
(c) 90^0 (d) 120^0

14. Find the velocity of the hanging block if the velocities of the free ends of the rope are as indicated in the figure.



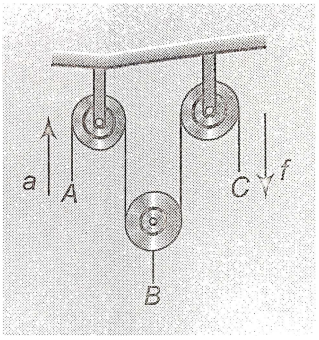
(a) 3/2 m/s
(b) 3/2 m/s↓
(c) 1/2 m/s
(d) 1/2m/s ↓

15. In the figure the velocity of different blocks is shown. The velocity of C is



(a) 6m/s (b) 4m/s
(c) 0 m (d) none of these

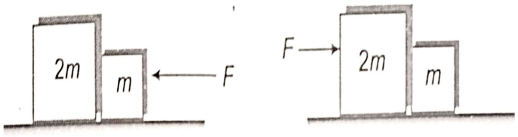
16. The pulleys in the diagram are all smooth and light. The acceleration of A is a upwards and the acceleration of C is f downwards. The acceleration of B is



(a) 2(f - a) uf
(b) 1/2 (a + f) down
(c) 1/2 (a + f) up
(d) 2(a - f)

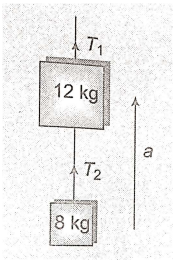
17. Two blocks are in contact on a frictionless table. One has mass m and the other 2m. A force f is applied on 2m as shown in the figure. Now the same force F is applied from the right

on m. In the two cases respectively, the ratio of contact force between the two block will be:



(a) same (b) 1:2
(c) 2:1 (d) 1:3

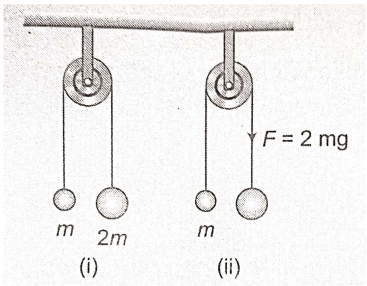
18. A body of mass 8 kg is hanging another body of mass 12 kg. The combination is being pulled by a string with an acceleration of 2.2 m/s^2 The tension T_1, and T_2, will be respectively (use g=9.8 m/s^2)



(a) 200 N. 80 N (b) 220 N,90 N
(c) 240 N. 96 N (d) 250 N, 96 N

19. A rope of mass 5 kg is moving vertically in vertical position with an upward force of 100 N acting at the upper end and a downward force of 70 N acting at the lower end. The tension at mid-point of the rope is
(a) 100 N
(b) 85 N
(c) 75 N
(d) 105 N

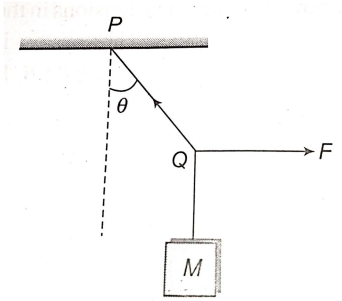
20. The pulley arrangements shown in the figure are identical the mass of the rope being negligible in case I, the mass ***m*** is lifted by attaching a mass ***2m*** to the other end of the rope. In case II, the mass m is lifted by pulling the other end of the rope with constant downward force **F=2mg,** where g is acceleration due to gravity The acceleration of mass in case I is



(a) zero
(b) more than that in case II
(c) less than that in case II
(d) equal to that in case II

Section B

21. A rocket with a lift-off mass 20,000 kg is blasted upwards with an initial acceleration of 5 m / s^2 Calculate the initial thrust (force) of the blast.
22. A shell of mass 0.02 kg is fired by a gun of mass 100 kg. If the muzzle speed of the shell is 80 m/s, what is the recoil speed of the gun?
23. A constant retarding force of 50 N is applied to a body of mass 20 kg moving with a speed of 15 m/s. How long does the body take to stop?
24. A constant force acting on a body of mass 3 kg changes its speed from 2 m/s to 3.5 m/s in 25 second. The direction of motion of the body remains unchanged. What is the magnitude and direction of the force?
25. A mass M is suspended by a rope from a rigid support at P as shown in the figure. Another rope is tied at the end Q, and it is pulled horizontally with a force F. If the rope PQ makes angle & with the vertical then find the tension in the string PQ



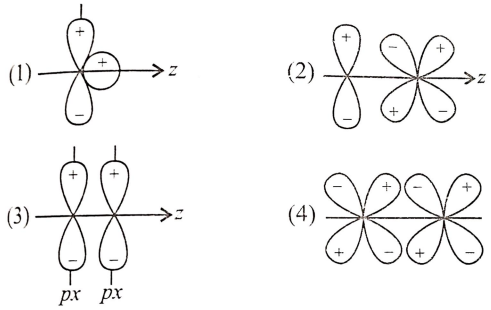
CHEMISTRY

Section A

1. $AlCl_3$ is covalent while AlF_3 is ionic. This can be justified on the basic of
(a) The valence bond theory
(b) Fajans Rules
(c) The molecular orbital Theory
(d) Hydration energy
2. Which of the following oxyacids of phosphorous are monoprotic (monobasic)?
(a) H_3PO_4 (b) H_3PO_3
(c) H_3PO_2 (d) $H_4P_2O_7$
3. Which of the following has been arranged in order of increasing covalent character?
(a) $KCI < CaCl_2 < AlCl_3 < SnCl_4$
(b) $SnCl_4 < AlCl_3 < CaCl_2 < KCI$
(c) $AlCl_3 < CaCl_2 < KCI < SnCl_4$
(d) $CaCl_2 < SnCl_4 < KCI < AICI_3$,
4. Which has maximum ionic mobility?
(a) $L i^+$
(b) $N a^+$

(c) K^+
(d) Cs^+

5. The bond angle between two hybrid orbitals is 180° .The percentage s-character of hybrid orbital is between
(a) 50 and 55% (b) 9 and 12%
(c) 22 and 23% (d) 11 and 12%
6. KF combines with HF to form KHF_2. The compound contains the species
(a) K^+,F^- and H^+
(b) K^+,F^- and HF
(c) K^+ and $[HF_2]^-$
(d) $[KHF]^+$ and F_2
7. The bonds present in N_2O_5 are
(a) Only ionic
(b) Covalent and coordinate
(c) Only covalent
(d) Covalent and ionic
8. Which of the following is a positive overlap which leads to bonding?



9. The resultant dipole moment (μ) of two compounds NOF and NO_2F is 1.81 D and 0.47 D respectively. Which dipole moment do you predict?
(a) 1.81 D for NO_2F and 0.47 D for NOF
(b) 0.47 D for NO_2F and 1.81 D for NOF
(c) For both NO_2F and NOF, dipole moment (μ) is 1.81 D
(d) For both NO_2F and NOF, dipole moment (μ) is 0.47 D
10. In terms of polar character, the correct order is
(a) $H_2S > HF > H_2O > NH_3$
(b) $HF > H_2O > NH_3 > H_2S$
(c) $HF > H_2S > NH_3 > H_2O$
(d) $H_2S > NH_3 > H_2O > HF$
11. How many and pi bonds are there in the molecule of tetracyano ethylene?
(a) 4 σ, 14π
(b) 8 σ,10 π
(c) 5 σ, 13 π
(d) 9 σ, 9 π
12. In compound X all the bond angles around central atom are 109°28°. Which one of the following will be X?
(a) Chloromethane
(b) Carbon tetrachloride
(c) lodoform
(d) Chloroform
13. The bond angles of NH_3 ,NH_4^+ and NH_2^- are in the order.
(a) $NH_2^- > NH_3 > NH_4^+$
(b) $NH_4^+ > NH_3 > NH_2^-$
(c) $NH_3 > NH_2^- > NH_4^+$
(d) $NH_3 > NH_4^+ > NH_2^{-+}$
14. Decreasing order of bond angle of (I) NO_2 (II) $NO_2^+$and (III) NO_3^- is
(a) I > II > III
(b) II > I > III
(c) III > II > I
(d) III > I > II
15. The formal charge of the O-atoms in the ion [: $\ddot{N} = \ddot{O}$:] is
(a)0 (b)+1
(c)-1 (d)-2
16. Which of the following MO's has two nodal planes?
(a) $\pi\ 2p_y$
(b) $\sigma\ 2_S$
(c) $\pi^*\ 2p_y$
(d) $\sigma^*\ 2p_z$
17. Which of the following sets does not contain isoelectronic species?
(a) PO_4^{3-}, SO_4^{2-}, ClO_4^-
(b) SO_3^{2-} , CO_3^{2-} ,NO_3^-
(c) BO_3^{3-} , CO_3^{2-} , NO_3^-
(d) CN^- ,N_2 ,C_2^{2-}
18. The decreasing (O-O) bond length order in the following is
(a) $O_2 > H_2O_2 > O_3$
(b) $H_2O_2 > O_3 > O_2$
(c) $O_3 > H_2O_2 > O_2$
(d) $O_3 > O_2 > H_2O_2$
19. Which of the following overlaps is correct (assuming Z-axis as internuclear axis)?
(I) $2p_x + 2p_x \rightarrow$a-bond
(II) $2s + 2p_y \rightarrow \pi$-bond
(III) $3d_{xy} + 3d_{xy} \rightarrow \pi$ -bond
(IV) $3d_{xy} + 3d_{xy} \rightarrow \pi$ -bond
(V) $2p_y + 2p_y \rightarrow \pi$-bond
(VI) $2p_z + 2p_z \rightarrow \sigma$-bond
(a) 1, II, III
(b) IV, V, VI
(c) I, III, V
(d) II, IV, VI
20. Which of the following orbital combination cannot from π bond (all sideways overlapping)?

Section -B

21. How many molecules among the following have zero dipole moment: NH_3 ,BF_3 ,NF_3, CCl_4?
22. The number of hypervalent species among the following: ClO_4^-, BF_3 ,SO_4^{2-} ,CO_3^{2-} is
23. How many of the following compounds have sp^3 hybridisation?
    i. SO_4^{2-} ii. SO_5^{2-} iii. PO_4^{3-}
    iv. PO_5^{3-} v. I_3^- vi. CO_3^{2-}
    vii. CO_4^{2-}
24. How many of the following oxides of nitrogen are paramagnetic?
    i. N_2O ii. NO iii. N_2O_3
    iv. NO_2 v. N_2O_4 vi. N_2O_5
    vii. NO_2^+ viii. NO_2^- ix. NO_3^-
25. Out of the following orbitals, the total number of orbitals which can overlap. Colaterally (if internucleus axis is z)
    (1) s^2 (2) p_x 3) p_y
    (4) f_2 (5) d_{xy} (6) d_{y2}
    (7) d_{zx} (8) $d_{x^2-y^2}$ (9) D_{Z2}

MATHS

Section-A

1. If θ is eliminated from the equations $x = a\cos(\theta-\alpha)$ and $y = b\cos(\theta-\beta)$ then $\frac{x^2}{b^2}+\frac{y^2}{b^2}-\frac{2xy}{ab}\cos(\alpha-\beta)$ is equal
    (1) $\sec^2(\alpha-\beta)$
    (2) $\text{Cosec}^2(\alpha-\beta)$
    (3) $Cos^2(-\beta)$
    (4) $Sin^2(\alpha-\beta)$
2. If $y = (1+\tan A)(1-\tan B)$ where $A-B=\frac{\pi}{4}$, then $(y+1)^{y+1}$ is equal to
    (1) 9 (2) 4
    (3) 27 (4) none of these
3. Let $f(n)\ 2\cos n\,x \forall n \in N$, then $f(1)\,f(n+1)-f(n)$ is equal to
    (1) $f(n+3)$
    (2) $f(n+2)$
    (3) $f(n+1)f(2)$
    (4) $f(n+2)f(2)$
4. $\frac{\sqrt{2}-\sin\alpha-\cos\alpha}{\sin\alpha-\cos\alpha}$ is equal to
    (1) $\sec\left(\frac{\alpha}{2}-\frac{\pi}{8}\right)$
    (2) $\text{Cos}\left(\frac{\pi}{8}-\frac{\alpha}{2}\right)$
    (3) $\tan\left(\frac{\alpha}{2}-\frac{\pi}{8}\right)$
    (4) $\cot\left(\frac{\alpha}{2}-\frac{\pi}{8}\right)$
5. The root of the equation $4x^2-2\sqrt{5}x+1=0$ are
    (1) $Sin\,36°, sin18°$
    (2) $Sin18°, cos\,36°$
    (3) $Sin36°, cos\,18°$
    (4) $Cos18°, cos36°$
6. If $\alpha,\beta,\gamma,\delta$ are the smallest positive angle in ascending order of magnitude which have their sines equal to the positive quantity k, then the value of $4\sin\frac{\alpha}{2}+3sin\frac{\beta}{2}+2sin\frac{\gamma}{2}+sin\frac{\delta}{2}$ is equal to
    (1) $2\sqrt{1-k}$
    (2) $2\sqrt{1+k}$
    (3) $\frac{\sqrt{1+k}}{2}$
    (4) none of these
7. $\text{Cos}^3x \sin 2x =$ $\sum_{x=0}^{n} a_r \sin(r\,x)\ \forall x \in R$, then
    (1) n = 5, a_1=1/2
    (2) n = 5, a_1=1/4
    (3) n = 5, a_2=1/8
    (4) n = 5, a_2=1/4
8. Given that a,b,c are the sides of a ΔABC which is right angle at C, then the minimum value of $\left(\frac{c}{a}+\frac{c}{b}\right)^2$ is
    (1) 0 (2) 4
    (3) 6 (4) 8
9. The maximum value of $\cos x\left\{sinx+\sqrt{sin^2x+sin^2\frac{\pi}{6}}\right\}$ is
    (1) $\frac{\sqrt{5}}{3}$ (2) $\sqrt{\frac{3}{2}}$
    (3) $\sqrt{\frac{5}{2}}$ (4) $\frac{\sqrt{5}}{2}$
10. Find the maximum value of $4\sin^2x+3\cos^2x+\sin\frac{x}{2}+\cos\frac{x}{2}$
    (1) $4+\sqrt{2}$ (2) $4-\sqrt{2}$
    (3) $\sqrt{2}$ (4) $8+\sqrt{2}$
11. In ΔABC, if $\angle A=\frac{\pi}{4}$, then find all possible values of tan B tan C.

12. If $\sin\theta$, sin k and $\cos\theta$ are in G.P, then the roots of the equation $.I + 2x\cot\phi + 1 = 0$ are always
    (A) real (B) imaginary
    (C) equal (D) greater than 1

13. If cos 25° + sin 25° = K, then cos 50° is equal to

(A) $k\sqrt{2-k^2}$ (B) $-\sqrt{2-k^2}$

(C) $\sqrt{2-k^2}$ (D) $-k\sqrt{2-k^2}$

14. If in the triangle ABC ,tan $\frac{A}{2}$,tan $\frac{B}{2}$ and tan $\frac{C}{2}$ are in harmonic progression the the laast value of cot $\frac{B}{2}$ is

(A) $\sqrt{2}$ (B) $\sqrt{3}$

(C) 2 (D) none of these

15. If Sin x+ cosec x +tan y+cot y = 4 where x and y$\in \left[0,\frac{\pi}{2}\right]$, then tan $\frac{y}{2}$ is a root of the equation

(A) $\alpha^2+2\alpha+1=0$

(B) $\alpha^2+2\alpha-1=0$

(C) $2\alpha^2-2\alpha-1=0$

(D) none the these

16. If A and B are acute angle such that A+B and A-B satisfy the equation tan $^2\theta - 4\,tan\theta + 1 = 0, then$

(A) A= $\frac{\pi}{4}$ (B) B = $\frac{\pi}{6}$

(C) A=$\frac{\pi}{6}$ (D) C= $\frac{\pi}{4}$

17. If the roots of the quadratic equation .x^2+ px +q =0 are tan 30° and tan 15°, respectively then the value of 2 +q-p is

(A) 2 (B) 3

(C) 0 (D) 1

18. The number of values of in the interval [0, 3π] satis- fying the **equation** 2 $\sin^2$x + 5sin x - 3 = 0 **is**

(A) 4 (B) 6

(C) 1 (D) 2

19. If A+B +C =$3\pi/2$,then cos2A+cos2B +Cos2C is equal to

(a) 1-4 CosA CosB CosC

(b) 4sinASinBsinC

(c)1+2CosA CosACosBCosC

(d) 1-4 sin A sinB sinC

20. If $\tan^2\theta = 2\tan^2\phi + 1$,then $\cos^2\theta+\sin^2\phi$equals

(a) -1 (b) 0

(c) 1 (d) none of these

Secion -B

Intiger type Question

1. Number of triangles ABC if tan A =x tan B= x+1 and tan C=1-x is_____

2. If $\frac{tanx}{2}=\frac{\tan y}{3}=\frac{\tan z}{5}, x+y+z = \pi\ and\ tan^2y+tan^2z = \frac{38}{K}\ then\ k =$ _____

3. If cot $(\theta-\alpha), 3\,cot\theta, \cot(\theta+\alpha)$ are in A.P and $\theta\ is$ not integral multiple of $\frac{\pi}{2}$, then the value of $\frac{4sin^2\theta}{3sin^2\alpha}$ _____

4. The value of $\sin^2 12° + sin^2 21° + \sin^2 39° + \sin^2 48° - \sin^2 9° - sin^2 18°\ is$ _____

5. $\left(\frac{sin33°}{sin11°sin49°sin71°}\right)^2+\left(\frac{cos33°}{cos11°cos49°cos71°}\right)^2$ is equal to _____