**Atomic Energy Central School No. 4 Rawatbhata**

**Class 11 - Physics**

**Multiple Choice Questions Test (August 2019-20)**

**Maximum Marks: 120** **Time Allowed: 180 minutes**

**Section A**

1. An airplane's compass indicates that it is headed due north, and its airspeed indicator shows that it is moving through the air at 240 km/h. If there is a 100-km h wind from west to east, what is the velocity of the airplane relative to the earth? **1**

   a) 255 km/h $26^{0}$ E of N b) 260 km/h $23^{0}$ E of N

   c) 270 km/h $24^{0}$ E of N d) 250 km/h $25^{0}$ E of N

2. A man stands on the roof of a 15.0 m tall building and throws a rock with a velocity of magnitude 30.0 m/s at an angle of 33.0° above the horizontal. You can ignore air resistance. Calculate the magnitude of the velocity of the rock just before it strikes the ground. **1**

   a) 30.6 m/s b) 29.6 m/s

   c) 32.6 m/s d) 34.6 m/s

3. The reason why cyclists bank when taking a sharp turn is **1**

   a) to supply the acceleration required to move fast

   b) cyclists enjoy turning to one side and so bank

   c) to decelerate at the turns as turns are dangerous

   d) to supply the sidewise (centripetal) acceleration required to make the direction change

4. If $A_x, A_y$ *and* $A_z$ are x, y and z components of a vector then its magnitude is **1**

   a) $\sqrt{A_x^2 + 2A_y^2 + A_z^2}$ b) $\sqrt{A_x^2 + A_y^2 + A_z^2}$

   c) $\sqrt{3A_x^2 + A_y^2 + A_z^2}$ d) $\sqrt{A_x^2 + A_y^2 + A_z^3}$

5. Two vectors are equal if **1**

   a) the magnitude and direction are the same for both

   b) the direction is the same for both

   c) the magnitude is the same for both

   d) the two vectors have opposite directions

6. A motorcycle stunt rider rides off the edge of a cliff. Just at the edge his velocity is horizontal, with magnitude 9.0 m/s. Find the magnitude of the motorcycle's position vector after 0.50s it leaves the edge of the cliff. **1**

a) 4.7 m
b) 3.5 m
c) 5.2 m
d) 4.3 m

7. A ball is thrown upwards with an initial velocity of 10 m $s^{-1}$. Determine the maximum height reached above the thrower's hand. Determine the time it takes the ball to reach its maximum height. **1**

a) 5.25 m, 0.42 s
b) 5.23 m, 1.12 s
c) 5.43 m, 0.92 s
d) 5.10 m, 1.02 s

8. A body is projected with a velocity of 20$ms^{-1}$ at 50$^{\circ}$ to the horizontal. Find Time of flight. **1**

a) 4.2 s
b) 3.5 s
c) 5.1 s
d) 3.1 s

9. An aircraft is flying at a height of 3400 m above the ground. If the angle subtended at a ground observation point by the aircraft positions 10.0 s apart is 30$^{o}$, what is the speed of the aircraft? **1**

a) 193 m/s
b) 172 m/s
c) 182 m/s
d) 192 m/s

10. Multiplying a vector $\vec{v}$ by a negative real number $\lambda$ **1**

a) gives a vector $\overrightarrow{v'} = \lambda\vec{v}$ in a direction opposite to $\vec{v}$
b) gives a vector $\overrightarrow{v'} = \lambda\vec{v}$ in the same direction as $\vec{v}$
c) gives a scalar that is $\lambda$ times the magnitude of $\vec{v}$
d) gives a scalar that is $\lambda$ times the polar angle of $\vec{v}$

11. The speed of a projectile when it is at its greatest height is $\sqrt{\frac{2}{5}}$ times its speed at half the max height. What is the angle of projection? **1**

a) $60^{\circ}$
b) $90^{\circ}$
c) $15^{\circ}$
d) $45^{\circ}$

12. A batter hits a baseball so that it leaves the bat at speed $v_0$ = 37.0 m/s at an angle a = 53.1$^{o}$. Find the time when the ball reaches the highest point of its flight, and its height h at this time. **1**

a) 3.02 s, 44.7 m
b) 3.32 s, 41.7 m
c) 3.12 s, 43.7 m
d) 3.22 s, 42.7 m

13. A motorcycle stunt rider rides off the edge of a cliff. Just at the edge his velocity is horizontal, with magnitude 9.0 m/s. Find the magnitude of the motorcycle's velocity vector 0.50 s after it leaves the edge of the cliff **1**

a) 11.3 m/s
b) 8.98 m/s
c) 10.2 m/s
d) 9.65 m/s

14. Vectors can be added by **1**

a) adding the magnitudes of the vectors
b) adding the angles of the vectors
c) parallelogram law of addition
d) translating the two vectors

15. Multiplying a vector $\vec{v}$ by a positive real number $\lambda$ **1**

a) gives a vector $\overrightarrow{v'} = \lambda\vec{v}$ in a direction opposite to $\vec{v}$
b) gives a scalar that is $\lambda$ times the polar angle of $\vec{v}$
c) gives a scalar that is $\lambda$ times the magnitude of $\vec{v}$
d) gives a vector $\overrightarrow{v'} = \lambda\vec{v}$ in the same direction as $\vec{v}$

16. We can define the difference of two vectors A and B as the **1**

a) sum of two vectors A and B' such that B' is equal to B multiplied by -1
b) sum of two vectors A and B' such that B' is equal to B multiplied by -2
c) sum of two vectors A and B' such that B' is equal to B multiplied by 0
d) sum of two vectors A and B' such that B' is equal to B multiplied by 1

17. A cricketer hits a cricket ball from the ground so that it goes directly upwards. If the ball takes, 10 s to return to the ground, determine its maximum height. **1**

a) 112.5 m
b) 132.5 m
c) 152.5 m
d) 122.5 m

18. A cyclist is riding with a speed of 27 km/h. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at the constant rate of 0.50 m/s every second. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn? **1**

a) 0.84 m $s^{-2}$, 58.5$^o$ with the direction of velocity
b) 0.82 m $s^{-2}$, 59.5$^o$ with the direction of velocity
c) 0.85 m $s^{-2}$, 56.5$^\circ$ with the direction of velocity
d) 0.86 m $s^{-2}$, 54.5$^o$ with the direction of velocity

19. A man stands on the roof of a 15.0-m-tall building and throws a rock with a velocity of magnitude 30.0 m/s at an angle of 33.0° above the horizontal. You can ignore air resistance. Calculate the maximum height above the roof reached by the rock; **1**

a) 12.6 m b) 11.7 m
c) 13.6 m d) 14.2 m

20. Magnitude of displacement of a particle is **1**

a) is equal to the path length of the particle between two points
b) is less than the path length of the particle between two points
c) is more than the path length of the particle between two points
d) is either less or equal to the path length of the particle between two points

21. Vectors can be added by **1**

a) vector addition
b) adding the magnitudes of the vectors
c) translating the two vectors
d) adding the angles of the vectors

22. The vector addition is **1**

a) associative b) non-commutative
c) asymmetric d) intransitive

23. A ball is drpped from a height. If it takes 0.2 s to cross the last 6.0 m before hitting the ground, find the height from which it was dropped.Take g=10m/s$^{2}$. **1**

a) 57.05 m b) 30.48 m
c) 32.35 m d) 48.05 m

24. To find the sum of vectors A and B, we place vector B **1**

a) so that its tail is at the tail of the vector A
b) so that its direction is the same as that of vector A
c) so that its tail is at the head of the vector A
d) so that its head is at the head of the vector A

25. At a distance L=400m from the traffic lights the brakes are applied to a locomotive moving at a velocity v=54km/hr. Determine the position of locomotive relative to the traffic lights 1 minute after the application of the brakes if its acceleration is -0.3m/s$^{2}$. **1**

a) 30 m b) 25 m

c) 15 m
d) 40 m

26. The basic difference between a scalar and vector is one of **1**

a) magnitude
b) direction
c) origin
d) polar angle

27. The position of a particle is given by $r = 3.0t\hat{i} + 2.0t^2\hat{j} + 4.0\hat{k}$ Find the magnitude and direction of velocity of the particle at t = 2.0 s. **1**

a) 8.84 m $s^{-1}$, $75^\circ$ with x-axis
b) 6.54 m $s^{-1}$, $74^\circ$ with x-axis
c) 7.54 m $s^{-1}$, $72^\circ$ with x-axis
d) 8.54 m $s^{-1}$, $70^\circ$ with x-axis

28. Null vector or a zero vector has a magnitude **1**

a) greater than zero
b) that is complex
c) equal to zero
d) less than zero

29. A unit vector is a vector **1**

a) having a magnitude of 1 and points in any chosen direction
b) having a magnitude of 1 and points in x-direction
c) having a magnitude of 1 and points in y-direction
d) having a magnitude of 1 and points in z-direction

30. An airplane's compass indicates that it is headed due north, and its airspeed indicator shows that it is moving through the air at 240 km/h. If there is a 100-km h wind from west to east. In what direction should the pilot head to travel due north? What will be her velocity relative to the earth? **1**

a) $35^{o}$ W of N, 198 km/h
b) $28^{o}$ W of N, 210 km/h
c) $25^{o}$ W of N, 218 km/h
d) $29^{o}$ W of N, 200 km/h

31. A body moving with uniform acceleration has a velocity of 12.0 cm/s in the positive x direction when its x coordinate is 3.00 cm. If its x coordinate 2.00 s later is -5.00 cm, what is the magnitude of its acceleration in $cm/s^2$ ? **1**

a) -14.0
b) -12.0
c) -16.0
d) -18.0

32. Two parallel rail tracks run north-south. Train A moves north with a speed of 27 km/ hr, and train B moves south with a speed of 45 km/ hr. What is the velocity of B with respect to A in m/s? Choose the positive direction of x-axis to be from south to north. **1**

a) -18
b) -28
c) -20
d) -15

33. A jet lands on an aircraft carrier at 60 m/s. It stops in 2.0 s? What is the **1**

displacement of the plane in m while it is stopping?

a) 60.0
b) 50
c) 45
d) 35

34. An object is said to be in uniform motion in a straight line if its displacement **1**

a) is decreasing in equal intervals of time
b) is equal in not equal intervals of time.
c) is increasing in equal intervals of time
d) is equal in equal intervals of time.

35. A drag racer starts her car from rest and accelerates at 10.0 $\mathrm{m/s^2}$ for the entire distance of 400 m . What is the speed of the race car in m/s at the end of the run? **1**

a) 89.4
b) 87.2
c) 86.0
d) 90.3

36. for motion in a straight line **1**

a) motion away from origin is positive
b) position to the left of the origin is taken as positive and to the right as negative.
c) motion towards origin is positive
d) position to the right of the origin is taken as positive and to the left as negative.

37. A jet lands on an aircraft carrier at 63 m/s. What is the displacement of the plane in m while it stopped in 2 s. **1**

a) 57
b) 60
c) 68
d) 63.0

38. Two parallel rail tracks run north-south. Train A moves north with a speed of 54 km/ hr, and train B moves south with a speed of 90 km/ hr. What is the velocity of B with respect to A in m/sec? Choose the positive direction of x-axis to be from south to north. **1**

a) -40.0
b) -55.0
c) -30.0
d) -45.0

39. The position of an object moving in a straight line can be specified with reference to **1**

a) an arbitrary star
b) a conveniently chosen origin
c) a triangle
d) another straight line

40. A car traveling at a constant speed of 45.0 m/s passes a trooper hidden behind a billboard. One second after the speeding car passes the billboard; the trooper sets out from the billboard to catch it, accelerating at a constant rate of 3.00 $\mathrm{m/s^2}$. How long does it take her to overtake the car? **1**

a) 34.0 s

b) 36.0 s

c) 33.0 s

d) 31.0 s

## Atomic Energy Central School No. 4 Rawatbhata

## Class 11 - Chemistry

## Multiple Choice Questions Test(August 2019)

**General Instructions:**

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### Section A

41. Which one of the following species is smallest in its size **1**

$Al^{3+}$, $Mg^{2+}$ , $Na^{+}$ , $Ne$?

a) $Ne$ b) $Mg^{2+}$

c) $Na^{+}$ d) $Al^{3+}$

42. Which one of the following is isoelectronic with Ne? **1**

a) $mg^{2+}$ b) $Al^{3+}$

c) $N^{3-}$ d) All of these

43. The correct increasing order of atomic radii for the same element is ____ ? **1**

a) covalent radius < Metallic radius < van der Waal's radius

b) covalent radius < crystal radius < Metallic radius

c) van der Waal's radius < Metallic radius < covalent radius

d) Metallic radius < covalent radius < van der Waal's radius

44. An element with atomic number $21$ is a **1**

a) transition element b) representative element

c) alkali metal d) halogen

45. The electronic configuration of an element in $Group\ 15\ and\ period\ 3$ of the periodic table is -------? **1**

a) $1s^2 2s^2 2p^6\ 3s^2 3p^1$ b) $1s^2 2s^2 2p^6 3s^2 3p^4$

c) $1s^2 2s^2 2p^6 3s^2 3p^3$ d) $1s^2 2s^2 2p^6 3s^2 3p^2$

46. Choose one of the following in the increasing order of electron gain enthalpy **1**

a) F < Cl < Br < I b) I < Br < F < Cl

c) Cl < I < Br < F d) Br < F < Cl < I

47. The electronic configuration of gadolinium (Atomic number 64) is **1**

a) $[Xe]4f^7 5d^1 6s^2$ b) $[Xe]4f^3 5d^5 6s^2$

c) $[\mathrm{Xe}]4f^7 5d^2 6s^1$ d) $[\mathrm{Xe}]4f^8 5d^6 6s^2$

48. Among the following elements, which has the least electron affinity? **1**

a) Phosphorus b) Nitrogen

c) Sulphur d) Oxygen

49. Which of the following will have the most negative electron gain enthalpy and which one the least negative? P, S, Cl, F. 1

a) P,Cl b) P,Cl

c) Cl, P d) P,S

50. Right order of increasing metallic character is: **1**

a) Si < Mg < Na < P < Be b) Be < Mg < Na < P< Si

c) P < Si < Be < Mg < Na. d) Si < Be < Mg < Na < P

51. $Al^{(3+)} < Mg^{(2+)} < Na+ < F^- < O^{(2-)} < N^{(3-)}$ The above can be aptly described as **1**

a) isoelectronic species b) the same number of electrons (9 electrons).

c) the same number of electrons (7 electrons). d) the same number of electrons (8 electrons).

52. The number of columns in the Modern periodic table in s , p , d and f - blocks are respectively ----, -----, ---- , -----. ? **1**

a) $6, 2, 14, 10$ b) $6, 2, 10, 14$

c) $2, 6, 10, 14$

53. For the four successive transition elements (Cr, Mn, Fe and Co), the stability of + 2 oxidation state will be there in which of the following order? (At. nos. Cr = 24, Mn = 25, Fe = 26, Co = 27) **1**

a) Mn > Fe > Cr > Co b) Cr > Mn > Co > Fe

c) Fe > Mn > Co > Cr d) Co > Mn > Fe > Cr

54. Arrange following elements in the order of their chemical reactivity in terms of oxidising property:F, Cl, O and N **1**

a) F > Cl > O > N b) F > O > Cl > N

c) Cl >F > O >N d) O> F> N> Cl

55. What is the general electronic configuration of the elements of group 14? **1**

a) $[Inert]\ ns^2\ np^1$ b) $[Inert]\ ns^2 np^4$

c) $[Inert]ns^2np^2$ d) $[Inert]\ ns^2np^3$

56. The elements charecterised by the filling of 4 f-orbitals, are: **1**

a) Alkali metals b) Alkaline earth metals
c) Lanthanoids d) Transition elements

57. Select an element with smallest size: **1**

a) Al b) P
c) B d) N

58. Diagonal relationships are shown by **1**

a) Li and Mg b) B and P
c) Be and Al d) Mg and Al

59. Dmitri Mendeleev (1834-1907) and the German chemist, Lothar Meyer (1830-1895) proposed arranging elements in **1**

a) decreasing order of their atomic weights b) decreasing order of their atomic numbers
c) increasing order of their atomic weights d) increasing order of their atomic numbers

60. The correct order for the increase in atomic radii is **1**

a) I< Br< Br< F b) F< C< I< Br
c) C< Br< I d) F< Cl < Br < I

61. The maximum number of hydrogen bonds that a molecule of water can have is **1**

a) 2 b) 1
c) 3 d) 4

62. Using MO theory predicts which of the following species has the shortest bond length? 1

a) $O_2^-$ b) $O_2{}^{2+}$
c) $O_2^{2-}$ d) $O_2^+$

63. In $NO_3^-$ ion, the number of bond pairs and lone pairs of electrons on nitrogen atom are **1**

a) 1, 3 b) 3, 1
c) 2, 2 d) 4, 0

64. Isostructural species are those which have the same shape and hybridisation. Among the given species identify the isostructural pairs. **1**

a) $[BF_4^- \; and \; NH_4^+]$ b) $[\mathrm{NF_3} \text{and } \mathrm{BF_3}]$

c) $[\mathrm{BCl_3} \text{and } \mathrm{BrCl_3}]$ d) $[NH_3 \; and \; NO_3^-]$

65. Considering X-axis as the internuclear axis which out of the following will not from a sigma bond and why? 1

a) $2p_y$and $2p_y$ b) 1s and 2s

c) 1s and 1s d) 1s and $2P_x$

66. A molecule or ion is stable if 1

a) $N_b = N_a$ b) $N_a \times N_b = 1$

c) $N_a < N_b$ d) $N_b < N_a$

67. When 2 is converted into 2 $^+$ 1

a) paramagnetic character increases b) both paramagnetic character and bond order increase

c) paramagnetic character decreases and the bond order increases d) bond order decreases

68. The structure of $\mathrm{F_7}$is 1

a) Octahedral b) Square pyramid

c) Trigonal bipyramid d) Pentagonal bipyramid

69. In acetylene molecule, between the carbon atoms there are 1

a) one sigma and two pi bonds b) three sigma bonds

c) two sigma and one pi bonds d) three pi bonds

70. Which one of the following pairs of species has the same bond order? 1

a) $\mathrm{CN^-}$ and $\mathrm{NO^+}$ b) $\mathrm{NO^+}$and $\mathrm{CN^+}$

c) ${O_2}^-$and $\mathrm{CN^-}$ d) $\mathrm{CN^-}$ and $\mathrm{CN^+}$

71. In $\mathrm{PO_4^{3-}}$ ion the formal charge on the oxygen atom of P–O bond is 1

a) – 0.75 b) – 1

c) + 1 d) + 0.75

72. Which of the following angle corresponds to $\mathrm{sp^2}$ hybridisation? 1

a) $109^\circ$ b) $180^\circ$

c) $90^\circ$ d) $120^\circ$

73. Hydrogen bonds are formed in many compounds e.g., 2 $\mathrm{O}$, HF, $\mathrm{NH_3}$.The boiling point of such compounds depends to a large extent on the strength of 1

hydrogen bond and the number of hydrogen bonds. The correct decreasing order of the boiling points of above compounds is :

a) $H_2O > HF > NH_3$ b) $HF > H_2O > NH_3$

c) $NH_3 > HF > H_2O$ d) $NH_3 > H_2O > HF$

74. Which one of the following is paramagnetic? **1**

a) CO b) $O_3$

c) NO d) $N_2$

75. Which one is diamagnetic among NO , NO and NO ? **1**

a) $NO^+$ $NO^+$ b) $NO^-$

c) NO d) None of these

76. The hybridization of orbitals of N atom in $No_3^-$, $No_2^+$ and $NH_4{}^+$ are respectively **1**

a) $sp,\ sp^3,\ sp^2$ b) $sp,\ sp^2,\ sp^3$

c) $sp^2,\ sp^3,\ sp$ d) $sp^2,\ sp,\ sp^3$

77. The electronegativity difference $\Delta EN)$ is large in one of the following. **1**

a) metal and a nonmetal b) Two nonmetals

c) Hydrogen and Helium d) Two metals

78. The number of types of bonds between two carbon atoms in calcium carbide is **1**

a) Two sigma, two pi b) One sigma, one pi

c) Two sigma, one pi d) One sigma, two pi

79. Rank the bonds in the set C=O, C-O, C$\equiv$O in order of decreasing bond length **1**

a) C-O > C=O > C$\equiv$O b) C=O > C$\equiv$O > C-O

c) C$\equiv$O < C-O < C=O d) C-O > C$\equiv$O > C=O

80. N , CO and NO are isoelectronic molecules. Their respective bond order is : **1**

a) 3,3,3 b) 2,3,4

c) 1,1,3 d) 2,3,3

**Atomic Energy Central School No. 4 Rawatbhata**

**Class 11 - Mathematics**

**Multiple Choice Questions Test(August 2019)**

**Maximum Marks: 40** **Time Allowed: 1 hour**

**General Instructions:**

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## Section A

81. The maximum value of $\text{in}\alpha + \sin\beta + \sin\gamma$, where $\alpha, \beta, \gamma$ are positive real numbers satisfying $\alpha + \beta + \gamma = \pi$ is **1**

a) (-) 3 b) negative

c) zero d) positive

82. Which of the following is not possible ? **1**

a) $\cos\theta = \frac{1+t^2}{1-t^2}, t \neq 0$ b) $\sin\theta = \frac{5}{7}$

c) $\sec\theta = \frac{5}{2}$ d) $\tan\theta = 100$

83. The general value of satisfying sin = - -and tan = $\frac{1}{\sqrt{3}}$ is **1**

a) $n\pi + \frac{\pi}{6}, n \in I$ b) $n\pi + (-1)^n\frac{7\pi}{6}, n \in I$

c) $2n\pi + \frac{7\pi}{6}, n \in I$ d) $2n\pi + \frac{11\pi}{6}, n \in I$

84. If $sin\alpha = \sin\beta$ and $\cos\alpha = \cos\beta$, then **1**

a) $\sin(\alpha + \beta) = 0$ b) $\cos(\alpha + \beta) = 0$

c) $\sin(\alpha - \beta) = 0$ d) $\cos(\alpha - \beta) = 0$

85. The number of values of x satisfying the condition sin x + sin 5 x = sin 3x in the interval [ 0 , $\pi$] is **1**

a) 2 b) 0

c) 6 d) 10

86. The value of $sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}\sin\frac{7\pi}{14}\sin\frac{9\pi}{14}\sin\frac{11\pi}{14}\sin\frac{13\pi}{14}$ is **1**

a) none of these b) $\frac{1}{128}$

c) $\frac{1}{64}$ d) $\frac{1}{16}$

87. Which of the following statements is incorrect ? **1**

a) $\cos\theta = 1$ b) $\sec\theta = \frac{1}{2}$

c) tan $\theta$ = 1 d) $\sin\theta = -\frac{1}{5}$

88. The equation (cos p – 1)$x^2$ + (cos p) x + sin p = 0, where x is a variable, has **1**

real roots. Then the interval of p may be any one of the following:

a) $(0, \pi)$ b) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

c) $(0, \pi)$ d) $(-\pi, 0)$

89. The equation sin$x - \frac{\pi}{2} + 1$ = 0 has no root in the interval **1**

a) $\left(0, \frac{\pi}{2}\right)$ b) none of these

c) $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$ d) $\left(\frac{\pi}{2}, \pi\right)$

90. The general value of satisfying the equation $2\sin^2\theta - 3\sin\theta - 2 = 0$ is **1**

a) $n\pi + (-1)^n \frac{\pi}{6}$ b) $n\pi + (-1)^n \frac{\pi}{2}$

c) $n\pi + (-1)^{n+1} \frac{\pi}{6}$ d) $n\pi + (-1)^n \frac{5\pi}{6}$

91. The set of values of x for which $\frac{\tan 3x - \tan 2x}{1 + \tan 3x \tan 2x} = 1$ is **1**

a) $\left\{\frac{\pi}{4}\right\}$ b) $\left\{2n\pi + \frac{\pi}{4} : n = 1, 2, 3...\right\}$

c) $\left\{n\pi + \frac{\pi}{4} : n\epsilon Z\right\}$ d) $\phi$

92. Number of solutions of the equation tan x + sec x = 2 cos x. lying in the interval $[0, 2\pi]$ is **1**

a) 3 b) 0

c) 2 d) 1

93. $(z+1)(\bar{z}+1)$ can be expressed as **1**

a) $|z^2| + 1$ b) $|z^2| + 2$

c) none of these d) $|z+1|^2$

94. The region of Argand's plane represented by the inequality $|1 - z| \leq |1 + z|$ is **1**

a) Re ( z ) $\leq$0 b) none of these

c) Im ( z ) $>$0 d) Re ( z ) $\geq$ 0

95. Arg. ( x ) , x R and x $< 0$ is **1**

a) $\pi/2$ b) $3\pi/2$

c) $\pi$ d) 0

96. The complex number z which satisfies $\frac{i+z}{i-z}\Big| = 1$,lies on **1**

a) the x - axis b) none of these

c) the line x + y =1 d) the y - axis

97. Which of the following is correct ? **1**

a) $3 - 4\mathrm{i} < 2 - 3\mathrm{i}$ b) $1 + \mathrm{i} < 1 - \mathrm{i}$

c) none of these. d) $2 + 3\mathrm{i} < 3 + 4\mathrm{i}$

98. Amp. $\mathrm{z} - 2 - 3\mathrm{i}) = \pi/4$then locus of z is **1**

a) none of these　　b) x + y = 0

c) x – y + 1 = 0　　d) x – y = 2

99. If $\alpha = \frac{z}{\bar{z}}$, then $|\alpha|$ is equal to : **1**

a) -1　　b) 0

c) 1　　d) none of these

100. If $p^2$ + p + 1 = 0, then, the value of $p^{3n} is$ equal to **1**

a) 0　　b) 1 or -1

c) -1　　d) 1

101. The points of the complex plane given by the condition arg. ( z ) = ( 2n + 1 ) , $n \in$ I lie on **1**

a) the positive real semi axis z = x , x $>$ 0　　b) the negative real semi axis z = x , x $<$ 0

c) the imaginary semi axis z = iy , y $>$ 0　　d) the imaginary semi axis z = iy , y $<$ 0

102. The points z = x + iy which satisfy the equation $z | = 1$ lie on **1**

a) the line x = 1　　b) the line y = 1

c) the line x + y = 1　　d) the circle whose centre is origin and radius = 1

103. The number of solutions of the equation $Im\left(z^2\right) = 0, |z| = 2$ is **1**

a) 1　　b) 4

c) 2　　d) 3

104. Square roots of i are **1**

a) $\pm\frac{1}{\sqrt{2}}(1+i)$　　b) none of these

c) $\pm 1$　　d) $\pm\frac{1}{\sqrt{2}}(1-i)$

105. The region of the XOY-plane represented by the inequalities $x \geq 6$ , $y \geq 2$ , $2x + y \leq 10$ is **1**

a) none of these　　b) exterior of a triangle

c) a polygon　　d) unbounded

106. The solution set for $3x - 2 | \leq 1/2$ **1**

a) none of these　　b) [ 2/3 , 2/3 ]

c) [ 1/2 ,5/6 ]　　d) [ 5/6 , 1/2 ]

107. Solution set of the inequality $2x \geq 0$ is **1**

a) half of XOY –plane which lies on the right of y – axis , including the points on y – axis .

b) half of XOY –plane which lies on the right of y – axis .

c) half of XOY –plane which lies on the right of x – axis .

d) none of these

108. The solution set for $\left|\frac{2(3-x)}{5}\right| < \frac{3}{5}$ **1**

a) $\left(\frac{1}{2}, \frac{3}{2}\right)$

b) none of these

c) ( 3/2 , 9/2 )

d) $\left(\frac{1}{4}, \frac{3}{4}\right)$

109. The length of a rectangle is three times the breadth. If the minimum perimeter of the rectangle is 160 cm, then. **1**

a) length $\leq$ 20

b) breadth $>$ 20

c) length $<$ 20

d) breadth $\geq$ 20

110. Graph of the system of inequations $x \geq 0$ , $y \leq 0$ is **1**

a) second quadrant

b) first quadrant

c) $4^{\text{th}}$ quadrant

d) third quadrant

111. Find all pairs of consecutive even positive integers, both of which are larger than 5, such that their sum is less than 23. **1**

a) (3,5), (5,7),(7,9)

b) (6,8) ,(8,10) ,(10,12)

c) none of these

d) (4,6),(6,8),(8,10)

112. Solve the system of inequalities $x - 5 > 0$ , $\frac{2x-4}{x+2} < 2$ **1**

a) $x > 5$

b) none of these

c) $x > 2$

d) $x < -2$

113. Solve the system of inequalities $-4x + 1 \geq 0$ , $3 - 4x < 0$ **1**

a) ( -2 , 3)

b) no solution

c) ( 1 , 3 )

d) ( - 4 , 3 )

114. The graph of the inequality $xy \geq 0$ is **1**

a) set of all points in the $2^{\text{nd}}$ and $4^{\text{th}}$ quadrants

b) set of all points in the first and third quadrants including the points on the axes .

c) set of all points on the x axis and y axis

d) none of these

115. If $|x - 1| > 5$, then **1**

a) $x \in [6, \infty)$

b) $x \in (6, \infty)$

c) $x \in (-\infty, -4) \cup ( 6, \infty)$ d) $x \in (-\infty, -4) \cup ( 6, \infty]$

116. The graph of the inequations $x \geq 0$ , $y \geq 0$ , $3x + 4y \leq 12$ is **1**

a) in the $2^{nd}$ quadrant b) exterior of a triangle

c) none of these d) interior of a triangle including the points on the sides

117. The sum of n terms of the series $1^3 + 3^3 + 5^3 + .........$ is **1**

a) none of these. b) $n^2 \left(2n^2 + 1\right)$

c) $n^2 \left(n^2 + 1\right)$ d) $n^2 \left(2n^2 - 1\right)$

118. Let $P(n) : n^2 - n + 41$ is a prime number . then : **1**

a) P ( 41 ) is not true b) P ( 5 ) is not true

c) P ( 1 ) is not true d) P ( 3) is not true

119. For all $n \in N, 7^{2n} - 48n - 1$ is divisible by : **1**

a) 1234 b) 2304

c) 25 d) 26

120. If n is a +ve integer, then $2^{3n} - 7n - 1$ is divisible by **1**

a) 36 b) 49

c) none of these d) 64

## Solution

## Class 11 - Physics

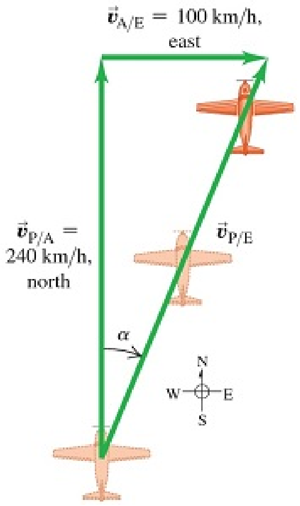
## MCQ (2019-20)

## Section A

1. (b)

   260 km/h $23^0$ E of N

   Explanation:
   This problem involves velocities in two dimensions (northward and eastward), so it is a relative velocity problem using vectors. We are given the magnitude and direction of the velocity of the plane (P) relative to the air (A). We are also given the magnitude and direction of the wind velocity, which is the velocity of the air A with respect to the earth (E):

   $\vec{v}_{P/A}$=240 km/h due north
   $\vec{v}_{A/E}$=100 km/h due east
   The magnitude and direction of velocity $\vec{v}_{P/E}$ of the plane relative to the earth.
   $\vec{v}_{P/E} = \vec{v}_{P/A} + \vec{v}_{A/E}$
   Image above shows that the three relative velocities constitute a right-triangle vector addition; the unknowns are the speed $v_{P/E}$ and the angle $\alpha$.
   $v_{P/E} = \sqrt{(240)^2 + (100)^2}$ =260 km/h
   $\alpha = tan^{-1}(\frac{100}{240})$ = $23^\circ$ E of N

2. (d)

   34.6 m/s

Explanation:

Let downward be the y direction.

$v_{ox} = v_o \times cos\theta = 30.0 \times cos 33.0^\circ$

= 25.2 m/s

$v_{oy} = v_o \times sin\theta = 30.0 \times sin 33.0^\circ$

= 16.3 m/s

The velocity in the x direction is constant all the time,

At the ground, we have h = -15.0 m,

We know,

$(v_y)^2 = (v_{oy})^2 + 2a_y h$

=> $v_y = \sqrt{(v_{oy})^2 + 2a_y h}$

$v_y = \sqrt{(16.3)^2 + 2(-9.8)(-15.0)}$

=> $v_y = 23.7\ m/s$

The magnitude of velocity of the rock just before it strikes the ground is

v = $\sqrt{(v_x)^2 + (v_y)^2}$

=> v = $\sqrt{(25.2)^2 + (23.7)^2}$ =34.6 m/s

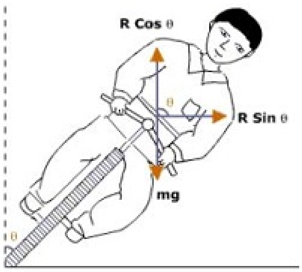
3. (d)

to supply the sidewise (centripetal) acceleration required to make the direction change

Explanation:

In order to take a safe turn, the cyclist has to bend a little from his vertical position. In this case, a component of the reaction provides the required centripetal force.

If q is angle made by the cyclist with the vertical then




$N cos\theta = mg \ldots . (1)$

$N sin\theta = \frac{mv^2}{r} \ldots .. (2)$

Dividing (2) by (1), we get

$\tan\theta = \frac{v^2}{rg}$

$\Rightarrow \theta = tan^{-1}(\frac{v^2}{rg})$

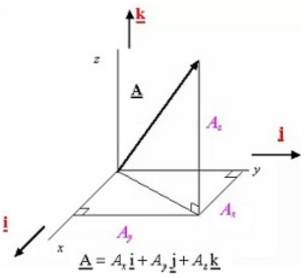
In actual practice, the value of q is slightly less because the force of friction also contributes towards the centripetal force.

4. (b)

$\sqrt{A_x^2 + A_y^2 + A_z^2}$

Explanation:

Rectangular component of a Vector: The projections of vector a along the x, y, and z directions are $A_x$, $A_y$, and $A_z$, respectively.




Magnitude of vector = $\sqrt{A_x^2 + A_y^2 + A_z^2}$

5. (a)

the magnitude and direction are the same for both

Explanation:

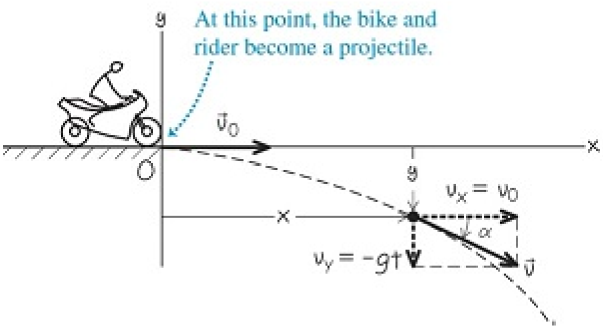
Equal vectors are vectors that have the same magnitude and the same direction. Equal vectors may start at different positions.

6. (a)

4.7 m

Explanation:

The motorcycle's x- and y-coordinates at t=0.50 s are




x = $v_{ox}$ t = $9.0 \times 0.50$=4.5 m

y = $-\frac{1}{2}gt^2$ = $-\frac{1}{2}\times 9.8\times(0.50)^2$= -1.2m

The negative value of y shows that the motorcycle is below its starting point.

The motorcycle's distance from the origin at t = 0.50s is r = $\sqrt{x^2+y^2}=\sqrt{(4.5)^2+(-1.2)^2}$ =4.7 m

7. (d)

5.10 m, 1.02 s

Explanation:

Initial velocity u = 10m/s

As at the maximum height ball ll stop so final velocity v = 0 m/s

Only acceleration working on it is acceleration due to gravity g = -9.8m/s$^2$

Let height = h

So we know

$v^2-u^2=2as$

=>$(0)^2-(10)^2=2\times(-9.8)h$

=> $h=\frac{-100}{-19.6}$ = 5.10 m

Also let time taken to reach maximum height = t

Then

We know

v = u +at

=> 0 = 10 +(-9.8)t

=> t = $\frac{-10}{-9.8}=1.02s$

8. (d)

3.1 s

Explanation:

Initial Velocity $v_o$ = 20 ms$^{-1}$

$\theta=50^\circ$

Time of flight = $\frac{2v_o sin\theta}{g}$

$=\frac{2\times 20\times sin50^\circ}{9.8}$

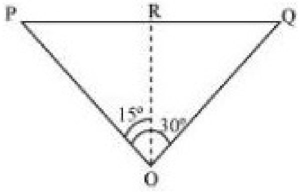
= 3.1 s

9. (c)

182 m/s

Explanation:

The positions of the observer and the aircraft are shown in the given figure.




Height of the aircraft from ground, OR = 3400 m

Angle subtended between the positions, $\angle$POQ = 30°

Time = 10 s

In $\triangle$PRO:

tan $15^{\circ}$ = $\frac{PR}{OR}$

PR = OR tan $15^{\circ}$

= $3400 \times tan 15^{\circ}$

$\triangle$PRO is similar to $\triangle$RQO.

$\therefore$ PR = RQ

PQ = PR + RQ

= 2PR = 2 $\times$ 3400 tan $15^{\circ}$

= 6800 $\times$ 0.268 = 1822.4 m

$\therefore$ Speed of the aircraft = $\frac{1822.4}{10}$

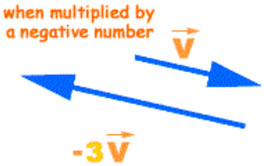
= 182.24 m/s $\approx$ 182 m/s

10. (a)

gives a vector $\overrightarrow{v'}$ = $\lambda\vec{v}$ in a direction opposite to $\vec{v}$

Explanation:

If a vector is multiplied by a negative number (for example -2, -3, -5, -60 unit etc.) or a scalar not only its magnitude is changed but its direction also reversed.




11. (a)

$60^{\circ}$

Explanation:

Time taken to reach the maximum height $= \frac{usin\theta}{g}$

Maximum height $= \frac{u^2 sin^2\theta}{2g}$

Half the maximum height $= \frac{u^2 sin^2\theta}{4g}$

Horizontal velocity at half the maximum height = $ucos\theta$

Vertical velocity at half the maximum height = $\frac{usin\theta}{\sqrt{2}}$

Velocity at half the maximum height = $\sqrt{u^2cos^2\theta + \frac{u^2sin^2\theta}{2}}$

According to question,

$ucos\theta = \sqrt{\frac{2}{5}}\sqrt{u^2cos^2\theta + \frac{u^2sin^2\theta}{2}}$

Squaring both sides,

$u^2cos^2\theta = \frac{2}{5}u^2(cos^2\theta + \frac{sin^2\theta}{2})$

$=> 5 - 5sin^2\theta = 2(1 - sin^2\theta + \frac{sin^2\theta}{2})$

$=> 5 - 5sin^2\theta = 2 - sin^2\theta$

$=> 4sin^2\theta = 3$

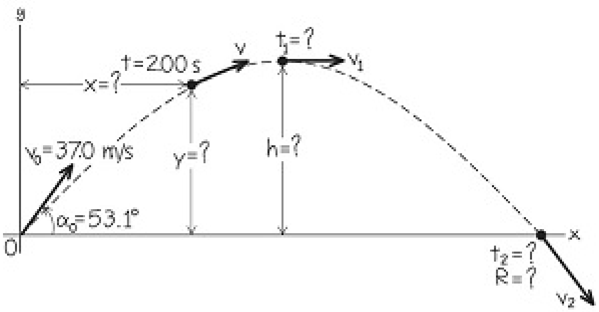
$=> sin\theta = \frac{\sqrt{3}}{2}$

$=> \theta = 60^\circ$

12. (a)

3.02 s, 44.7 m

Explanation:




The initial velocity of the ball has components

$v_{ox}$ = $v_o$ cos $\alpha_o$= $37.0 \times cos53.1^\circ$

= 22.2 m/s

$v_{oy}$ = vo$_o$ sin $\alpha_o$= $37.0 \times sin53.1^\circ$

= 29.6 m/s

At the highest point, the vertical velocity $v_y$ is zero. Call the time when this happens $t_1$; then

$v_y = v_{oy} - gt_1 = 0$

$\Rightarrow t_1 = \frac{v_{oy}}{g} = \frac{29.6}{9.8} = 3.02$ s

The height at the highest point is the value of y at time $t_1$:

$h = v_{oy}t_1 - \frac{1}{2}g(t_1)^2$

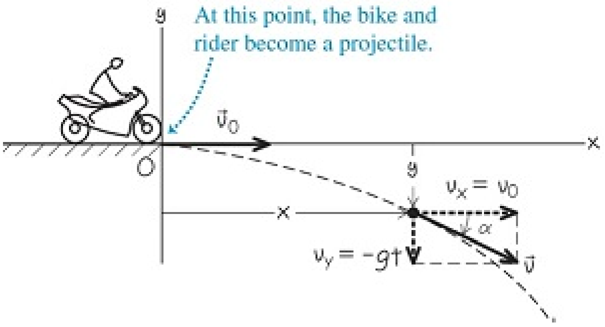
$= 29.6 \times 3.02 - \frac{1}{2} \times 9.8 \times (3.02)^2$

= 44.7 m

13. (c)

10.2 m/s

Explanation:




the velocity components at t=0.50 s are

$v_x = v_{ox} = 9.0 m/s$

$v_y = -gt = -9.8 \times 0.50 = -4.9 m/s$

The motorcycle has the same horizontal velocity $v_x$ as when it left the cliff at t = 0, but in addition there is a downward (negative) vertical velocity $v_y$.

The velocity vector at t = 0.50 s is

$\vec{v} = v_x\hat{i} + v_y\hat{j} = 9.0\hat{i} + (-4.9)\hat{j}$

at t=0.50 s the velocity has magnitude v given by

v = $\sqrt{(v_x)^2 + (v_y)^2} = \sqrt{(9.0)^2 + (-4.9)^2}$

= 10.2 m/s

14. (c)

parallelogram law of addition

Explanation:

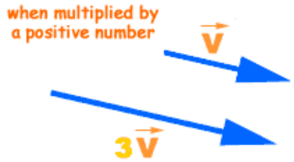
Parallelogram law of vector addition is,If two vectors are considered to be the adjacent sides of a Parallelogram, then the resultant of two vectors is given by the vector which is a diagonal passing through the point of contact of two vectors.

15. (d)

gives a vector $\overrightarrow{v'}$ = $\lambda\vec{v}$ in the same direction as $\vec{v}$

Explanation:

When a vector is multiplied by a positive number (for example 2, 3,5, 60 unit etc.) or a scalar only its magnitude is changed but its direction remains the same as that of the original vector.




16. (a)

sum of two vectors A and B' such that B' is equal to B multiplied by -1

Explanation:

Vector subtraction is defined in the following way.

- The difference of two vectors, A - B , is a vector C that is, C = A - B
- The addition of two vector such that C = A + (-B). B has been taken in opposite direction.

Thus vector subtraction can be represented as a vector addition.

17. (d)

122.5 m

Explanation:

We know that at the maximum height, the velocity of the ball is 0 m/s.

We also know that the ball takes the same time to reach its maximum height as it takes to travel from its maximum height to the initial position, due to time symmetry. The time taken is half the total time.

Therefore, we have the following information for the second (downward) part of the motion of the ball:

t = 5 second; half the total time

$v_{top} = 0\ m/s$

g = 9.8 m/$s^2$ downward

s = ?

As we know

s = ut+$\frac{1}{2}gt^2$

Put all the given value,

=> s = $0 \times 5 + \frac{1}{2} \times 9.8 \times 25$

=> s = 122.5 m

18. (d)

0.86 m $s^{-2}$, 54.5$^0$ with the direction of velocity

Explanation:

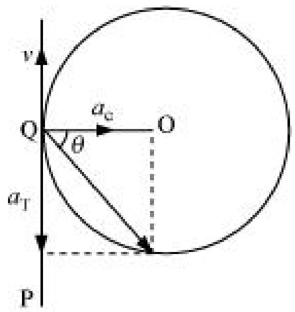
Speed of the cyclist, v = 27 km/h = 7.5 m/s

Radius of the circular turn, $r$ = 80 m

Centripetal acceleration is given as:

$a_c$ = $\frac{v^2}{r} = \frac{(7.5)^2}{80} = 0.7$ $ms^{-2}$

The situation is shown in the given figure:




Suppose the cyclist begins cycling from point P and moves toward point Q. At point Q, he applies the breaks and decelerates the speed of the bicycle by 0.5 $m/s^2$.

This acceleration is along the tangent at Q and opposite to the direction of motion of the cyclist.

Since the angle between $a_c$ and $a_T$ is 90$^0$, the resultant acceleration $a$ is given by:

a = $\sqrt{(a_c)^2 + (a_T)^2} = \sqrt{(0.7)^2 + (0.5)^2}$

= $\sqrt{0.74}$ = 0.86 $ms^{-2}$

tan θ = $\frac{a_c}{a_T}$

where θ is the angle of the resultant with the direction of velocity.

tan θ = $\frac{0.7}{0.5}$ = 1.4

θ = $tan^{-1}$(1.4) = 54.56$^0$ with the direction of velocity.

19. (c)
13.6 m

Explanation:
Let downward be the y direction.
$v_{ox} = v_o \times cos\theta = 30.0 \times cos 33.0^\circ$
= 25.2 m/s
$v_{oy} = v_o \times sin\theta = 30.0 \times sin 33.0^\circ$
= 16.3 m/s
At the maximum height, the velocity in the y direction $v_y$ is zero:
Using $(v_y)^2 = (v_{oy})^2 + 2a_y h$
$=> 0 = (16.3)^2 + 2(-9.8)h$
$h = \frac{-(16.3 \times 16.3)}{-2 \times 9.8}$ = 13.6 m

20. (d)
is either less or equal to the path length of the particle between two points

Explanation:
The maximum possible value for displacement is the distance travelled, so it cannot be of a greater value than distance (path length).
The magnitude of the displacement is always less than or equal to the distance traveled. If two displacements in the same direction are added, then the magnitude of their sum will be equal to the distance traveled.

21. (a)
vector addition

Explanation:
Vector addition is the operation of adding two or more vectors together into a vector sum. The so-called parallelogram law gives the rule for vector addition of two or more vectors. For two vectors, the vector sum is obtained by placing them head to tail and drawing the vector from the free tail to the free head.

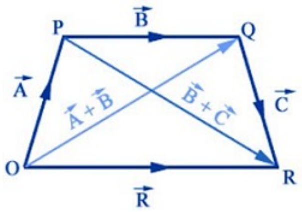
22. (a)
associative

Explanation:

Associative law of vector addition: The law states that the sum of vectors remains same irrespective of their order or grouping in which they are arranged.

Consider three vectors $\vec{A}, \vec{B}\ and\ \vec{C}$ Applying "head to tail rule" to obtain the resultant of ($\vec{A}+\vec{B}$ ) and ($\vec{B}+\vec{C}$ ).

Then finally again find the resultant of these three vectors :




In $\triangle$ OPR

$\overrightarrow{OR}=\overrightarrow{OP}+\overrightarrow{PR}$

Or

$\vec{R}=\vec{A}+(\vec{B}+\vec{C})$ ....(I)

In $\triangle$ OQR

$\overrightarrow{OR}=\overrightarrow{OQ}+\overrightarrow{QR}$

Or

$\vec{R}=(\vec{A}+\vec{B})+\vec{C}$ ....(ii)

Thus from (1) and (2)

$\vec{A}+(\vec{B}+\vec{C})=(\vec{A}+\vec{B})+\vec{C}$

This fact is known as the associative law of vector addition.

23. (d)

48.05 m

Explanation:

Let the initial velocity of the ball before the last 6m be =u

a= 10 m/s$^2$, s= 6.0m, t= 0.2 sec

=>$s=ut+\frac{1}{2}at^2$

$=>6=0.2u+\frac{1}{2}\times 10\times 0.04$

=> u = 29 m/s

Now consider the journey from rest to this height.

v =29 m/s, u= 0 m/s,a=10 m/s$^2$

$v^2-u^2=2as$

$=>841-0=2\times 10\times s$

=> s = 42.05 m

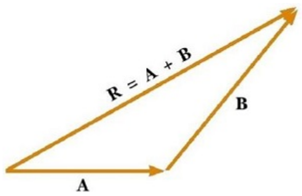
Therefore the total height = 42.05 + 6 = 48.05 m

24. (c)

so that its tail is at the head of the vector A

Explanation:

Triangle law of vector addition states that when two vectors are represented by two sides of a triangle in magnitude and direction taken in same order then third side of that triangle represents in magnitude and direction the resultant of the vectors.




Taken in same order mean tail of Vector B must coincide with head of vector A as shown in image.

25. (b)

25 m

Explanation:

Initial velocity u = 54 km/h = 15 m/s

Let Final velocity v = 0

Acceleration a = -0.3 m/s$^2$

Time taken to stop = t

Using $v = u + at$

=> $0 = 15 + (-0.3)t$

=> t = 50 sec

It means it has been stopped before 1 minutes.

So distance covered in 1 minute

$v^2 - u^2 = 2as$

=> $0 - 225 = 2 \times (-0.3)s$

=> s = 375 m

Position of locomotive relative to the traffic lights= 400-375 = 25 m

26. (b)

direction

Explanation:

Scalar quantity gives you an idea about how much of an object there is, but vector quantity gives you an indication of how much of an object there is and that also in which direction. So, the main difference between these two quantities is associated with the direction, i.e. scalars do not have direction but vectors do.

27. (d)

8.54 m $s^{-1}$, $70^\circ$ with x-axis

Explanation:

Position vector $\vec{r} = 3.0t\hat{i} + 2.0t^2\hat{j} + 4.0\hat{k}$

We know velocity is given by

$\vec{v} = \frac{dr}{dt}$

So, $\vec{v} = 3.0\hat{i} + 4t\hat{j}$

Velocity after 2 seconds

$\vec{v}_2 = 3\hat{i} + 8\hat{j}$

Magnitude of velocity = $\sqrt{(3)^2 + (8)^2}$

= $\sqrt{73}$= 8.54 $ms^{-1}$

Direction is given by

$\theta = tan^{-1}(\frac{8}{3}) = 69.5 \approx 70^\circ$ with x-axis

28. (c)

equal to zero

Explanation:

A null vector is a vector having magnitude equal to zero.It is represented by $\vec{0}$.

A null vector has no direction or it may have any direction.

Generally a null vector is either equal to resultant of two equal vectors acting in opposite directions or multiple vectors in different directions.

$\vec{0} = \vec{A} + (-\vec{A})$

29. (a)

having a magnitude of 1 and points in any chosen direction

Explanation:

A unit vector in a normed vector space is a vector (often a spatial vector) of length 1. A unit vector is often denoted by a lowercase letter with a circumflex, or "hat": $\hat{i}$ (pronounced "i-hat"). The term direction vector is used to describe a unit vector being used to represent spatial direction.

$\hat{i}$ = a unit vector directed along the positive x axis

$\hat{j}$ = a unit vector directed along the positive y axis

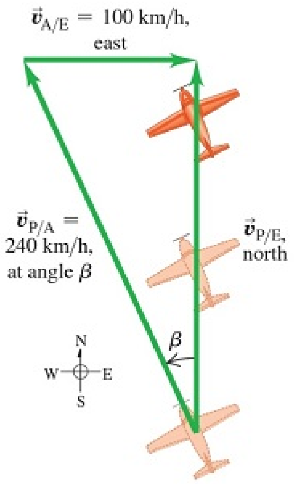
$\hat{k}$ = a unit vector directed along the positive z axis

30. (c)

$25^{o}$ W of N, 218 km/h

Explanation:

This is a relative velocity problem with vectors. Image given is a scale drawing of the situation. Again the vectors form a right triangle:




$\vec{v}_{P/E} = \vec{v}_{P/A} + \vec{v}_{A/E}$

As shown in image, The pilot points the nose of the airplane at an angle $\beta$ into the wind to compensate for the crosswind. This angle, which tells us the direction of the vector $\vec{v}_{P/A}$(the velocity of the airplane relative to the air), is one of our target variables. The other target variable is the speed of the airplane over the ground, which is the magnitude of the vector $\vec{v}_{P/E}$ (the velocity of the airplane relative to the earth). The known and unknown quantities are:$\vec{v}_{P/E} =$ magnitude unknown due North

$\vec{v}_{P/A}$ = 240 km/h due north

$\vec{v}_{A/E}$ = 100 km/h due east

We'll solve for the target variables by using iimage and trigonometry.

$v_{P/E} = \sqrt{(240)^2 - (100)^2}$ =218km/h

$\beta = sin^{-1}(\frac{100}{240})$ = 25°

The pilot should point the airplane 25° west of north, and her ground speed is then 218 km/h.

31. (c)

-16.0

Explanation:

Distance covered s = $Final\ position - initial\ position$ = -5-3 = -8 cm

Initial velocity u = 12.0 cm/s

Time taken t = 2.0 s

We know

$s = ut + \frac{1}{2}at^2$

$=> -8 = 2 \times 12.0 + \frac{1}{2}a \times 4$

$=> -8 = 24 + 2a$

$=> a = \frac{-8-24}{2} = -16.0\ cm/s^2$

32. (c)

-20

Explanation:

Velocity of A $v_A = +27\ kmh^{-1} = +7.5\ ms^{-1}$

Veloctiy of B $v_B =-45\ kmh^{-1} = -12.5\ ms^{-1}$

Relative velocity of B with respect to A $v_{BA} = v_B - v_A$

$-7.5 - 12.5 = -20\ ms^{-1}$

i.e. the train B appears to A to move with a speed of 20 $ms^{-1}$ from north to south.

33. (a)

60.0

Explanation:

Initial velocity u = 60 m/s

As it stops so final velocity v = 0 m/s

Time taken t = 2 seconds

We know

v-u = at

$=> a = \frac{v-u}{t}\ \ .....(1)$

Also

$s = ut + \frac{1}{2}at^2$

From (1), we have

$s = ut + \frac{1}{2}(\frac{v-u}{t})t^2$

$=> s = ut + \frac{1}{2}(v-u)t$

After putting given values, we have

$=> s = (60 \times 2) + \frac{1}{2}(0-60) \times 2$

=> s = 120-60 = 60 m

34. (d)

is equal in equal intervals of time.

Explanation:

Uniform motion is the kind of motion in which a body covers equal displacement in equal intervals of time. It does not matter how small the time intervals are, as long as the displacements covered are equal.

If a body is involved in rectilinear motion and the motion is uniform, then the acceleration of the body must be zero.

35. (a)

89.4

Explanation:

Initial velocity u = 0

Acceleration a = 10.0 m/$s^2$

Distance covered s = 400 m

Final velocity v = ?

We know

$v^2 - u^2 = 2as$

$=> v^2 - 0 = 2 \times 10 \times 400$

$=> 8000 = v^2$

$=> v = \sqrt{8000} = 89.4\ m/s$

36. (d)

position to the right of the origin is taken as positive and to the left as negative.

Explanation:

To describe motion along a straight line, we can choose an axis, say X-axis, so that it coincides with the path of the object. We then measure the position of the object with reference to a conveniently chosen origin, say O, Positions to the right of O are taken as positive and to the left of O, as negative.

37. (d)

63.0

Explanation:

Initial velocity u = 63 m/s

At it stops final velocity v = 0 m/s

Time taken t = 2 s

We know,

$s=\frac{1}{2}(u+v)t$

$=> s=\frac{1}{2}(0+63)\times 2$

=> s = 63 m

38. (a)

-40.0

Explanation:

Velocity of A $v_A=+54\ kmh^{-1}=+15\ ms^{-1}$

Veloctiy of B $v_B=-90\ kmh^{-1}=\ -25\ ms^{-1}$

Relative velocity of B with respect to A $v_{BA}=v_B-v_A$

$-25-15=\ -40\ ms^{-1}$

i.e. the train B appears to A to move with a speed of 40 $ms^{-1}$ from north to south.

39. (b)

a conveniently chosen origin

Explanation:

To describe motion along a straight line, we can choose an axis, say X-axis, so that it coincides with the path of the object. We then measure the position of the object with reference to a conveniently chosen origin, say O, Positions to the right of O are taken as positive and to the left of O, as negative.

40. (d)

31.0 s

Explanation:

Initial speed of the car u = 45 m/s

Let t = 0 s when the car passes the trooper.

The trooper starts from rest 1 s after the car passes the billboard.

In this 1 s the car would have covered a distance of 45 m.

Let y be the time at which the trooper overtakes the car.

Distance covered by car at time y

$S = 45 + uy = 45 + 45y......(1)$

(The distance is measured from the billboard)

The same distance is covered by the trooper also.

$S = 0 + \frac{1}{2} \times 3 \times (y)^2....(2)$

(Initial speed of trooper = 0).

Equating (1) and (2)

$45 + 45y = \frac{3}{2}(y)^2$

$=> 3y^2 - 90y - 90 = 0$

$=> y^2 - 30y - 30 = 0$

Using quadratic formula

$y = \frac{30 \pm \sqrt{900+120}}{2}$ = $\frac{30 \pm 31.93}{2} = 30.97s \approx 31s$

Neglected negative value of y

**Solution**

**Class 11 - Chemistry**

**Multiple Choice Questions Test(August 2019)**

**Section A**

41. (d)

    $Al^{3+}$

    Explanation:

    - The given species are all isoelectronic species .
    - $Ne$ though, isoelectronic with other species is a neutral and inert element, so in the absence of any charge over its atom would have largest size.
    - In case of other cationic species ;

    Greater the number of positive charge over a cation more is the effective nuclear attraction resulting into greater reduction in size of the cation.

    Therefore , out of

    $Al^3+\ ,\ Mg^{2+}\ ,\ Na^+\ , Ne$

    $Al^{3+}$ is smallest in size.

42. (d)

    All of these

    Explanation:

    Isoelectronic species have same number of electrons.

    Ne ( Z=10) has 10 electrons.

    N ( Z=7) has 7 electrons and with addition of 3 more electrons it becomes $N^{3-}$ anion which has 10 electrons.

    Mg (Z=12) has 12 electron and with removal of 2 electrons it becomes $Mg^{2+}$ cation which has 10 electrons.

    Al (Z=13) has 13 electrons and with removal of 3 electrons it becomes $Al^{3+}$ cation which has 10 electrons.

    Since all the species have same number of electrons that is 10 , so they are isoelectronic.

43. (a)

    covalent radius < Metallic radius < van der Waal's radius

Explanation:
For the same element ,

- Metallic radius of atoms are always greater than corresponding covalent radius.
- Metallic radius is always lesser than van der Waal's radius

Hence , the correct increasing order of atomic radii of an element is covalent < Metallic < van der Waal's radius.

44. (a)
transition element

Explanation:
The element is,
$Scandium,\ (\ Sc\ ) with\ atomic\ number\ (Z) = 21$
The electronic configuration of
$_{21}Sc\ is [Ar]\ 3d^1, 4s^2\ ; hence, it\ is\ a\ transition\ element.$

45. (c)
$1s^2 2s^2 2p^6 3s^2 3p^3$

Explanation:
Since , according to classification of elements in Modern periodic table,
Period number gives an idea of Valence shell number (n) while group number gives an idea of Valence electrons i.e. no. Of electrons short to nearest octet or duplet.
Here, period no. = n = 3 and to complete the octet i.e. 8 electrons in Valence shell 15th group is 3 electrons short so, it must be having 5 electrons in the Valence shell.
$\therefore$ the electronic configuration of element in $3^{rd} period$ and $15^{th} Group$ is $(1s^2, 2s^2 2p^6, 3s^2 3p^3)$.

46. (b)
I < Br < F < Cl

Explanation:
In general as the we move down the group electron gain enthalpy decreases; so the expected trend should be I < Br < Cl < F but in actual the order is I < Br <

F < Cl . This is due to small size of F atom. The valence electrons of F atom provide strong repulsion to incoming electron, hence F has unexpectedly low electron affinity.

47. (a)

$[Xe]4f^7 5d^1 6s^2$

Explanation:

$[Xe]4f^7 5d^1 6s^2$

48. (b)

Nitrogen

Explanation:

Nitrogen has electronic configuration of $1s^2\ 2s^2\ 2p^3$. It has half filled p orbitals in this outermost shell which is a stable configuration. It is difficult to add electron in such orbitals and lesser energy is released on addition of electrons hence the electron affinity value will decrease.

49. (c)

Cl, P

Explanation:

Chlorine has the electronic configuration of $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$, it need one more electrons to get fully filled electronic configuration. It will accept an electron easily to acquire stability, hence it has most negative electron gain enthalpy. Whereas phosphorus has $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$; here p-orbitals are half filled. This half filled configuration gives extra stability to phosphorus, hence it will be resistent to accept an electron. It has a positive electron affinity or in simple words energy is added to make P accept an electron.

50. (c)

P < Si < Be < Mg < Na.

Explanation:

Elements of s block are more matallic than p block elements

51. (a)

isoelectronic species

Explanation:

Isoelectronic species are elements or ions that have the same, or equal number of electrons. Although isoelectronic species have the same number of electrons, they are different in their physical and chemical properties.

52. (c)

$2, 6, 10, 14$

Explanation:

The number of columns in different blocks of elements in the periodic table is in accordance of Aufbau principle which also gives the linear order of blocks (as atomic number increases ) in the periodic table.

Therefore , the number of coumns for

(i) s -block elements =

$2$

(ii) p - block elements =

$6$

(iii) d- block elements =

$10$

(iv) f - block elements =

$14$

53. (a)

Mn > Fe > Cr > Co

Explanation:

This is attritubuted to the extra stability of half filled orbitals that is seen only in $Mn^{2+}$ (*i.e.* $d^5$). The other members have Fe ($d^6$); Cr ($d^4$) and Co ($d^7$) respectively.

54. (b)

F > O > Cl > N

Explanation:

Within a period, the oxidising character increases from left to right. Therefore, among F, O and N, oxidizing power decreases in the order: F > O > N. However, within a group, oxidizing power decreases from top to bottom. Thus, F is a stronger oxidising agent than Cl. Further because O is more electronegative than Cl, therefore, O is a stronger oxidising agent than Cl. Thus, overall decreasing order of oxidizing power is: F > O > Cl > N.

55. (c)

$[Inert]ns^2np^2$

Explanation:

The general electronic configuration of different elements is given with reference to complete configuration of an inert element preceding it. It ,is usually denoted as $[Inert]$and thereafter the number of electrons in the last orbit of the element is written following $nl^x$ notation , where

$n = principal\ quantum\ number$

$l = secondary\ or\ Azimuthal\ quantum\ number$

$x = number\ of\ electrons$

So, the general electronic configuration of group 14 elements ( ie. a p-block element ) is

$[inert]\ ns^2,\ np^2$

56. (c)

Lanthanoids

Explanation:

The two rows of elements at the bottom of the Periodic Table, called the Lanthanoids, Ce(Z = 58) – Lu(Z = 71) and Actinoids, Th(Z = 90) – Lr (Z = 103) are characterised by the outer electronic configuration $(n-2)f^{1-14}$ $(n-1)d^{0-1}ns^2$. The last electron added to each element is filled in f- orbital. These two series of elements are hence called the Inner-Transition Elements (f-Block Elements).

57. (d)

N

Explanation:

Generally atomic size along the period decreases while down the group it increases.

58. (c)

Be and Al

Explanation:

Elements of second period Li, Be and B resemble closely the elements Mg, Al and Si of the third period in the next higher group. Diagonal relationship is due to similar size of ions and almost similar electron negativities of the elements.

59. (c)

increasing order of their atomic weights

Explanation:

When they arranged elements in the increasing order of their atomic weights, both of them observed that the chemical and physical properties of the elements repeated after a regular interval.

60. (d)

F< Cl < Br < I

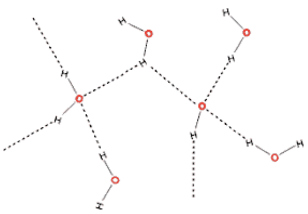
Explanation:

In a group movig from top to bottom the number of shells increases. So the atomic size increases. Although the effective nuclear charge increases but its effect is negligible in comparison to the effect of increasing number of shells.

61. (d)

4

Explanation:



The two hydrogens of the water molecule can form hydrogen bonds with other oxygens in water, and the two lone pair of electrons on oxygen of the water molecule can attract other hydrogens in water. Hence, 4 possible hydrogen bonds.

62. (b)

$O_2^{2+}$

Explanation:

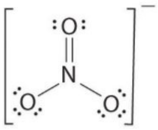
Bond length is inversely proportional to bond order. $O_2^{2+}$ has highest bond order as electrons are removed from antibonding MO.

63. (d)

4, 0

Explanation:

The nitrate ion is formed by the loss of the hydrogen ion, and so its structure is:



Around the central nitrogen there are 4 pairs of shared electrons, and no remaining lone pair. The original lone pair has now become a bonding pair. Two of those pairs make up a double bond.

64. (a)

$[BF_4^- \ and \ NH_4^+]$

Explanation:

$BF_4^-$ and $NH_4^+$ both have $sp^3$ hybridisation.

65. (a)

$2p_y$and $2p_y$

Explanation:

For p-orbitals (l = 1), there are three possible orientations corresponding to m = -1, 0, +1 values. This means that there are three p - orbitals in each p-subshell. These are designated as $p_x$, $p_y$ and $p_z$;

These three orbitals are equal in energy but differ in their orientations. Each orbital consists of two lobes symmetrical about a particular axis. Depending upon the orientation of the lobes, these are designated as $2p_x$, $2p_y$ and $2p_z$, as they are symmetrical about x, y and z-axes respectively. That is, $2p_x$ orbital has two lobes symmetrical around x-axis and the lobes of $2p_z$ orbital are symmetrical around z-axis while $2p_y$ orbital has two lobes symmetrical around y-axix so it doesn't form sigma bond.

66. (c)

$N_a < N_b$

Explanation:

**Stability of molecule :** It is determined by bond order.Higher is the bond order greater is the stability of molecule.

**Bond order** is defined as the number of covalent bonds between the two combining atoms of a molecule.

Bond order = 0.5 ($N_b - N_a$)

If $N_b > N_a$, then molecule will be stable. Where

$N_b$ = number of bonding electrons or number of electrons in bonding M.O's

$N_a$ = number of antibonding electrons

67. (c)

paramagnetic character decreases and the bond order increases

Explanation:

**For $O_2$: $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2pz^2$,**
**($Л2py^2$= $Л2px^2$), ($Л^*2py^1$= $Л^*2px^1$) $\sigma^*2pz$**
**For $O_2{}^+$: $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2pz^2$,**
**($Л2py^2$= $Л2px^2$), ($Л^*2py^1$= $Л^*2px^0$) $\sigma^*2pz$**

Bond order = $\frac{N_b - N_a}{2}$

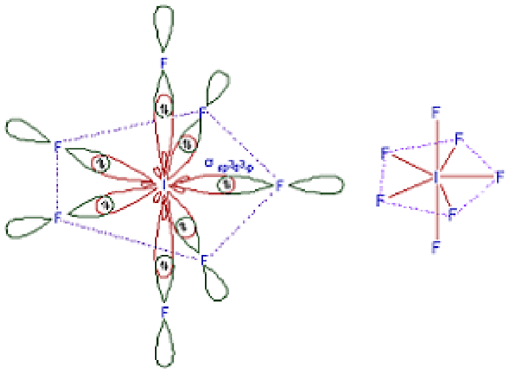
For $O_2$ = $\frac{10-6}{2}$ = 2

For $O_2{}^+$ = $\frac{10-5}{2}$ = 2.5

68. (d)

Pentagonal bipyramid

Explanation:




Pentagonal bipyramidal structure of $IF_7$

In $IF_7$ out of 7 Flourine atoms 5 of them are placed on a plane in Pentagon shape. In remaining 2 flourines one is placed above the plane and other below the plane each at 90 degrees

69. (a)

one sigma and two pi bonds

Explanation:

acetylene is $C_2H_2$.

C atoms are bound with triple bond i.e. 1 sigma and 2 pie bonds.

70. (a)

$CN^-$ and $NO^+$

Explanation:

Bond order=$\frac{n_b - n_a}{2}$

There are 8 bonding electrons and 2 antibonding electrons, therefore B.O.= $\frac{8-2}{2}$=3

$NO^+$ has 10 electrons, a triple bond between N and O and two pairs, one on each atom. This means that both N and O follow the octet rule. Bond order is 3.

71. (b)

– 1

Explanation:

Formal charge on the oxygen atom of P–O bond is – 1.

Formal charge = ( no. Of Valence electrons) - ( no. Of non bonded electrons + no. Of bonds).

72. (d)

$120^\circ$

Explanation:

$sp^2$ hybridisation have triangular planar structure so bond angle is $120^o$

73. (a)

$H_2O > HF > NH_3$

Explanation:

Boiling point order depend on hydrogen bonding strength which depends on the no. of hydrogen bonds formed and electronegative difference. $H_2O$ and $NH_3$ forms 4 hydrogen bonds while HF forms only 2. But F is more electronegative than N.

74. (c)

NO

Explanation:

The number of electrons in Nitrogen are 7 and in oxygen are 8. Hence the number of electrons that would be present in the molecular orbitals in NO are 7 + 8 = 15. As the number of electrons are odd, all the electrons in NO molecule cannot be paired. Hence, a single electron would be present in a π*2p orbital. Therefore NO is an odd electron species and the gas is hence paramagnetic due to the presence of unpaired electron.

75. (a)

$NO^+$ $NO^+$

Explanation:

Molecules having all their subshells completely filled are diamagnetic, i.e., they are not influenced greatly by a magnetic field. Paramagnetic is the opposite and it is the nature of elements possesing incompletely filled subshell(s).

The Lewis structure of NO molecule can be represented as

: N . = : O : or

: N : = . O :

It is observed that the total no. of unbonded electrons is odd. Therefore, there must be an incompletely filled subshell. Therefore, it is paramagnetic. In $NO^+$,

due to loss of 1 electron, the no. of unbonded electrons becomes even.
Therefore, all subshells must be completely filled. Therefore, it is diamagnetic.

76. (d)

$sp^2,\ sp,\ sp^3$

Explanation:

Hybridization of orbitals of N atom in$No_3^-$, $No_2^+$ and $NH_4{}^+$are $sp^2,\ sp,\ sp^3$ which can be explained by their Lewis structures.
The empty p- orbitals of N take part in hybridisation.

77. (a)

metal and a nonmetal

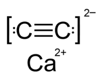
Explanation:

Metals are electropositive in nature as they easily lose electrons, so they are reducing agents. On the contrary, Non-metals are electronegative because they gain electrons and thus they are oxidising agents.

78. (d)

One sigma, two pi

Explanation:




$CaC_2$ has a combination of bonds. It is an ionic lattice that has $Ca^{2+}$ cations and acetylide $C_2{}^{2-}$ anions. Within each $C_2{}^{2-}$there is a triple bond between the 2C atoms, consisting of 1 sigma and 2 pi bonds.

79. (a)

C-O > C=O > C≡O

Explanation:

The length of the bond is determined by the number of bonded electrons (the bond order). The higher the bond order, the stronger the pull between the two atoms and the shorter the bond length. Generally, the length of the bond between two atoms is approximately the sum of the covalent radii of the two atoms. CO has triple bond so has minimum bond length.

80. (a)

3,3,3

Explanation:

Total number of electrons in $N_2$ molecule is 7+ 7= 14.

As per the formula Bonded pair of electrons $N_b$: $\sigma 1s^2\ \sigma 2s^2\ \pi 2p_y^2\ \pi 2p_z^2\ \sigma 2p_x^2$

Total 10 electrons.

Anti bond pairs of electrons $N_a$: $\sigma 1s*^2\ \ \sigma 2s*^2$ Total 4 electrons.

Bond Order (B.O.) = $\frac{N_b - N_a}{2} = \frac{10-4}{2} = 3$

Similarly bond order of CO And $NO^+$ is 3

**Solution**

**Class 11 - Mathematics**

**Multiple Choice Questions Test(August 2019)**

**Section A**

81. (d)
positive

Explanation:
Since sine ratio is positive in both first and second quadrants and the angles sum up to 180 and the ratios are related to triangle , the value is always positive.

82. (a)
$\cos\theta = \frac{1+t^2}{1-t^2}, t \neq 0$

Explanation:
The value of $\cos\theta$ lies between - 1 and 1
But when t=2 the value of $\cos\theta = \frac{1+t^2}{1-t^2}, t \neq 0$ is $\frac{5}{-3}$ which is more than 1 , so it is not possible.

83. (c)
$2n\pi + \frac{7\pi}{6}, n \in I$

Explanation:
$\sin\theta = \frac{-1}{2}$
$\Rightarrow \sin\theta = sin\left(-\frac{\pi}{6}\right)$
$\Rightarrow \theta = n\pi + (-1)^n\left(-\frac{\pi}{6}\right), n\epsilon Z$
$\Rightarrow \theta = \frac{7\pi}{6}, \frac{11\pi}{6}$
$tan\theta = \frac{1}{\sqrt{3}}$
$\Rightarrow tan \quad \theta = tan\left(\frac{\pi}{6}\right)$
$\Rightarrow \theta = n\pi + \left(\frac{\pi}{6}\right), n\epsilon Z$
$\Rightarrow \theta = \quad \frac{\pi}{6}, \frac{7\pi}{6}$
$So \quad principal \quad value \quad for \quad both \quad sin\theta \quad and \quad tan\theta \quad is \quad \frac{7\pi}{6}$
$Hence \quad the \quad general \quad solution \quad is \quad 2n\pi + \frac{7\pi}{6}, n \in I$

84. (c)
$\sin(\alpha - \beta) = 0$

Explanation:
$Given \quad sin\alpha = sin\beta \quad and \quad cos\alpha = cos\beta$
$Now \quad sin\alpha.cos\beta = cos\alpha.sin\beta$
$\Rightarrow sin\alpha.cos\beta - cos\alpha.sin\beta = 0$
$\Rightarrow sin(\alpha - \beta) = 0$

85. (c)
6

Explanation:

$sinx + sin5x = sin3x \qquad \left[\because sinC + sinD = 2sin\left(\frac{C+D}{2}\right)cos\left(\frac{C-D}{2}\right)\right]$

$\Rightarrow 2sin3x.\,cos\,(-2x) - sin3x = 0$

$\Rightarrow sin3x\,[2cos2x - 1] = 0$

$\Rightarrow sin3x = 0 \quad or \quad cos2x = \frac{1}{2}$

$\Rightarrow sin3x = sin0 \quad or \quad cos2x = cos\frac{\pi}{3}$

$\Rightarrow 3x = n\pi + (-1)^n.0 \Rightarrow x = \frac{n\pi}{3} or \quad 2x = 2n\pi \pm \frac{\pi}{3} \Rightarrow x = n\pi \pm \frac{\pi}{6}, n\epsilon Z$

$\Rightarrow x = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi \qquad or \quad x = \frac{\pi}{6}, \frac{5\pi}{6}$

$\Rightarrow \quad 6 \quad solutions \quad in \quad the \quad interval \quad [0, \pi]$

86. (c)
$\frac{1}{64}$

Explanation:
$First \quad convert \quad the \quad odd \quad multiples \quad of \quad \frac{\pi}{14} \quad to \quad even \quad multiples \quad using \quad the \quad formulas \quad sin\theta = cc$

$So \quad we \quad get \quad sin\frac{\pi}{14} = cos\frac{6\pi}{14}, sin\frac{3\pi}{14} = cos\frac{4\pi}{14}, sin\frac{5\pi}{14} = cos\frac{2\pi}{14}, sin\frac{7\pi}{14} = 1,$

$sin\frac{9\pi}{14} = sin\left(\frac{\pi}{2} + \frac{2\pi}{14}\right) = cos\frac{2\pi}{14}, sin\frac{11\pi}{14} = sin\left(\frac{\pi}{2} + \frac{4\pi}{14}\right) = \quad cos\frac{4\pi}{14}, sin\frac{13\pi}{14} = sin\left(\frac{\pi}{2} + \frac{6\pi}{14}\right) = cos\frac{6\pi}{14}$

$Now \quad sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}\sin\frac{7\pi}{14}\sin\frac{9\pi}{14}\sin\frac{11\pi}{14}\sin\frac{13\pi}{14}$

$= cos^2\frac{6\pi}{14}.\,cos^2\frac{4\pi}{14}.\,cos^2\frac{2\pi}{14}$

$= \frac{\left(sin^2\frac{2\pi}{14}.cos^2\frac{2\pi}{14}\right).cos^2\frac{4\pi}{14}.cos^2\frac{6\pi}{14}}{sin^2\frac{2\pi}{14}} \qquad [\because \quad sin2x = 2sinx.\,cosx \quad ]$

$= \frac{\frac{1}{4}sin^2\frac{4\pi}{14}.cos^2\frac{4\pi}{14}.cos^2\frac{6\pi}{14}}{sin^2\frac{2\pi}{14}}$

$= \frac{\frac{1}{4}.\frac{1}{4}.sin^2\frac{8\pi}{14}.cos^2\frac{6\pi}{14}}{sin^2\frac{2\pi}{14}} \qquad [\because \quad sin2x = 2sinx.\,cosx \quad ]$

$= \frac{\frac{1}{16}\cdot\left(sin\frac{8\pi}{14}.cos\frac{6\pi}{14}\right)^2}{sin^2\frac{2\pi}{14}}$

$= \frac{\frac{1}{16}\cdot\left(\frac{1}{2}\right)^2\cdot\left(sin\frac{14\pi}{14}+sin\frac{2\pi}{14}\right)^2}{sin^2\frac{2\pi}{14}} \qquad [\because \quad 2sinA.\,cosB = sin\,(A+B) + sin\,(A-B)]$

$= \frac{\frac{1}{64}\cdot\left(0+sin\frac{2\pi}{14}\right)^2}{sin^2\frac{2\pi}{14}} \qquad [\because \quad sin\pi = 0 \quad ]$

$= \frac{1}{64}$

87. (b)
$\sec\theta = \frac{1}{2}$

Explanation:
$\sec\theta = \frac{1}{2} \Rightarrow cos\theta = 2$
which is not possible since $cos\theta$ is a periodic function whose value oscillates between -1 and 1

88. (c)
$(0, \pi)$

Explanation:

$(cosp–1)x^2 + (cosp)x + sinp = 0$
$We \quad have \quad the \quad roots \quad are \quad real \quad when \quad the \quad discriminant \geq 0$
$\Longrightarrow cos^2 p - 4(cosp–1).\, sinp \geq 0$
$\Longrightarrow cos^2 p - 4cospsinp + 4sinp \geq 0$
$\Longrightarrow (cosp–2sinp)^2 - 4sin^2 p + 4sinp \geq 0$
$\Longrightarrow (cosp–2sinp)^2 + 4sinp\,(1 - sinp) \geq 0...........(i)$
$We \quad have \quad for \quad all \quad values \quad of \quad p \quad (cosp–2sinp)^2 \geq 0 \quad and\,(1 - sinp) \geq 0 \qquad [\because sinp \leq 1]$
$Hence \quad from \quad equation \quad (i) \quad we \quad get \quad sinp \quad has \quad to \quad be \quad nonnegative \quad for \quad all \quad values \quad of \quad p$
$But \quad we \quad have \quad sinp \geq 0 \quad only \quad when \quad p \in (0, \pi)$

89. (b)
none of these

Explanation:
Since sin x lies between -1 to 1 hence the given equation will lie between $(-\pi)/2to2 - \pi/2$.

90. (c)
$n\pi + (-1)^{n+1}\frac{\pi}{6}$

Explanation:
$2\sin^2\theta - 3\sin\theta - 2 = 0$
$\Rightarrow 2\sin^2\theta - 4\sin\theta + \sin\theta - 2 = 0$
$\Rightarrow 2\sin\theta\,(\sin\theta - 2) + 1\,(\sin\theta - 2) = 0$
$\Rightarrow (2\sin\theta + 1)\,(\sin\theta - 2) = 0$
$\Rightarrow \sin\theta = \frac{-1}{2} \quad or \quad \sin\theta = 2$
$\Rightarrow \sin\theta = sin\left(-\frac{\pi}{6}\right) \qquad [\because \quad \sin\theta = 2 > 1 \quad so \quad no \quad solution]$
$\Rightarrow \theta = n\pi + (-1)^n\left(-\frac{\pi}{6}\right), n\epsilon Z$
$\Rightarrow \theta = n\pi + (-1)^{n+1}\left(\frac{\pi}{6}\right), n\epsilon Z$

91. (c)
$\left\{n\pi + \frac{\pi}{4} : n\epsilon Z\right\}$

Explanation:
$\frac{\tan 3x - \tan 2x}{1 + \tan 3x \tan 2x} = 1 \Rightarrow tan\,(x) = 1 \quad \left[\because tan\,(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}\right]$
$\Rightarrow tan\,(x) = tan\left(\frac{\pi}{4}\right)$
$\Rightarrow x = n\pi + \frac{\pi}{4}, n\epsilon Z$

92. (a)
3

Explanation:

$tanx + secx = 2cosx$
$\Rightarrow \frac{sinx+1}{cosx} = 2cosx$
$\Rightarrow sinx + 1 - 2\cos^2 x = 0$
$\Rightarrow sinx + 1 - 2\left(1 - sin^2 x\right) = 0$
$\Rightarrow 2sin^2 x + sinx - 1 = 0$
$\Rightarrow 2sin^2 x + 2sinx - sinx - 1 = 0$
$\Rightarrow 2\sin x\left(\sin x + 1\right) - 1\left(\sin x + 1\right) = 0$
$\Rightarrow \left(2\sin x - 1\right)\left(\sin x + 1\right) = 0$
$\Rightarrow \sin x = \frac{1}{2} \quad or \quad sinx = -1$
$\Rightarrow \sin x = sin\left(\frac{\pi}{6}\right) \quad or \quad \sin x = sin\left(-\frac{\pi}{2}\right)$
$\Rightarrow x = n\pi + (-1)^n \frac{\pi}{6} \quad or \quad x = n\pi + (-1)^n\left(-\frac{\pi}{2}\right), n\epsilon Z$
$\Rightarrow x = \frac{\pi}{6}, \pi - \frac{\pi}{6}[n = 0, n = 1] \qquad or \quad x = \frac{3\pi}{2}[n = 2]$
$\Rightarrow x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}$

93. (d)
$|z + 1|^2$

Explanation:
We have $z\bar{z} = |z|^2$
Now $(z + 1)(\bar{z} + 1) = (z + 1)\left(\overline{z + 1}\right) = |z + 1|^2$

94. (d)
Re ( z ) $\geq 0$

Explanation:
Let $Z = x + iy$
Given | 1 − z | $\leq$ | 1 + z |
$\Rightarrow |1 - (x + iy)| \leq |1 + x + iy|$
$\Rightarrow |(1 - x) - iy| \leq |(1 + x) + iy|$
$\Rightarrow \sqrt{(1 - x)^2 + y^2} \leq \sqrt{(1 + x)^2 + (y)^2}$
Squaring on both sides we get
$(1 - x)^2 + y^2 \leq (1 + x)^2 + (y)^2$
$\Rightarrow 1 + x^2 - 2x + y^2 \leq 1 + x^2 + 2x + y^2$
$\Rightarrow -2x \leq 2x$
$\Rightarrow 4x \geq 0$
$\Rightarrow x \geq 0$
Hence we get x=Re ( z ) $\geq 0$

95. (c)
$\pi$

Explanation:
Given x $\in$ R and x $< 0$, therefore the number is $-x + 0i$ and this will be a point inthe second quadrant as x is negative
We have arg($-x + 0i$)=$\theta = \tan^{-1}\left|\frac{y}{x}\right| = \tan^{-1}\left|\frac{0}{-1}\right| = \tan^{-1} 0 = 0$
We have in the second quadrant the principal value of argument= $\Pi - \theta = \quad \Pi - 0 = \Pi$
Hence Arg. ( x ) , x $\in$ R and x $< 0$ is $\pi$

96. (a)
the x - axis

Explanation:
$\left|\frac{i+z}{i-z}\right| = 1$

$\Rightarrow |i+z|=|i-z|$
$\Rightarrow |i+x+iy|=|i-(x+iy)|$
$\Rightarrow |i(1+y)+x|=|-x+i(1-y)|$
$\Rightarrow \sqrt{(1+y)^2+x^2}=\sqrt{-(x)^2+(1-y)^2}$
$\Rightarrow (1+y)^2+x^2=-(x)^2+(1-y)^2$
$\Rightarrow y^2+2y+1+x^2=x^2+y^2-2y+1$
$\Rightarrow 4y=0$
$\Rightarrow y=0$
which is the X-axis.

97. (c)
none of these.

Explanation:
There is no linear ordering in the set of complex numbers.Hence it is not possible to say one complex number is smaller or bigger than the other

98. (c)
x – y + 1 = 0

Explanation:
Let $z=x+iy$
Then $z-2-3i=(x+iy)-2-3i=(x-2)+i(y-3)$
Let $\theta$ be the amplitude of z.
Then Amp $(\mathrm{z}-2-3\mathrm{i})=\pi/4$
$\Rightarrow \tan^{-1}\left(\frac{y-3}{x-2}\right)=\frac{\Pi}{4}$
$\Rightarrow \frac{y-3}{x-2}=tan\frac{\Pi}{4}=1$
$\Rightarrow y-3=x-2$
$\Rightarrow x-y+1=0$

99. (c)
1

Explanation:
Given $\alpha=\frac{z}{\bar{z}}$
Then $|\alpha|=\left|\frac{z}{\bar{z}}\right|=\frac{|z|}{|\bar{z}|}=1$ $\left[\because\left|\frac{z_1}{z_2}\right|=\frac{|z_1|}{|z_2|},|z|=|\bar{z}|\right]$

100. (b)
1 or -1

Explanation:
$p^2+p+1=0\Rightarrow p=\frac{-(1)\pm\sqrt{1^2-4.1.1}}{2}=\frac{-1\pm\sqrt{-3}}{2}=\frac{-1\pm\sqrt{3}i}{2}=\omega,\omega^2$
Now $p=\omega\Rightarrow p^{3n}=\omega^{3n}=\left(\omega^3\right)^n=1^n=\quad 1\quad or\quad -1$ , depending n is even or odd
also $p=\omega^2\Rightarrow p^{3n}=\left(\omega^2\right)^{3n}=\left(\omega^3\right)^{2n}=1^{2n}=\quad 1$
Hence p=1,-1

101. (b)
the negative real semi axis z = x , x $<0$

Explanation:
Let $z=x+iy$ then value of $\theta$ which satisfies the equation $tan\theta=\frac{y}{x}$ is caleed argument or amplitude.
Then Arg (z)= $\tan^{-1}\left(\frac{y}{x}\right)$
Now arg. ( z ) = ( 2n + 1 ) $\pi\Rightarrow\tan^{-1}\left(\frac{y}{x}\right)=(2n+1)\pi$

$\Rightarrow \tan(2n+1)\pi = \frac{y}{x}$
$\Rightarrow \frac{sin(2n+1)\pi}{cos(2n+1)\pi} = \frac{y}{x}$
$\Rightarrow \frac{0}{(-1)^{2n+1}} = \frac{y}{x}$
$\Rightarrow \frac{0}{-1} = \frac{y}{x}$
$\Rightarrow -y = 0$
Hence the points lie on the negative real semi axis z = x , x $< 0$

102. (d)
the circle whose centre is origin and radius = 1

Explanation:
$z = x + iy$
$Now \quad |z| = 1 \Rightarrow |x + iy| = 1$
$\Rightarrow \sqrt{x^2 + y^2} = 1 \Rightarrow x^2 + y^2 = 1$
which is the equation of a circle whose centre is origin and radius = 1

103. (b)
4

Explanation:
Let $z = x + iy$, then we have $\bar{z} = x - iy$
$z^2 = (x + iy)^2 = x^2 - y^2 + 2xyi$
$\therefore im\left(z^2\right) = 0 \Rightarrow 2xy = 0 \ldots\ldots\ldots(i)$
$|z| = 2 \Rightarrow \sqrt{x^2 + y^2} = 2 \Rightarrow x^2 + y^2 = 4 \ldots\ldots\ldots\ldots(ii)$
$\left(x^2 - y^2\right)^2 = \left(x^2 + y^2\right)^2 - 4x^2.y^2$
$\Rightarrow \left(x^2 - y^2\right)^2 = 16$
$\Rightarrow x^2 - y^2 = \pm 4 \ldots\ldots\ldots(iii)$
When $x^2 - y^2 = 4$ from (ii) and (iii) we get $2x^2 = 8 \Rightarrow x^2 = 4 \Rightarrow x = \pm 2$
Now from (i) we get y=0
Hence $z = \pm 2$
Now when $x^2 - y^2 = -4$ from (ii) and (iii) we get $2y^2 = 8 \Rightarrow y^2 = 4 \Rightarrow y = \pm 2$
Now from (i) we get x=0
Hence $z = \pm 2i$
Therefore the solutions of the equation $Im\left(z^2\right) = 0, |z| = 2$ are $z = \pm 2i$ and $z = \pm 2$ and so number of solutions=4.

104. (a)
$\pm\frac{1}{\sqrt{2}}(1 + i)$

Explanation:
Let $\sqrt{i} = x + iy$
Squaring both sides ,we get
$i = (x + iy)^2 = x^2 - y^2 + 2xyi$
Subtracting (i) from (iii), we get
$2y^2 = 1 \Rightarrow y^2 = \frac{1}{2} \Rightarrow y = \pm\frac{1}{\sqrt{2}}$
Comparing real and imaginary parts , we get $x^2 - y^2 = 0 \ldots\ldots\ldots\ldots(i) \quad and \quad 2xy = 1 \ldots\ldots\ldots\ldots\ldots(ii)$
We have $\left(x^2 - y^2\right)^2 = \left(x^2 + y^2\right)^2 - 4x^2.y^2$
$\Rightarrow 0 = \left(x^2 + y^2\right)^2 - (2xy)^2 = \left(x^2 + y^2\right)^2 - 1$
$\Rightarrow \left(x^2 + y^2\right)^2 = 1$
$\Rightarrow x^2 + y^2 = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(iii)$
Adding (i) and (iii) we get
$2x^2 = 1 \Rightarrow x^2 = \frac{1}{2} \Rightarrow x = \pm\frac{1}{\sqrt{2}}$
Hence $\sqrt{i} = x + iy$ =$\pm\frac{1}{\sqrt{2}}(1 + i)$

105. (a)

none of these

Explanation:

Since x $\geq 6$ we have $2 \text{ x } \geq 12$

Also given $\text{y} \geq 2$

Hence we have $2 \text{ x } + \text{y} \geq 12 + 2 \Rightarrow 2 \text{ x } + \text{y} \geq 14$

which means minimum value of $2 \text{ x } + \text{y}$ is 14.

Now since $2\text{x} + \text{y} \leq 10$ is not possible, the system x $\geq 6$, $\text{y} \geq 2$, $2\text{x} + \text{y} \leq 10$ have no solution.

106. (c)

[ 1/2 ,5/6 ]

Explanation:

$|3x-2| \leq \frac{1}{2}$ $\quad [\because |x| \leq a \Leftrightarrow -a \leq x \leq a]$

$\Rightarrow \frac{-1}{2} \leq 3x-2 \leq \frac{1}{2}$

$\Rightarrow \frac{-1}{2}+2 \leq 3x-2+2 \leq \frac{1}{2}+2$

$\Rightarrow \frac{3}{2} \leq 3x \leq \frac{5}{2}$

$\Rightarrow \frac{3}{2}.\frac{1}{3} \leq 3x.\frac{1}{3} \leq \frac{5}{2}.\frac{1}{3}$

$\Rightarrow \frac{1}{2} \leq x \leq \frac{5}{6}$

$\Rightarrow x\epsilon\left[\frac{1}{2},\frac{5}{6}\right]$

107. (a)

half of XOY –plane which lies on the right of y – axis , including the points on y – axis .

Explanation:

$2\text{x} \geq 0$

$\Rightarrow \frac{2x}{2} \geq \frac{0}{2}$

$\Rightarrow x \geq 0$

The solution region of x $\geq 0$ will be the half of XY –plane which lies on the right of y – axis , including the points on y – axis [ First and Fourth quadrants ]

108. (c)

( 3/2 , 9/2 )

Explanation:

$\left|\frac{2(3-x)}{5}\right| < \frac{3}{5}$ $\quad [\because |x| < a \Leftrightarrow -a < x < a]$

$\Rightarrow -\frac{3}{5} < \frac{2(3-x)}{5} < \frac{3}{5}$

$\Rightarrow -\frac{3}{5}.\frac{5}{2} < \frac{2(3-x)}{5}.\frac{5}{2} < \frac{3}{5}.\frac{5}{2}$

$\Rightarrow -\frac{3}{2} < 3-x < \frac{3}{2}$

$\Rightarrow -\frac{3}{2}-3 < 3-x-3 < \frac{3}{2}-3$

$\Rightarrow -\frac{9}{2} < -x < \frac{-3}{2}$

$\Rightarrow \frac{9}{2} > x > \frac{3}{2}$

$\Rightarrow x\epsilon\left(\frac{3}{2},\frac{9}{2}\right)$

109. (d)

breadth $\geq 20$

Explanation:

For the rectangle let length=L and breadth=B , then we have the perimeter= $2\left(L+B\right)$

According to the question L=3B and perimeter $\geq 160$

Now perimeter $\geq 160$
$\Rightarrow 2(L+B) \geq 160$
$\Rightarrow 2(3B+B) \geq 160$ [Using L=3B]
$\Rightarrow 2(4B) \geq 160$
$\Rightarrow 8B \geq 160$
$\Rightarrow B \geq 20$

110. (c)
$4^{\text{th}}$ quadrant

Explanation:
The solution region of x $\geq 0$ will be the half of XY –plane which lies on the right of y – axis , including the points on y – axis [ First and Fourth quadrants ]
The solution region of y $\leq 0$ will be the half of XY –plane which lies under x – axis , including the points on x – axis [ Third and Fourth quadrants ]
Hence the solution region of x $\geq 0$ , y $\leq 0$ will be the the intersection of the above two regions ,which is the fourth quadrant.

111. (b)
(6,8) ,(8,10) ,(10,12)

Explanation:
Let the consecutive even positive integers be x and x+2.
By data, x>5 and $x+(x+2)<23$
Now $x+(x+2)<23$
$\Rightarrow 2x+2<23$
$\Rightarrow 2x<21$
$\Rightarrow x<\frac{21}{2}=10\frac{1}{2}$
So we have the least possible value of x is 6 and the maximum value of x is 10.
Therefore the possible pairs of consecutive even positive integers are (6,8) ,(8,10) ,(10,12).

112. (a)
x $>$ 5

Explanation:
x $-$ 5 $>$ 0
$\Rightarrow x>5$
$\Rightarrow x\epsilon(5,\infty)$
Now $\frac{2x-4}{x+2}<2$
$\frac{2x-4}{x+2}-2<0$
$\Rightarrow \frac{2x-4-2(x+2)}{x+2}<0$
$\Rightarrow \frac{2x-4-2x-4}{x+2}<0$
$\Rightarrow \frac{-8}{x+2}<0$
$\Rightarrow x+2>0$ $\left[\because \frac{a}{b}<0, a<0 \quad \Rightarrow \quad b>0\right]$
$\Rightarrow x>-2$
$\Rightarrow x\epsilon(-2,\infty)$
Hence the solution set is $(5,\infty)\cap(-2,\infty)=(5,\infty)$
which means x $>$ 5

113. (b)
no solution

Explanation:
$-$ 4x $+$ 1 $\geq$ 0

$\Rightarrow -4x \geq -1$
$\Rightarrow \frac{-4x}{-4} \leq \frac{-1}{-4}$
$\Rightarrow x \leq \frac{1}{4}$
$\Rightarrow x \epsilon \left(-\infty, \frac{1}{4}\right]$
$3 - 4x < 0$
$\Rightarrow -4x < -3$
$\Rightarrow \frac{-4x}{-4} > \frac{-3}{-4}$
$\Rightarrow x > \frac{3}{4}$
$\Rightarrow x \epsilon \left(\frac{3}{4}, \infty\right)$
Hence solution set is $\left(-\infty, \frac{-5}{2}\right] \bigcap \left(\frac{3}{4}, \infty\right) = \Phi$
which means no solution exist.

114. (b)
set of all points in the first and third quadrants including the points on the axes .

Explanation:
We have $xy \geq 0 \Rightarrow x \geq 0 and y \geq 0 \quad or \quad x \leq 0 and y \leq 0$

Now $x \geq 0 and y \geq 0$ implies the solution set consists of all points in the first quadrant including the points on the positive X-axis and the positive Y-axis.
And $x \leq 0 and y \leq 0$ implies the solution set consists of all points in the third quadrant including the points on the

negative X-axis and the negative Y-axis.
Hence the required solution set consists of all the points in the first and third quadrants including the points on the axes (X-axis and Y-axis)

115. (c)
$x \in (-\infty, -4) \cup^{(} 6, \infty)$

Explanation:
$|\mathrm{x} - 1| > 5$
$\Rightarrow x - 1 < -5 \quad or \quad x - 1 > 5 \qquad [\because |x| > a \Leftrightarrow x < -a \quad or \quad x > a]$
$\Rightarrow x - 1 + 1 < -5 + 1 \quad or \quad x - 1 + 1 > 5 + 1$
$\Rightarrow x < -4 \quad or \quad x > 6$
$\Rightarrow x \in (-\infty, -4) \cup^{(} 6, \infty)$

116. (d)
interior of a triangle including the points on the sides

Explanation:
We have the graph of the system $\mathrm{x} \geq 0$ , $\mathrm{y} \geq 0$ is the region in the first quadant including all the points on the positive axes( X-axis and Y-axis)
Now consider $3\mathrm{x} + 4\mathrm{y} = 12$
If we put x=0 in the above equation we get y=12/4=3 and if we put y=0 in the above equation we get x=12/3=4
Which means the graph of $3\mathrm{x} + 4\mathrm{y} = 12$ is a straight line passing through the points (4,0) and (0,3)
Now if we put (0,0) in the inequality $3\mathrm{x} + 4\mathrm{y} \leq 12$ we get $0 \leq 12$ which is true and hence the graph of this will be the region in the plane which contain the origin including all the points on this line.
Now we can see the X-axis ,Y-axis and the line $3\mathrm{x} + 4\mathrm{y} = 12$ will make a small right angled triangle in the first quadrant with their vertices at (0,0) , (4,0) and (0,3)
Hence the solution of the system $\mathrm{x} \geq 0$ , $\mathrm{y} \geq 0$ , $3\mathrm{x} + 4\mathrm{y} \leq 12$ will be the interior of this triangle including the points on the sides

117. (d)
$n^2 \left(2n^2 - 1\right)$

Explanation:

When n = 1 we get 1 . When n = 2 we get RHS : 4x7 = 28 LHS : 1+*27 = 28...... By PMI this is true.*

118. (a)

P ( 41 ) is not true

Explanation:

Since when n = 41 we have 〖41〗$^{2}$, which is not a prime number.

119. (b)

2304

Explanation:

When n = 1 the value is 0. When n = 2 the value is 2304..... Hence by the principle of mathematical induction the expression is divisible by 2304.

120. (b)

49

Explanation:

When n = 2 the value is 49.