

**IUT ADMISSION TEST 2017-2018****QUESTION PAPER****PHYSICS**

- The coordinate of a particle in meters is given by  $x(t) = 16t - 3.0t^3$ , where the time  $t$  is in seconds. What is the value of  $t$  when the particle is momentarily at rest?  
A) 0.75 s      B) 1.3 s      C) 5.3 s      D) 7.3 s
- A plane has an air speed of 240 km/hr. What should be the planes heading if it is to travel due north, relative to the earth in a wind blowing with a velocity of 100 km/hr in an easterly direction?  
A)  $24.62^\circ$       B)  $2.462^\circ$       C)  $2462^\circ$       D)  $42.62^\circ$
- An elevator is accelerated upward at  $2\text{ m/s}^2$ . If the elevator weighs 500kg, what is the tension in the supporting cable? ( $g = 9.8\text{ m/s}^2$ ).  
A) 20.604 kg      B) 206.04 kg      C) 602.04 kg      D) 60.204 kg
- A force of 100 N is required to stretch a steel wire  $2.0\text{ mm}^2$  in cross sectional area and 2.0 m long a distance of 0.50 mm. How much work is done?  
A) 0.25 N-m      B) 0.025 N-m      C) 2.5 N-m      D) 25 N-m
- A boy jogs around a horizontal circle with a constant speed. He travels one fourth of a revolution, a distance of 25 m along the circumference of the circle, in 5 s. The magnitude of his acceleration is :  
A)  $0.31\text{ m/s}^2$       B)  $1.3\text{ m/s}^2$       C)  $1.6\text{ m/s}^2$       D)  $3.9\text{ m/s}^2$
- A car is being driven on a road having two distant circular bends  $B_1$  and  $B_2$  of radius  $R$  and  $3R$  respectively. If  $S_1$  is the speed of the car at the bend  $B_1$  and  $S_2$  is the speed at the bend  $B_2$ , what should the ratio  $S_1/S_2$  be so that the centripetal forces at both bands are equal?  
A) 1      B)  $\sqrt{3}$       C)  $1/\sqrt{3}$       D)  $1/\sqrt{2}$
- In a spring balance, the length of the spring is 20 cm which can read from 0 to 60 N. Find the potential energy of the spring when it reads 40 N.  
A) 0.267 J      B) 26.7 J      C) 2.67 J      D) 267 J
- A proton collides with a neutron (mass almost identical to the proton) to form a deuteron. What will be the velocity of the deuteron if it is formed from a proton moving with velocity  $7.0 \times 10^6\text{ m/s}$  to the left and a neutron moving with velocity  $4.0 \times 10^6\text{ m/s}$  to the right? (Proton mass =  $1.67 \times 10^{-27}\text{ kg}$ ).  
A)  $1.5 \times 10^6\text{ m/s}$  towards left      B)  $15 \times 10^6\text{ m/s}$  upward  
C)  $15 \times 10^5\text{ m/s}$  downward      D)  $-1.5 \times 10^6\text{ m/s}$  towards left
- To what volume must a liter of oxygen be expanded if the molecules per unit volume is  $12.0 \times 10^{11}\text{ cm}^{-3}$ ? Diameter of the oxygen molecule =  $3\text{ \AA}$ . Assume that the gas starts at STP.  
( $R = 8.3 \times 10^7\text{ dynes} \cdot \text{cm} \cdot \text{mole}^{-1} \text{ K}^{-1}$ ,  $N_o = 6.02 \times 10^{23}\text{ mole}^{-1}$ ).  
A)  $22.41 \times 10^{10}\text{ cm}^3$       B)  $2.241 \times 10^{10}\text{ cm}^3$       C)  $2.241 \times 10^{10}\text{ m}^3$       D)  $4.482 \times 10^{10}\text{ cm}^3$
- A lens is used to produce a sharp image on a screen. When the right half of the lens is covered with an opaque material, how will image be affected?  
I. The right half of the image will disappear.  
II. The left half of the image will disappear.  
III. The image size will become approximately  $\frac{1}{2}$  of the original size.  
IV. The image brightness will become approximately  $\frac{1}{2}$  of the original brightness.  
A) I, II and III only      B) I and III only      C) II and IV only      D) IV only

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23. Two discs  $A$  and  $B$  are mounted coaxially on a vertical axle. The discs have moments of inertia  $I$  and  $2I$ , respectively about the common axis. Disc  $A$  is imparted an initial angular velocity  $2\omega$  using the entire potential energy of a spring compressed by a distance  $x_1$ . Disc  $B$  is imparted an angular velocity  $\omega$  by a spring having the same spring constant and compressed by a distance  $x_2$ . Both the discs rotate in the clockwise direction. The ratio of  $x_1/x_2$  is  
 A) 2                      B)  $1/2$                       C)  $\sqrt{2}$                       D)  $1/\sqrt{2}$
24. The pressure exerted on the ground by a man is greatest when  
 A) He stands with both feet flat on the ground.      B) He stands flat on one foot.  
 C) He stands on the toes of one foot.                      D) He lies down on the ground.
25. The displacement of a particle varies according to the relation  $x = 4(\cos\pi t + \sin\pi t)$ . The amplitude of the particle is  
 A) -4                      B) 4                      C)  $4\sqrt{2}$                       D) 8
26. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency?  
 A) 5%                      B) 20%                      C) Zero                      D) 0.5%
27. Two closed organ pipe sounded simultaneously give 5 beats per second between the fundamentals. If the shorter pipe is 1.1 m, find the length  $L_L$  of the longer pipe. (Speed of sound in air = 340 m/s)  
 A) 1.18 m                      B) 1.18 cm                      C) 11.8 cm                      D) 11.8 m
28. A real gas is changed slowly from state 1 to state 2. During this process no work is done on or by the gas. This process must be  
 A) Isothermal                      B) Adiabatic                      C) Isovolumic                      D) Isobasic
29. A Carnot heat engine operate between a hot reservoir at absolute temperature  $T_H$  and a cold reservoir at absolute temperature  $T_C$ . Its efficiency is  
 A)  $\frac{T_H}{T_C}$                       B)  $\frac{T_C}{T_H}$                       C)  $1 - \frac{T_H}{T_C}$                       D)  $1 - \frac{T_C}{T_H}$
30. A small object has charge  $Q$ . Charge  $q$  is removed from it and placed on a second small object. The two objects are placed 1 m apart. For the force that each object exerts on the other to be a maximum,  $q$  should be  
 A)  $2Q$                       B)  $Q$                       C)  $Q/2$                       D)  $Q/4$
31. A physics instructor in anteroom charges an electrostatic generator to  $25\ \mu\text{C}$ , then carries it into the lecture hall. The net electric flux in  $\text{N}\cdot\text{m}^2/\text{C}$  through the lecture hall wall is  
 A) 0                      B)  $25 \times 10^{-6}$                       C)  $2.2 \times 10^5$                       D)  $2.8 \times 10^6$
32. A certain farsighted person has a minimum distance of distinct vision of 150 cm. He wishes to read clearly at distance of 25 cm. what focal length glasses should he used and what is the type of the lens?  
 A) 300 m                      B) 30 m                      C) 30 cm                      D) 3.0 cm
33. An observer is moving with a velocity of  $0.95c$  in a direction perpendicular to a rod of length  $L$ . The observer will measure the length of the rod to be  
 A) Equal to  $L$                       B) Less than  $L$                       C) Greater than  $L$                       D) Zero
34. Which of the following electromagnetic radiation has photons with the greatest energy?  
 A) Blue light                      B) Yellow light                      C) Radio waves                      D) X-rays
35. In Compton scattering from stationary electrons the largest change in wave length occurs when the photon is scattered through  
 A)  $0^\circ$                       B)  $90^\circ$                       C)  $45^\circ$                       D)  $180^\circ$



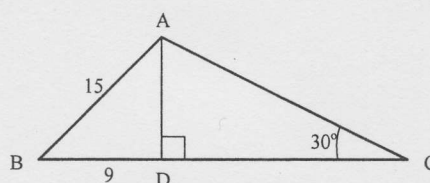
## CHEMISTRY

36. The half-life period for a first order reaction is 15 hours. How much reactant will remain unreacted at the end of 50 hours?  
 A)  $\frac{3}{5}$  B)  $\frac{1}{10}$  C)  $\frac{1}{5}$  D)  $\frac{1}{20}$
37. Which is an example of Isoelectron?  
 A)  ${}_{13}^{27}\text{Al}^{3+}$ ,  ${}_{8}^{16}\text{O}^{2-}$  B)  ${}_{7}^{14}\text{N}$ ,  ${}_{8}^{15}\text{O}^{2-}$  C)  ${}_{15}^{32}\text{P}$ ,  ${}_{16}^{32}\text{S}$  D)  ${}_{54}^{131}\text{Xe}$ ,  ${}_{27}^{59}\text{Co}$
38. Which is the strongest oxidizing agent of the following?  
 A)  $\text{K}_2\text{Cr}_2\text{O}_7$  B)  $\text{CuSO}_4$  C)  $\text{KMnO}_4$  D)  $\text{Fe}_2(\text{SO}_4)_3$
39. Which of the following statement is not true?  
 A) Increase of atomic size decreases electron affinity. B) Increase of nuclear charge increases electron affinity.  
 C) Increase of electron density in valence shell increases electron affinity. D) Increase of suborbit increases ionisation energy.
40. In IR spectra, the stretching frequency of carboxylic -OH group arise at -  
 A)  $3300 - 2500 \text{ cm}^{-1}$  B)  $1760 - 1690 \text{ cm}^{-1}$  C)  $1320 - 1210 \text{ cm}^{-1}$  D)  $1440 - 1395 \text{ cm}^{-1}$
41. At  $11^\circ\text{C}$  temperature and 749 mm pressure, the weight of a gaseous hydrocarbon is 0.11 gm. If in that compound, there is 85.71% Carbon, then what is its molecular formula? (Volume = 46.43 mL; molecular weight = 56).  
 A)  $\text{CH}_4$  B)  $\text{C}_4\text{H}_8$  C)  $\text{C}_2\text{H}_6$  D)  $\text{CH}_2$
42. Which is incorrect?  
 A) Size of anion increase  $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$ . B) Covalent character increase  $\text{AgF} < \text{AgCl} < \text{AgBr} < \text{AgI}$ .  
 C) Ionic character increase  $\text{AgF} < \text{AgCl} < \text{AgBr} < \text{AgI}$ . D) Solubility decrease  $\text{AgF} > \text{AgCl} > \text{AgBr} > \text{AgI}$ .
43. The Lewis structure for the compound series ketone is  
 A)  $\begin{array}{c} \text{H} \quad :\text{O}: \\ | \quad || \\ \text{H}-\text{C}-\text{C}-\ddot{\text{O}}-\text{H} \\ | \\ \text{H} \end{array}$  B)  $\begin{array}{c} \text{H} \quad :\text{O}: \quad \text{H} \\ | \quad || \quad | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ | \quad \quad | \\ \text{H} \quad \quad \text{H} \end{array}$   
 C)  $\begin{array}{c} \text{H} \quad :\text{O}: \\ | \quad || \\ \text{H}-\text{C}-\text{C}-\text{H} \\ | \\ \text{H} \end{array}$  D)  $\begin{array}{c} \text{H} \quad :\text{O}: \quad \text{H} \\ | \quad || \quad | \\ \text{H}-\text{C}-\text{C}-\ddot{\text{O}}-\text{C}-\text{H} \\ | \quad \quad | \\ \text{H} \quad \quad \text{H} \end{array}$
44. What is the formation enthalpy of sugar? If the combustion enthalpy of carbon, hydrogen, and sugar are -406 kJ, -284 kJ, and -5638.82 kJ, respectively.  
 A) -4040.82 kJ/mol. B) 6936.82 kJ/mol.  
 C) -2207.18 kJ/mol. D) 1498.82 kJ/mol.
45. Butane molecule is converted to 2-methyl propane by Isomerisation in the presence of the following environment.  
 A)  $\text{AlCl}_3$ ,  $\text{H}_2\text{SO}_4$ ,  $300^\circ\text{C}$ . B)  $\text{Al}_2\text{O}_3$ ,  $\text{HCl}$ ,  $150^\circ\text{C}$ .  
 C)  $\text{Al}_2\text{O}_3$ ,  $\text{H}_2\text{SO}_4$ ,  $150^\circ\text{C}$ . D)  $\text{AlCl}_3$ ,  $\text{HCl}$ ,  $300^\circ\text{C}$ .
46. Concentrated  $\text{H}_2\text{O}_2$  solution is used as oxidant in rocket fuel and diluted  $\text{H}_2\text{O}_2$  solution is used as hair bleach. A 30%  $\text{H}_2\text{O}_2$  (w/w) aqueous solution has density 1.11 g/mL. What is the molarity and mole fraction of this  $\text{H}_2\text{O}_2$  solution?  
 A) 7.97 M, 0.185 B) 9.79 M, 0.158  
 C) 9.79 M, 0.185 D) 7.97 M, 0.158
47. Temporary hardness of water is caused due to the presence of which compounds in water?  
 A)  $\text{CaCO}_3$  B)  $\text{CaCl}_2$  and  $\text{MgCl}_2$   
 C)  $\text{Ca}(\text{HCO}_3)_2$  and  $\text{Mg}(\text{HCO}_3)_2$  D)  $\text{Na}_2\text{CO}_3$

48. All of the following are the true statements concerning reaction orders except:
- A) The rate of a zero-order reaction is constant. B) After three half-lives, a radioactive sample will have one-ninth of its original concentration.
- C) The unit for the rate constant for first order reactions are  $s^{-1}$ . D) If doubling the concentration of a reactant doubles the rate of the reaction, then the reaction is first order in that reactant.
49. An exothermic reaction is at equilibrium. If temperature is increased, which of the following will take place?
- A) The value of "K" will increase. B) The value of "K" will decrease.
- C) The value of "K" will not change. D) None of them.
50. Which one of the following is used to form a salt bridge in electrochemical cell?
- A)  $KNO_3$  B)  $HNO_3$  C)  $AgNO_3$  D)  $H_2SO_4$

## MATHEMATICS

51. If  $i^2 = -1$ , then  $\sqrt{(8 + 6i)} = ?$
- A)  $(3 + i)$  B)  $-(3 + i)$  C)  $\pm(3 + i)$  D)  $(3 - i)$
52. If  $\begin{bmatrix} a & b \\ a_1 & b_1 \end{bmatrix} \begin{bmatrix} 3 & -5 \\ -1 & 2 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 2 & 0 \end{bmatrix}$ , then the values of  $a$  and  $b$  are?
- A)  $a = 1$  and  $b = 2$  B)  $a = 2$  and  $b = 3$  C)  $a = 2$  and  $b = 5$  D)  $a = 3$  and  $b = 8$
53. If  $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$  and  $B = A^{-1}$ , then  $b_{23} = ?$
- A) 1 B) 2 C) -1 D) -2
54. What is the perimeter of  $\triangle ABC$ ?



- A) 48 B)  $48 + 12\sqrt{2}$  C)  $60 + 6\sqrt{3}$  D)  $48 + 12\sqrt{3}$
55. From the figure below, equation of the parabola is
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- The diagram shows a parabola opening to the right on a Cartesian coordinate system. The vertex is at (4, 0). The axis of symmetry is the line  $x = 2$ , which is labeled as  $x+2=0$ . The point (4, 0) is marked on the x-axis.
- A)  $y^2 = 4(x-1)$  B)  $y^2 = 6(x-2)$  C)  $y^2 = 4(x-3)$  D)  $y^2 = 12(x-1)$
56. Find the term independent of  $x$  in the expansion of  $\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^6$
- A)  $\frac{3}{11}$  B)  $\frac{5}{12}$  C)  $\frac{7}{11}$  D)  $\frac{7}{12}$
57.  $\int x^x (1 + \ln x) dx = ?$
- A)  $x^x + c$  B)  $x^{2x} + c$  C)  $x^{2x} \ln x + c$  D)  $\frac{1 + \ln x}{x} + c$

58.  $\lim_{x \rightarrow 0} \frac{x}{\sqrt{1 - \cos x}} = ?$

A) 2

B)  $\frac{1}{4}$

C)  $\sqrt{2}$

D)  $\frac{1}{\sqrt{2}}$

59. For what values of  $k$ ,  $3x - 4y = k$  will touch  $x^2 + y^2 - 8x = 0$  ?

A) -8.32

B) -32.8

C) 8.32

D) 81.3

60.  $\begin{vmatrix} 1+x & x & 2 \\ 3 & 2 & 1 \\ 2 & 5 & 7 \end{vmatrix} = 0, \quad x = ?$

A)  $\frac{5}{2}$

B)  $-\frac{31}{10}$

C)  $\frac{3}{37}$

D) None

61.  $\begin{vmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix} = ?$

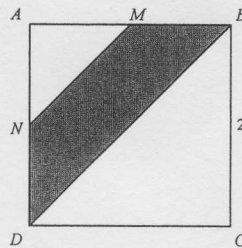
A) 1

B)  $w$

C)  $w^2$

D) 0

62. In the following figure,  $M$  and  $N$  are the midpoints of two of the sides of square  $ABCD$ . What is the area of the shaded region?



A) 1.5

B) 1.75

C) 3.0

D)  $2\sqrt{2}$

63. Find the sum to infinity of the following series,

$$\frac{3}{(2)(4)} - \frac{5}{(4)(6)} + \frac{7}{(6)(8)} - \dots$$

A)  $\frac{1}{4}$

B)  $\frac{1}{3}$

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

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

64.  $\cos^2 x + \cos^2 \left(x + \frac{\pi}{3}\right) + \cos^2 \left(x - \frac{\pi}{3}\right) = ?$

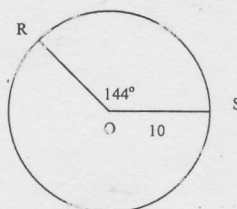
A)  $-\frac{3}{4}$

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

C)  $-\frac{3}{4} \cos 3x$

D)  $-\frac{3}{2} \cos 3x$

65. In the following circle, what is the length of arc  $RS$ ?



A) 8

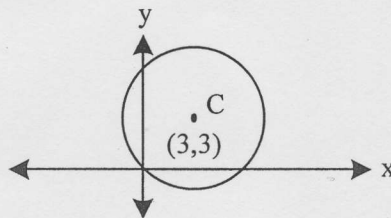
B) 20

C)  $8\pi$

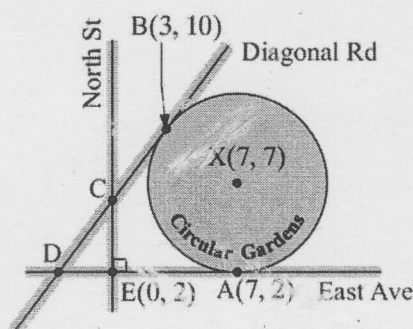
D)  $20\pi$



66. Find the area of the triangle whose vertices are the origin and foci of the ellipse  $16(x-2)^2 + 25(y-3)^2 = 400$ .  
 A) 9 sq. units      B) 12 sq. units      C) 16 sq. units      D) 10 sq. units
67.  $0.5 + 0.05 + 0.005 + \dots$ . The sum of the series up to infinity is  
 A)  $\frac{1}{3}$       B)  $\frac{7}{9}$       C)  $\frac{1}{9}$       D)  $\frac{5}{9}$
68. There are 10 blue and 15 red marbles in a box. A boy picks up two marbles at the random one by one. The probability of both being of the same color is  
 A)  $\frac{2}{3}$       B)  $\frac{4}{5}$       C)  $\frac{3}{20}$       D)  $\frac{7}{20}$
69. In the following circle, the area is  $K\pi$ , what is the value of  $K$ ?



- A) 3      B) 6      C) 9      D) 18
70. If  $y + x = x^{-y}$ , Find  $\frac{dy}{dx}$ .  
 A)  $\frac{x^2 + 2y}{2x + \log x}$       B)  $\frac{x + 2y + 5}{(x + y) + \log x}$       C)  $\frac{xy + y^2 + 1}{x + \log x}$       D)  $-\frac{xy + x + y^2}{x[1 + (x + y)\log x]}$
71. There are 100 people on a line. Shawon is the 37<sup>th</sup> person and Naomi is the 67<sup>th</sup> person. If a person on line is chosen at random, what is the probability that the person is standing between Shawon and Naomi?  
 A)  $\frac{1}{100}$       B)  $\frac{29}{100}$       C)  $\frac{3}{10}$       D)  $\frac{31}{100}$
72. A equation of a straight line having slope  $m$  and  $x$ -intercept  $b$  is-  
 A)  $y = m(x - b)$       B)  $x = my + b$       C)  $y = mx + b$       D)  $y = mx - b$
73. If two roots of the equation  $x^2 + bx + a = 0$ , are equal and one root of the equation  $x^2 + ax + 8 = 0$  is 4, the value of  $b$  will be  
 A) 4      B)  $2\sqrt{6}i$       C)  $1 - i$       D)  $1 + i$
74. A Circular Garden is bounded by East Avenue and Diagonal Road as shown in the figure given below. Diagonal Road intersects North Street at C and East Avenue at D. Diagonal Road is tangential to the Circular Garden at B. Find the equation of the diagonal Road.

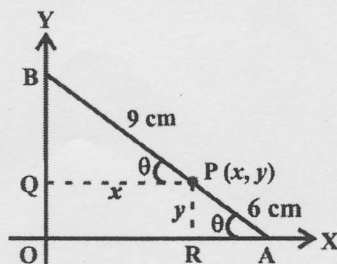


- A)  $3x - 4y + 18 = 0$       B)  $x - 3y + 18 = 0$   
 C)  $7x - 10y + 18 = 0$       D)  $10x - 7y + 18 = 0$

75. When  $x = 1$ , the function  $x^3 - 3x^2 + 7 = 0$  is :

- A) Increasing B) Maximum C) Decreasing D) Minimum

76. A rod AB of length 15 cm rests in between two coordinate axes in such a way that the end point A lies on x-axis and end point B lies on y-axis. A point P(x, y) is taken on the rod in such a way that AP = 6 cm. If the rod moves with its ends always touching the coordinate axes, find the equation of the locus of the point P.



- A)  $\frac{x^2}{81} + \frac{y^2}{36} = 1$  B)  $\frac{x^2}{36} + \frac{y^2}{81} = 1$  C)  $\frac{x^2}{36} + \frac{y^2}{9} = 1$  D)  $\frac{x^2}{9} + \frac{y^2}{36} = 1$

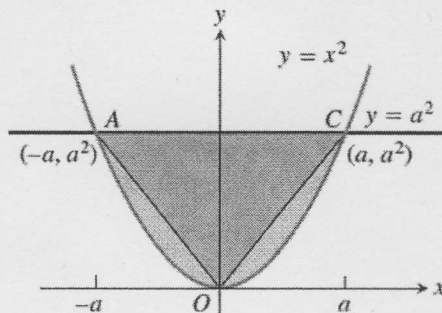
77.  $\int \frac{dx}{x + \sqrt{x}} = ?$

- A)  $\ln(\sqrt{x} + 1) + c$  B)  $\tan^{-1}(\sqrt{x} + 1) + c$  C)  $2\ln(\sqrt{x} + 1) + c$  D)  $2\tan^{-1}(\sqrt{x} + 1) + c$

78. If  $y = \sec^2(\tan^{-1} x)$ , then  $\frac{dy}{dx} = ?$

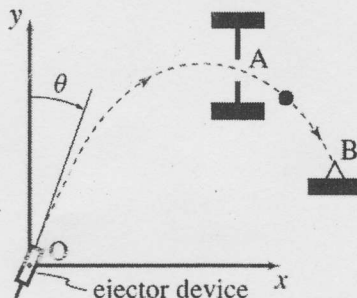
- A)  $\frac{x}{1+x^2}$  B)  $\frac{x}{\sqrt{1+x^2}}$  C)  $x$  D)  $2x$

79. The figure given below shows triangle AOC inscribed in the region cut from the parabola  $y = x^2$  by the line  $y = a^2$ . Find the limit of the ratio of the area of the triangle to the area of the parabolic region as  $a$  approaches zero.



- A)  $\frac{3}{4}$  B)  $\frac{4}{5}$  C)  $\frac{5}{6}$  D)  $\frac{6}{7}$

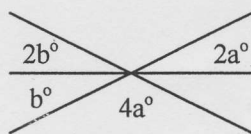
80. A small ball from the ejector device at O is ejected in such a way that it passes through the small aperture at A and strikes the contact point at B as shown in the figure below. The coordinates of A and B are (2, 2) and (3, 1), respectively. If the player controls the angle  $\theta$  and velocity  $v$ , then the value of  $\theta$  that gives him a success is:



- A)  $29.7^\circ$  B)  $66.8^\circ$  C)  $23.2^\circ$  D)  $74.1^\circ$



81. In the figure below, what is the value of  $b$ ?



- A) 9                      B) 18                      C) 27                      D) 36
82. What is the total number of terms of  $(x + 3y + 5z)^{20}$  ?  
A) 231                      B) 250                      C) 501                      D) 102
83. For what values of  $a$ , roots of  $ax^2 + 3x + 4 = 0$  will be complex?  
A)  $a = \frac{9}{16}$                       B)  $a < \frac{9}{16}$                       C)  $a > \frac{9}{16}$                       D)  $a \geq \frac{9}{16}$
84. What is the minimum value of  $x^2 - 2x + 5$  ?  
A) 3                      B)  $\frac{11}{4}$                       C) 4                      D) 5
85. For what values of  $k$ , roots of  $(k-1)x^2 - (k+2)x + 4 = 0$  will be real and equal?  
A) 2, 10                      B) 12, 10                      C) 2, 1                      D) None

## ENGLISH

### Question 86-90:

Choose the appropriate word for the blank space to complete the sentence of the following passage:

For the first time, scientists have directly detected gravitational waves, ripples in space-time, in addition to light from the spectacular collision of two neutron stars. This marks the first time that a cosmic event has been viewed in both gravitational waves and light.

The discovery was made using the U.S.-based Laser Interferometer Gravitational-Wave Observatory (LIGO); the Europe-based Virgo detector; and some 70 ground and space-based observatories.

Neutron stars are the smallest, densest stars known to exist and are formed when massive stars explode in supernovas. As these neutron stars spiraled together, they emitted gravitational waves that \_\_\_\_\_ for about 100 seconds; when they collided; a \_\_\_\_\_ light in the form of gamma rays was emitted and seen on Earth about two seconds after the gravitational waves. In the days and weeks following the smashup, other forms of light or electromagnetic radiation — including X-ray, ultraviolet, optical, infrared, and radio waves were detected.

The observations have given astronomers a(n) \_\_\_\_\_ opportunity to probe a collision of two neutron stars. For example, observations made by the U.S. Gemini Observatory, the European Very Large Telescope, and the Hubble Space Telescope \_\_\_\_\_ signatures of recently synthesized material, including gold and platinum, solving a decades-long mystery of where about half of all elements heavier than iron are produced.

The LIGO-Virgo results are published today in the journal *Physical Review Letters*; additional papers from the LIGO and Virgo \_\_\_\_\_ and the astronomical community have been either submitted or accepted for publication in various journals.

- |                      |              |                   |                |
|----------------------|--------------|-------------------|----------------|
| 86. A) stable        | B) ephemeral | C) detectable     | D) invisible   |
| 87. A) durable       | B) permanent | C) visible        | D) temporary   |
| 88. A) unprecedented | B) enormous  | C) astronomical   | D) significant |
| 89. A) discover      | B) uncloak   | C) gather         | D) provide     |
| 90. A) dealings      | B) divisions | C) collaborations | D) league      |

**Question 91-95:**

Choose the word or phrase which is most nearly **opposite** of the meaning of the given word.

- |                |               |                                 |               |                  |
|----------------|---------------|---------------------------------|---------------|------------------|
| 91. Turbulence | A) Immunity   | B) Tranquility                  | C) Meditation | D) Coordination  |
| 92. Equivocal  | A) Clear      | B) Open to many interpretations | C) Unsure     | D) Indefinite    |
| 93. Guile      | A) Innocence  | B) Clever                       | C) Tricky     | D) Sophisticated |
| 94. Voracious  | A) Hungry     | B) Greedy                       | C) Satisfied  | D) Starving      |
| 95. Acrimony   | A) Bitterness | B) Ill-will                     | C) Animosity  | D) Civility      |

**Question 96-100:**

Choose the word or phrase which is most nearly **similar** of the meaning of the given word.

- |                |                     |              |                |  |
|----------------|---------------------|--------------|----------------|--|
| 96. Auspicious | A) Lucky            | B) Guileless | C) Unpromising | D) Cryptic   |
| 97. Vociferous | A) Offensively loud | B) Satisfied | C) Hushed      | D) Shy   |
| 98. Dogmatic   | A) Ambiguous        | B) Willing   | C) Stubborn    | D) Skeptical   |
| 99. Poignant   | A) Heart touching   | B) Cheerful  | C) Indifferent | D) Calm  |
| 100. Galvanize | A) Discourage       | B) Comfort   | C) Excite      | D) Coat (iron or steel) with a protective layer of copper. |