جـامعة بيروت العربية

BEIRUT ARAB UNIVERSITY

## Faculty of Engineering

## Admission Exam Sample

## General Instructions

1- The First Page of the booklet is the answer sheet. Fold this page along the perforations, slowly and carefully tear off the answer sheet.

2- Write your name and your seat number then fill the seat number in the proper place on the answer sheet.

3- Be sure to fill only one answer with a pencil for each question.

4- Use of mobiles is prohibited

1. The equation $x^2 - (k-4)x + 9 = 0$ has two repeated roots, when

   A. $k = 0$          B. $k = 1$          C. $k = -1$          D. $k = -2$

2. Two identical dice are thrown, one after the other. What is the probability that the second number is greater than the first number by 2?

   A. 1/12          B. 1/9          C. 1/6          D. 7/36

3. The integral $\int_{-1}^{1} (x^3 + x^2)\, dx$ is equal to

   A. $\int_{-1}^{1} x^2\, dx$          B. $2\int_{-0.5}^{0.5} x^2\, dx$          C. 0          D. 1/2

4. The product of two complex numbers $(a + b\,i)$ and $(c + d\,i)$ is a real number if

   A. $a = -c$          B. $ac = bd$          C. $ad = -bc$          D. $ad = bc$

5. The two vectors $\bar{a} = <c, -1, 2>$ and $\bar{b} = <2, d, -4>$ are parallel, if $c$ and $d$ are

   A. $2, -1$          B. $-1, 2$          C. $1, -2$          D. $2, 1$

6. The integral $\int \ln e^{2x}\, dx$ is equal to

   A. $\dfrac{1}{2x} + c$          B. $\dfrac{1}{2} e^{2x} + c$          C. $\dfrac{1}{2x} e^{2x} + c$          D. $x^2 + c$

7. The function $f(x) = x^2 - 3x$, is a decreasing function from $x = -\infty$ to

   A. $x = 3/2$          B. $x = 2$          C. $x = 3/4$          D. $x = 4$

8. The area between $f(x) = x^2$ and x-axis from $x = 0$ to $x = 1$ is

   A. 1/2          B. 3          C. 1/3          D. 2/3

9. A class has 8 boys and 7 girls. Three students are selected at random one after one. The probability that the first two are girls and the third is a boy is?

   A. 8/65          B. 3/15          C. 4/13          D. 3/14

10. The points A(1,2), B(3,10), and C(4,y) are collinear ( on the same line), if

    A. $y = 12$          B. $y = 8$          C. $y = 14$          D. $y = 10$

11. Two squares are drown inside and outside a circle of radius $r$, as shown. The area between the two squares is equal to

    A. $r^2$          B. $2r^2$          C. $r^2/4$          D. $r^2 - 4$
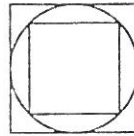
12. $\lim_{x \to 0} \dfrac{e^x - 1}{x^2}$

    A. $1/2$          B. $0$          C. $1$          D. $\infty$

13. The solution of the simultaneous equations $x - y = 2$ and $x^2 + 3y - y^2 = 11$ is

    A. $x = 4, y = 2$      B. $x = 5, y = 3$      C. $x = 3, y = 1$      D. $x = -1, y = -1$

14. Two spheres are with the same center C(1,0,1), the first passes through point A(2, -3, 4) and the second through B(3,-1,2). If the radii of the two circles are $r_1$ and $r_2$ respectively, then

    A. $r_1 = r_2$          B. $r_1 > r_2$          C. $r_1 = \ln r_2$          D. $r_1 < r_2$

15. The first derivative $\dot{f}(x)$ of $f(x) = \cos^2 x - \dfrac{3}{x^2} - e^{\ln x} + \sin^2 x$ at $x = 1$, is

    A. $\dot{f}(1) = 4$      B. $\dot{f}(1) = -2$      C. $\dot{f}(1) = 2.5$      D. $\dot{f}(1) = 5$

16. A water tank of volume V m3 is filled with water with a rate of a $m^3$/s and simultaneously discharges water with a rate of b $m^3$/s. If $a > b$ , it is completely filled in:

    A. $\dfrac{V}{a-b}$ seconds      B. $\dfrac{V}{a+b}$ seconds      C. $\dfrac{V}{b-a}$ seconds      D. $\dfrac{a-b}{V}$ seconds

17. Which of the following circles is tangent to the line with equation $y = x - 2\sqrt{2}$ ?

    A. $x^2 + y^2 = 2$      B. $x^2 + y^2 = 4$      C. $x^2 + y^2 = 16$      D. $x^2 + y^2 = 8$

18. Let $N = a^k \times b^m \times c^n$ be a positive even integer, where $k, m, n$ are positive integer numbers. Then N will definitely be an even number whenever

   A. $a, b, c$ are even     B. $a, b, c$ are odd     C. $k, m, n$ are even     D. $k + n$ is even.

19. Which is the smallest of the following, as n approaches zero?

   A. $\left(n + \sqrt{3}\right)^3$     B. $\dfrac{\log_3 (9)^2}{n}$     C. $\left(3 \sin\left(\dfrac{\pi}{3}\right)\right)^n$     D. $\log_2\left(\log_2 \dfrac{1}{n}\right)$

20. The equations $ax + by = c$ and $x + y = 1$ have an infinite number of solutions if

   A. $c = 1$     B. $a, b, c$ are not equal     C. $a = b = 1$     D. $a, b, c$ are equal

21. A box of pens consists of 12 red pens and 20 blue pens. The probability that a person draws two pens different in color is:

   A. 12/62     B. 4/52     C. 1/240     D. 15/62

22. If $a, b, c$ are real numbers, the number of solutions to $y = (ax + b)^2 e^{cx}$ are?

   A. 3     B. 2     C. 1     D. 7

23. Two identical dice are thrown, one after the other. What are the probabilities that both give different numbers?

   A. 1     B. 0     C. 5/6     D. 1/5

24. The median of the following temperature readings: 10, 12, 32, 41, 25, 16, 24, 27, 9

   A. 9     B. 24     C. 25     D. 21.7

25. $\lim_{h \to 0} \dfrac{\left( \sin \left( e^{\frac{-1}{h}} + h \right) \right)^2}{h^2}$ is equal to

A. 1      B. 0      C. has no limit      D. $\infty$

26. The imaginary part of $\dfrac{(x + iy)}{x - iy}$ is:

A. $3x^2 y - y^3$      B. 0      C. $\dfrac{x^2 - y^2}{x^2 + y^2}$      D. $\dfrac{2xy}{x^2 + y^2}$

27. The average of 20 numbers is zero. Of them, at the most, how many may be greater than zero?

A. 9      B. 19      C. 10      D. 7

28. If $1 + x + x^2 + x^3 + \cdots$ equals 3, then $1 + 2x + 3x^2 + 4x^3 + \cdots$ equals

A. 3/2      B. 9      C. 6      D. 12

29. If the 3 lines y=2x+1, 2y=x-3, y=5x+m intersect at one point then m equals

A. -2      B. 2      C. 6      D. -4

30. A matrix has the 4 elements $a_{11}=n-1$, $a_{12}=n$, $a_{21}=n+2$, $a_{22}=n-4$. If its determinant is 0, then n equals

A. -2      B. 4/7      C. -3/7      D. ¾

31. An arithmetic series has 14 terms and its sum is 322. If the 7th term equals 21, then the 8th term equals

A. 35      B. 25      C. 34      D. 28

32. $2^n > n^2$ for $n$ greater than

A. 1                 B. 2                 C. 3                 D. 4

33. If $y = \frac{1}{2}x + \frac{1}{2}\left(\frac{1}{2}x + \frac{1}{2}\left(\frac{1}{2}x + \frac{1}{2}\left(\frac{1}{2}x + \cdots\right)\right)\right)$ and if $x=7$, then $y$ is closest to

A. 3.5               B. 7                 C. 4.125            D. 6

34. The equation $x(x^2 + 4)(x^2 - x - 6)) = 0$ has how many *real* roots?

A. 5                 B. 2                 C. 3                 D. 4

35. Four parks have the same area but have four different shapes: triangle, circle, pentagon, and square. We would like to erect a fence around each park. Which fence would be the longest?

A. Triangle          B. Circle            C. Pentagon         D. Square

36. In an election between two candidates, one got 55% of the valid votes, where 20% of the total votes were invalid. If the total number of votes was 7500, the number of valid votes that the other candidate got was:

A. 2700              B. 2900              C. 3000             D. 3100

37. All the following points are on the graph of $y = 3x + 1$, except

A. (-2, -5)          B. (1,4)             C. (0,1)            D. (2,6)

38. Given the complex number $z = -1 - i$, then $z^6$ is

A. 8-8$i$            B. 8+8$i$            C. -8$i$            D. 16-16$i$

39. The solution of the inequality $-3 < 2x + 5 \leq 7$ is
A. $x \in (-4,1]$        B. $x \in [4,1]$          C. $x \in [-4,-1)$        D. $x \in (4,-1)$

40. What is $\cos^4 x - \sin^4 x$ equal to?

A. 1                 B. $\cos^4 x$            C. $\cos 2x$            D. $\sin^4 x$

41. A spring elongates by 3 cm under the action of a force 90 N. The energy required to make an elongation of 6 cm is

   A.  90 J        B.   5.4 J        C.   2.7 J        D.   10.8 J

42. A lake of water is at a height of 80 m above a turbine-alternator system that furnishes an electric power of 104 KW. If the efficiency of the water-turbine-alternator system is 40%, the mass flow rate of water equals

   A. 31.25 kg/s       B.  12.5 kg/s       C.   31250 kg/s       D.   12500 kg/s

43. A cylinder has radius 5 cm and length 10 cm. If the material density for the cylinder equals 8000 kg/m3, the weight of the cylinder is

   A.  6.28 N        B.  62.8 N        C.  0.6 N        D.  628 N

44. A small marble of mass m=0.1kg slides from rest on a rough surface of R=5m as shown in the adjacent figure. The marbles reaches the horizontal surface with v=3 m/s. find the lost energy during this trip
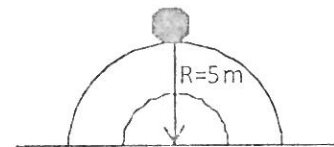


   A.  5 J        B.  4.55 J        C.  0.45 J        D.  0 J

45. The linear momentum of a body is $P = at + bt^2$. The force acting on the body is given as

   A.  a + b        B.  a + 2bt        C.  a + 2b        D.  2bt
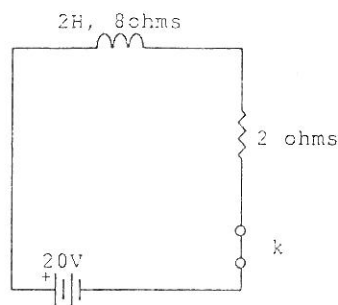
46. In the above electric circuit, the steady state is reached with the switch (k) is closed. We open the switch (k) suddenly and the current decays linearly with time to zero in 8 ms. Find the self-induced e.m.f. in the coil.

    A. 250 v            B. 500 v            C. 125 v            D. 50 v

47. In the given electric circuit, the current in the (4 ohms) resistance and the potential drop across this resistance are given as
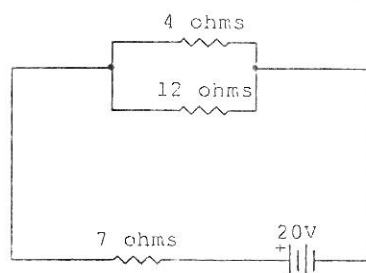


    A. 1.5 A, 6 v        B. 1.5 A, 16 v       C. 2 A, 16 v        D. 2 A, 6 v

48. Determine the wavelength of the photon emitted by the $^{24}_{12}Mg$ nucleus when it passes from the energy level E3=5.22 Mev to the energy level E2=4.12 Mev. (Given h=6.6×10-34 J.s and c=3×108 m/s)

    A. $5.2×10^{-13}$ m     B. $5.2×10^{-11}$ m     C. $11.3×10^{-11}$ m     D. $11.3×10^{-13}$ m

49. The half-life of radon-222 is T days. How many days (n) would it take for the activity due to radon in a tightly closed building to decrease to 5% of its initial value.

    A. $n = \dfrac{-T \ln 0.05}{0.693}$

    B. $n = \dfrac{T \ln 0.05}{0.693}$

    C. $n = \dfrac{-T \ln 5}{0.693}$

    D. $n = \dfrac{T \ln 5}{0.693}$
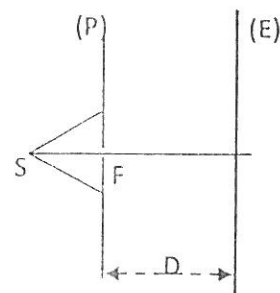
50. A source of monochromatic radiation of wavelength $\lambda = 0.6$ μm in air illuminates under normal incidence a horizontal slit F of width a=0.3 mm cut in an opaque screen (P). A screen of observation (E) is placed parallel to (P) at a distance D =4 m. Calculate the linear width L of central fringe in mm.
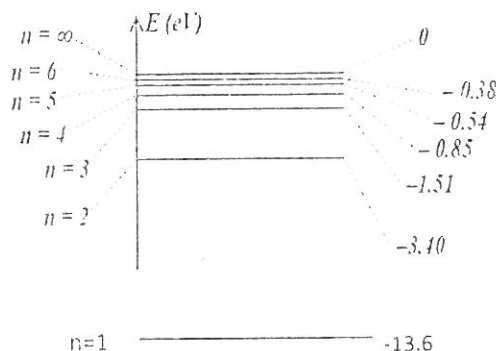
   A. 12 mm      B. 13 mm      C. 5 mm      D. 16 mm

51. A force-extension graph is shown in the diagram. The work done in extending the spring by 70 mm equals

   A. 0.12 J      B. 1.75 J      C. 0.24 J      D. 3.5 J
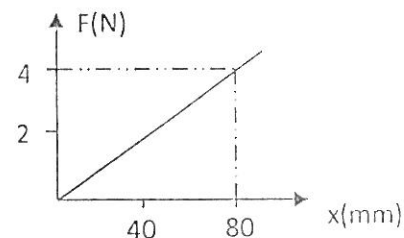


52. A hydrogen atom undergoes a downward transition. Specify the transition that may result in the emission of the visible radiation whose wavelength is the largest.



   A. From level 0 to level 1      B. From level 2 to level 1
   C. From level 3 to level 2      D. From level 0 to level 2

53. A red radiation has a wavelength ($\lambda R = x$ nm) in vacuum. If the corresponding photon energy equals 1.8 eV, the value of x is: (Given h=6.6×10-34 J.s and c=3×108 m/s)

   A. 587nm      B. 637 nm      C. 737 nm      D. 687 nm

54. Power is a measure of the

   A. rate of change of momentum      B. force which produces motion
   C. change of energy      D. rate of change of energy

55. The primary coil of the transformer is connected to the mains of $U1=220V$. The secondary of the transformer delivers across its terminals a voltage: $u2 = 3\cos\omega t$ (V). The secondary coil has 15 turns and cannot withstand a current of effective value greater than 10 A. Calculate the maximum effective value of the current that the primary coil can withstand
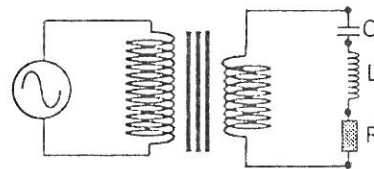
A. $I_1= 7\,mA$  B. $I_1=70\,mA$  C. $I_1=970\,mA$  D. $I_1=97\,mA$

56. A circular loop of radius 10 cm is placed in a uniform magnetic field of magnitude ($B=0.2$ T), so that the plane of the loop makes an angle 30o with B. The magnetic flux crossing the loop is

A. $\pm3.14\times10^{-3}$ Wb  B. $\pm5.44\times10^{-3}$ Wb  C. $\pm31.4$ Wb  D. $\pm54.4$ Wb

57. An ultraviolet radiation of wavelength $\lambda$ illuminates the surface of a metal of work function 3.4 eV. If the kinetic energy of an ejected electron equals 10-19 J, find the value of $\lambda$ in meters. (Given h is Blank's constant and c is light speed in vacuum)

A. $\dfrac{hc\times10^{19}}{5.44}$  B. $\dfrac{hc\times10^{19}}{6.44}$  C. $\dfrac{4.44}{hc\times10^{19}}$  D. $\dfrac{hc\times10^{19}}{4.44}$

58. A student weighing 700 N climbs at a constant speed to the top of an 8 m vertical rope in 10s. The average power expended by the student to overcome gravity is most nearly

A. 1.1 W  B. 87.5 W  C. 560 W  D. 875 W

59. A ball is thrown horizontally from a cliff with a velocity of vo from a height h. Which of the following can be used to calculate the kinetic energy of the ball just before it hits the ground.
K.E = .....

A. mgh  B. $1/2\,mv_0^2$  C. $1/2\,mv_0^2- mgh$  D. $1/2\,mv_0^2 + mgh$

60. Which of the following are units of work: (I) kg m/s2  ( II) N m  (III)  Joule (IV) kg m2/s3?

A. I and III only  B. II only  C. II and III only  D. II, III and IV

61. Mass M1 is moving with speed v toward stationary mass M2. The speed of the center of mass of the system is

A. $\frac{M_1}{M_2} v$

B. $\left[1 + \frac{M_1}{M_2}\right] v$

C. $\left[\frac{M_1}{M_1 + M_2}\right] v$

D. $\left[1 + \frac{M_2}{M_1}\right] v$

62. Two masses, m and 2m moving with velocities 2v and v respectively are each brought to rest by external forces. Which of the following statements is correct?

    A. The same amount of work is done on both masses.
    B. Twice as much work is done on the larger mass.
    C. Twice as much work is done on the smaller mass.
    D. The change in kinetic energy of both masses is the same.

63. An object oscillates at the end of a spring. The position as a function of time is presented by the graph. Which of the following formulas represent the velocity in m/s of the object? X in m t in sec.
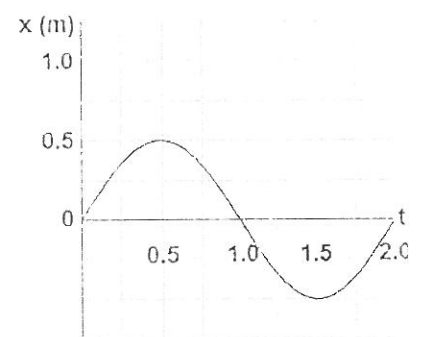
A. $(0.5\pi) \cos (\pi t)$

B. $(0.5\pi) \sin (\pi t)$

C. $(0.5) \sin (\pi t)$

D. $(\pi) \cos (\pi t)$

64. In R, L, C series circuit the effective current is 2 A. The effective voltage of the main source is 220 V and R=100 ohms. calculate the power factor of the circuit

A. 0.909

B. 0.85

C. 0.11

D. 0.345

65. Self induction phenomena in a given electric circuit means

    A. Generation of voltage due to variation of self flux
    B. Generation of voltage due to variation of external flux
    C. The total current in the circuit is zero
    D. No induced current in the circuit

66. In a mechanical oscillation, the term forced oscillation means:

A. The oscillator oscillates with the same period as that of the external vibrator
B. The oscillator oscillates opposite to the external vibrator
C. Resonance is occurred.
D. None of the above.

67. In an AC electric circuit, the main voltage leads the total current if the circuit is called

A. a capacitive circuit.               B. a resistive circuit.
C. an inductive circuit.               D. all of A, B and C.

68. An electron of charge (q=-1.6x10-19 C), starts from rest at the negative plate to the positive plate of a large capacitor of thickness D=0.2 m, connected to an external DC voltage of (V=1000 v). find the kinetic energy in J when it arrives the positive plate.

A. $8 \times 10^{-16}$ J        B. $1.6 \times 10^{-16}$ J        C. $8 \times 10^{-22}$ J        D. $1.6 \times 10^{-22}$ J

69. A system consists of two objects having masses m1 and m2 (m1 < m2). The objects are connected by a mass-less string, hung over a pulley as shown, and then released. When the speed of each object is v, the magnitude of the total linear momentum of the system is
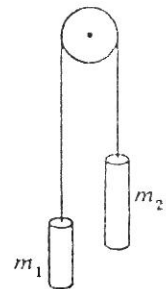


A. $(m_1 + m_2)$ v        B. 0.5 $(m_2 - m_1)$ v        C. $(m_2 - m_1)$ v        D. $m_2$ v

70. A capacitor with capacitance (C), is connected in series to a non-resistive coil of inductance L=20 mH. It gives a resonating current at a proper frequency f0=300 Hz. Find the value of (C).

A. 24 µF        B. 34 µF        C. 4 µF        D. 14 µF

71. If the temperature of the equilibrium system $CH_3OH(g) + 101$ kJ $\leftrightarrows CO(g) + 2H_2(g)$ increases,
   A. $[CH_3OH]$ increases and $[CO]$ decreases.
   B. $[CH_3OH]$ decreases and $[CO]$ increases.
   C. $[CH_3OH]$ increases and $[CO]$ increases.
   D. The concentrations in the system do not change.

72. If 3.0 L of helium at 20.0°C is allowed to expand to 4.4 L, with the pressure remaining the same, what is the new temperature?

   A. 702°C          B. 430°C          C. 157°C          D. -55°C

73. Given the thermochemical equation: $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ $\Delta H = -91.8$ kJ
   How much heat in kJ will be evolved when 1,480 kg of ammonia is produced at a constant pressure? (H=1, N=14)

   A. $1 \times 10^6$          B. $2 \times 10^6$          C. $3 \times 10^6$          D. $4 \times 10^6$

74. The gas phase reaction $X + Y \rightarrow Z$ has a reaction rate which is experimentally observed to follow the relationship of rate $= k[X]^2[Y]$. If the concentration of X is tripled and the concentration of Y is doubled, the reaction rate would be increased by a factor of:

   A. 9          B. 12          C. 18          D. 36

75. Which of the following will undergo an addition reaction with chlorine?

   A. $CH_3CH_2CH_2CH_3$     B. $CH_3CH_2CH=CHCH_3$     C. $CH_3CH_2COOH$     D. $CH_3CH_2OH$

76. Which molecule has a linear arrangement of all component atoms?

   A. $CH_4$          B. $H_2O$          C. $CO_2$          D. $NH_3$

77. In the Lewis structure for the $OF_2$ molecule, the number of lone pairs of electrons around the central oxygen atom is

   A. 1          B. 2          C. 3          D. 4

78. Consider the following reaction: $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
    The element being oxidized and the oxidizing agent are:

    A. N and $NH_3$      B. O and $O_2$      C. O and $NH_3$      D. N and $O_2$

79. An oxide of lead contains 90.65% Pb, by weight. The empirical formula is:
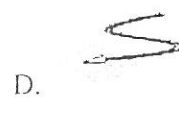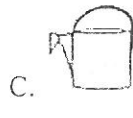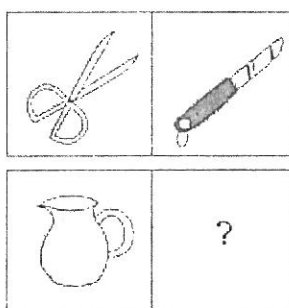    (O=16, Pb=207)

    A. $Pb_3O_4$      B. $PbO$      C. $Pb$      D. $Pb_2O_3$

80. If $K_w$ is $2.9 \times 10^{-15}$ at $10°C$, what is the pH of pure water at $10°C$?
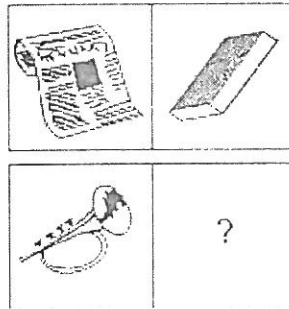
    A. 7.27      B. 7.00      C. 6.72      D. 7.53

## Section IV: Thinking Skills (20 Questions)

81. Choose the picture that would go in the empty box so that the two bottom pictures are related in the same way as the top two are related.

82. Choose the picture that would go in the empty box so that the two bottom pictures are related in the same way as the top two are related.



A. 

B. 

C. 

D. 

83. Look at this series: 36, 34, 30, 28, 24, ... What number should come next?

   A. 20            B. 22            C. 23            D. 26

84. Look carefully for the pattern, and then choose which pair of numbers comes next: 28 25 5 21 18 5 14

   A. 11 5          B.10 5           C. 5 10          D.11 8

85. Statement I : The prices of petrol and diesel in the domestic market have remained unchanged for the past few months.
   Statement II: The crude oil prices in the international market have gone up substantially in the last few months.
   A. Statement I is the cause and statement II is its effect
   B. Statement II is the cause and statement I is its effect
   C. Both statements I and II are independent causes
   D. Both statements I and II are effects of independent causes

86. Statement I: The government has recently fixed the fees for professional
courses offered by the unaided institutions which are much lower
than the fees charged last year.
   Statement II: The parents of the aspiring students launched a severe agitation
last year protesting against the high fees charged by the unaided
institutions.
   A. Statement I is the cause and statement II is its effect
   B. Statement II is the cause and statement I is its effect
   C. Both the statements I and II are independent causes
   D. Both the statements I and II are effects of independent causes

87. What time should the last watch show?
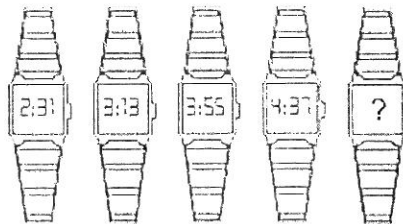


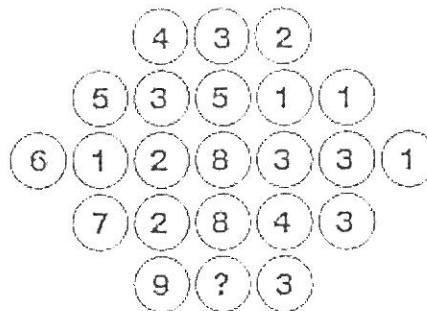   A. 4:19          B. 5:19          C. 4:79          D. 2:31
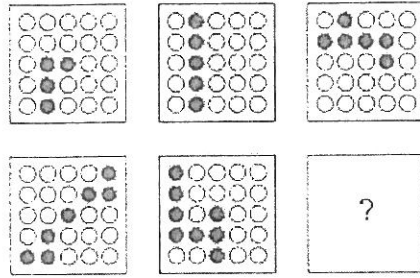
88. Which word does NOT belong with the others?

   A. tyre          B. steering wheel          C. engine          D. car

89. What number comes inside the circle?



   A. 5          B. 8          C. 6          D. 3

90. What number comes inside the circle?



A.    B.    C.    D. 

91. One of the following proverbs is closest in meaning to the saying "Birds of a feather flock together". Choose one
    A. A bird in the hand is worth two in the bush
    B. A man is known by the company he keeps
    C. Fine feathers make fine birds
    D. Don't jujdge a book by its cover

92. Which letter comes next B A C B D C E D F?

A. C                 B. C                 C. D                 D. F

93. Which two numbers best continue the sequence: 1, 10, 3, 9, 5, 8, 7, 7, 9, 6, _, _ ?

A. 11, 5             B. 10, 5             C. 10, 4             D. 11, 6

94. Each letter has a value. The numbers give the sum of values in the corresponding rows and columns. What should replace the question mark?

| A | A | A | A | 28 |
|---|---|---|---|----|
| A | A | B | B | 30 |
| S | S | P | A | 20 |
| S | S | P | B | 16 |
| ? | 19 | 20 | 30 | |

A. 23                B. 25                C. 28                D. 30

95. If two typists can type two pages in two minutes. How many typists will it take to type 18 pages in six minutes?

    A. 3                         B. 4                    C. 6                   D. 12

96. Mary was both $13^{th}$ highest and $13^{th}$ lowest in a spelling contest. How many people were in the contest?

    A. 13                      B. 25                  C. 26                 D. 27

97. Which is the least like the others?

    A. Inch                   B. Mile                 C. Acre                D. Foot

98. If 70% of the population have stomach trouble, 75% have weak eyes, 80% have liver trouble, and 85% have a hearing problem. What percent at least have all four ailments?

    A. 15%                   B. 5%                   C. 25%                D. 10%

99. Mrs Graham meets her husband at the station with a car promptly at 5 pm everyday, averaging 30 miles per hour. One day, he without notifying her, caught an earlier train which arrived at 4 pm and started walking home. She picked him up part way and they got home 15 minutes earlier than usual. How fast did he walk in miles per hour.

    A. 60/17                B. 4                    C. 11/2             D. 30/7

100.       What comes next in the sequence: 1, 11, 21, 1211, 111221, 312211?

A. 131122221          B. 22133112          C.33221123          D. 12311232