APGENCO MECHANICAL ENGINEERING 2012 PAPER
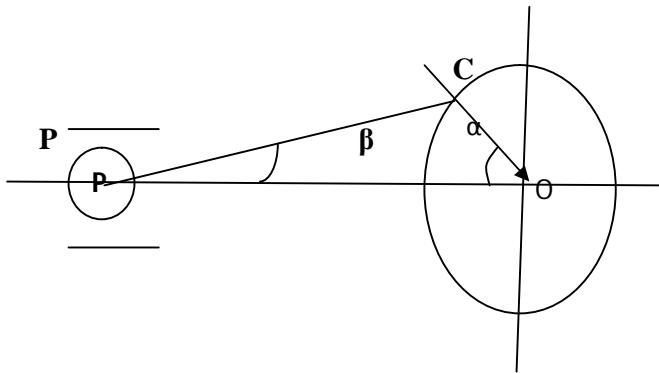
MAX MARKS: 100   TIME: 2Hours   100 Questions

SECTION: A   70 Marks

Q.1. The cross head velocity in the slider crank mechanism, for the position shown in Fig. below?

(A) $V_c\ cos(90\text{-}\alpha\text{+}\beta)\ cos\beta$ (B) $V_c\ cos(90\text{-}\alpha\text{+}\beta)\ sec\beta$
(C) $V_c\ cos(90\text{-}\alpha\text{-}\beta)\ cos\beta$ (D) $V_c\ cos(90\text{-}\alpha\text{-}\beta)\ sec\beta$

Q.2. A Small element at critical section of a component is in a bi-axial state of stress with the two principal stresses being 360MPa and 140MPa. The maximum working stress according to Distortion energy theory is

(A) 220MPa   (B) 110MPa   (C) 314MPa   (D) 330MPa

Q3. Fifty observations of production operations relieved a mean cycle time of 10min. the worker was evaluated to be performing at 90% efficiency. Assuming the allowances to be 10% of the normal time, the stand and time (in sec) for the job is

(A) 0.198   (B) 7.3   (C) 9.0   (D) 9.9

Q.4. The lengths of the links of a 4-bar linkage with revolute pairs only are p,q,r and s units. Given that p<q<r<s, which of these links should fixed one , for obtaining "a double crank" mechanism

(A) links of length p   (B) links of length q
(C) links of length r   (D) links of length s

Q.5. A project consists of activities A to M shown in the net in the figure below with the duration of activities marked in days.

D, 10

A, 2   E, 5   G, 6   L, 3

B,8   H, 10

C, 4   F, 9   K, 3   M, 8
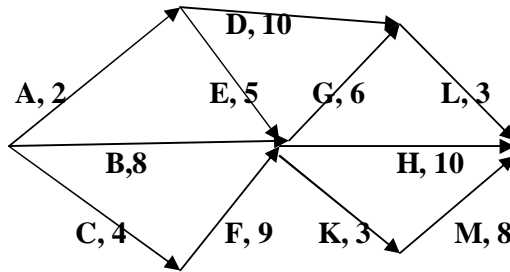
The project can be completed

(A)Between 18, 19 days   (B) Between 20, 22 days

(C) Between 24, 26 days   (D) Between 60, 70 days

Q.6. There are two products P and Q with the following characteristics

Product	Demand(Units)	Order cost(Rs./Order)	Holding cost(Rs/Unit/Year)
P	100	50	4
Q	400	50	1

The Economic order quantity (EOQ) of products P and Q will be in ratio

(A) 1:1   (B) 1:2   (C) 1:4   (D) 1:8

Q.7. A Vibrating machine is isolated from the floor using springs. If the ratio of excitation frequency of vibrating machine to natural frequency of the isolation system is equal to 0.5, the transmissibility ratio of isolation is

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

Q.8. In the window air conditioner, the expansion device used is

(A) Capillary tube   (B) Thermo static expansion valve

(C) Automatic expansion valve   (D) Float valve

Q.9. Figure shows a quick return mechanism. Crank OA rotates clock wise uniformly OA=2 cm, OO'=4 cm. The ratio of time forward motion to that for return motion is

B

A

O'

O
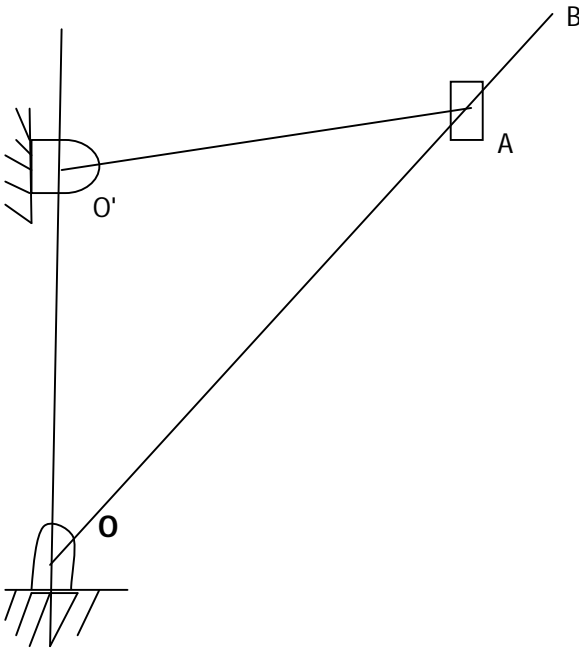
(A) 0.5 (B) 2 (C) √12 (D) 1

Q.10.A thick cylinder subjected to an internal pressure of 60MPa. If the hoop stress on the outer surface is 150 MPa, then the hoop stress on the internal surface is

(A) 105MPa (B) 180MPa (C) 210MPa. (D) 135MPa

Q.11. The Equation of motion for a single degree of freedom system with viscous damping is 4ẍ+9ẋ+16x=0. The damping ratio is

(A) 9/128 (B) 9/16 (C) 9/8√2 (D) 9/8l

Q.12. Thermal efficiency of steam turbine can be increased by

(A) Reheating (B) Regeneration (C)Increasing the inlet pressure (D) All of the above

Q.13. Steam turbines are used for

(A) Electric power generation (B) Direct drive for fans, compressors

(C) Marine propulsion (D) All of the above

Q.14. In an impulse steam turbine, the steam expands in

(A) Nozzles   (B) Moving blades

(C) Nozzle and Moving blades   (D) Moving and fixed blades

Q.15. In an air craft gas turbine, the axial flow compressor is preferred because of

(A) High pressure rise   (B) Low frontal area   (C) High thrust   (D) High propulsion

Q.16. The essential function of the carburetor in a S.I. Engine is to

 (A) Meter the fuel into air stream and amount dictated by the load and speed

 (B) Vaporize the fuel

 (C) Distribute the fuel uniformly into all cylinders

 (D) Both (B) and (C)

Q.17. The most popular firing order in case of a four cylinder in line IC engine is

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

Q.18.The air fuel ratio for idling speed of an automobile petrol engine is close to

(A)10:1   (B) 15:1   (C) 17:1   (D) 21:1

Q.19. A power screw is a device used for power transmission to convert

(A) Rotary motion into a linear motion   (B) Linear motion into rotary motion
(C) Sliding motion   (D) Centrifugal motion into rotary motion

Q.20. Creep depends on

(A) Pressure   (B) Temperature   (C) Load applied   (D) Stiffness

Q.21. Ratio of force transmitted to the force applied is known as

(A) Damping factor   (B) Damping coefficient
(C) Transmissibility   (D) Magnification factor

Q.22. A simple gas turbine power plant used for air craft propulsion works on

(A) Rankine cycle   (B) Carnot cycle   (C) Brayton cycle   (D) Otto cycle

Q.23. In EDM process, the tool and work piece are separated by

(A) An electrolyte   (B) A metal conductor   (C) Dielectric fluid   (D) Metallic slum

Q.24. Surface roughness on a drawing is represented by

(A) Triangles   (B) Circles   (C) Squares   (D) Rectangles

Q.25. Poor fusion in a welded joint is due to

(A) High welding speed   (B) Dirty metal surface   (C) Improper current   (D) Lack of flux

Q.26. Mechanical properties of the metal improves in hot working due to

(A) Recovery of grains   (B) Recystallisation
(C) Grain growth   (D) Refinement of grain size

Q.27. Certain pilot study showed that % of occurrence of an activity as 50% with 95% confidence level ad an accuracy of ±2%, the no. of observations are

(A) 2500   (B) 2300   (C) 2200   (D) 2000

Q.28. Ann IC engine has a bone and stroke of 2 units each. The area to calculate heat loss can be taken as

(A) 4π (B) 5π (C) 6π (D) 8π

Q.29. In a weaving operation, the parameter to be controlled in the number of defects per 10 square yards of material, control chart appropriate for this task is

(A) P-chart   (B) C-chart   (C) R-chart   (D) X-chart

Q.30. The profile of a cam in a particular zone is given by $x = \sqrt{3}\cos\theta$ and $y = \sin\theta$. The normal to the cam profile at $\theta = \pi/4$ is at an angle (with respect to x axis)

(A) $\pi/4$ (B) $\pi/2$ (C) $\pi/3$ (D) 0

Q.31. A heat engine operates at 75% of the maximum possible efficiency. The ratio of heat source temperature to the heat sink temperature (in Kelvin) is 5/3. The function of the heat supplied, that is converted to work is

(A) 0.6   (B) 0.4   (C) 0.3   (D) 0.7

Q.32 .A gas contained in a cylinder is compressed reversibly from the initial state (P1,V1) to the final state (P2, V2) according to the path, PV^n= constant. The work done on the gas

(A) $n(P1V1-P2V2)$ (B) $\dfrac{P2V2-P1V1}{1-n}$ (C) $\dfrac{P(V1-V2)}{n}$ (D) $\dfrac{P(V1-V2)}{1-n}$

Q.33. When wet steam is throttled to a low pressure, its temperature

(A) Increases   (B) Does not change   (C) Gets halved   (D) Decreases

Q.34. A Carnot engine with an efficiency of 0.6 drives a Carnot refrigerator, having a COP of 5. The energy absorbed from the cold body by the refrigerator for each kJ energy absorbed from the source by the engine is

(A) 2 KJ   (B) 8 kJ   (C) 0.12 kJ   (D) 3 kJ

Q.35. The maximum work, that can be obtained from a system during a given process in which the initial and final temperature of the system are equal to the surrounding temperature, is equal to the decrease in

(A) Internal energy   (B) Helmholtz Free energy

(C) Gibbs Free energy   (D) Enthalpy

Q.36. The thermal efficiency of an ideal Rankine cycle is lower than that of a carnot cycle operating between the same temperature limits because

(A) Energy rejection does not take place at constant temperature

(B) The turbine is not reversible and adiabatic

(C) Energy addition does not take place at constant temperature

(D) The pump is not reversible and adiabatic

Q.37. Identify the correct set of approximations made in the thermodynamic analysis of internal combustion engines

P. The combustion process is replaced by an equivalent energy addition process

Q. The working fluid is a mixture of carbon dioxide and water vapor

R. The combustion process is replaced by an equivalent energy addition process

S. The working fluids have constant heat capacities

(A) P,R,S   (B) P,R   (C) R,S   (D) P,Q,R

38. If Nu is the Nusselt number, Re the Reynolds number, Gr the Grashoff number and Pr the Prandtl number, then Stanton number is

(A) Nu/Re.Pr   *(B) Nu/Gr.Pr*   *(C) Gr.Pr/Nu*   *(D) Re/Nu.Pr*

Q.39. A block plate (0.5 m x 1 m) is at a distance of 0.5 m from a second black plate, (1 m x 2 m). The shape factor F_{12} of the first plate is 0.48. What is the shape factor F_{21} of second plate?

(A) 0.24   *(B) 0.12*   *(C) 0.06*   *(D) 0.36*

Q.40. a wire, 1 mm in diameter and 10 m long, is submerged in liquid water at atmospheric pressure. An electric current is passed through the wire. The current is increased until the water boils. For this situation h = 4000W/m^2-^{o}C. The water temperature is 100 ^{o}C. If the wire surface to be maintained at 120 ^{o}C, the electric power that need be spplied to the wire is

(A) 28.142W   *(B) 27.136W*   *(C) 12.568W*   *(D) 25.136W*

Q.41. A certain quantity of liquid is heated for 10 minutes by an electric resister, which draws 3 amperes current at 200 volts. The liquid is continuously stirred by a paddle wheel, which was operated by a 200 W rating motor. The amount of energy transferred to the liquid is

(A) 480 KJ   *(B) 360 kJ*   *(C) 800 kJ*   *(D) 240 kJ*

Q.42. One face of copper plate, 3cm thick, is maintained at 300 ^{o}C, while he other face is at 100 ^{o}C. If the thermal conductivity of copper at the average temperature is 374 W/m-^{o}C, The amount of heat transferred through the plate, in MW/m2, is

(A) 3.74   *(B) 2.49*   *(C) 2.74*   *(D) 3.49*

Q.43. Water at rate of 60Kg/mm is heated from 35to 85 ^{o}C by an oil. The LMTD is given as 40 ^{o}C. The overall coefficient is 300W/m2-^{o}C. Specific heat of water is 4.2kJ/kg-^{o}C. The heat exchange area, in square meters, is

(A) 18.5   *(B) 15.5*   *(C) 17.5*   *(D) 16.5*

Q.44. Two very large parallel plates are at 127 C AND 27 ^{o}C. Their emissivities are 0.4 and 0.5 respectively. Stefan-Boltzmann constant is 5.669x10^{-8} W/m^2 –K^4 .Then, the net heat exchanged between them, in W/m^2 , is

(A) 243   *(B) 273*   *(C) 283*   *(D) 343*

Q.45. U is the overall heat transfer coefficient, A is the surface area of the heat exchanger, C_{min} is the m_c of fluid undergoing maximum temperature change and C_{max} is the m_c of the fluid undergoing minimum temperature change , then the Number of Transfer Units (NTU) is

(A) UA/C_{min} (B) $C_{max}UA/C_{min}$ (C) UA/C_{max} (D) $C_{min}UA/C_{max}$.

Q.46. A fluid of jet cross sectional area A and velocity V strikes a flat plate moving with a velocity u. If ρ is the density of fluid, the mass of fluid per second striking the plate is

(A) $\rho A (V+u)$ (B) $\rho A (V-u)$ (C) ρAV (D) $\rho A (u-V)$

Q.47. The discharge in m³ /sec. for laminar flow through a pipe of diameter 0.04m having centerline velocity of 1.5 m/sec. is

(A) $3\pi/10000$ (B) $\pi/2500$ (C) $\pi/5000$ (D) $\pi/7500$
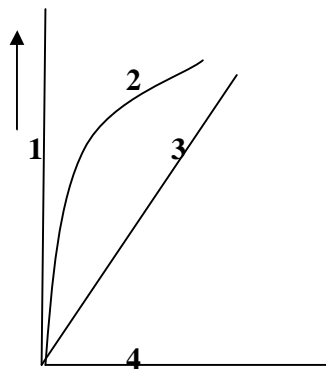
Q.48. The hydraulic mean depth of the pipe 1 m diameter flowing full is

(A) 4m   (B) 0.50 m   (C) 0.125 m   (D) 0.25 m

Q.49. An oil of specific gravity 0.9 is contained in a vessel. At a point the height of the oil is 40 m. The corresponding height of water at that point is

(A) 40 m   (B) 4 m   (C) 36 m   (D) 3.6 m

Q.50. Curve '2¨ in Fig. 1 corresponds to

Velocity gradient⟶

(A) Ideal fluid   (B) Newtonian fluid   (C) Non-Newtonian fluid   (D) Ideal solid

Q.51. For a given orifice time taken for the water level to fall down 8 to 4 m is 10 seconds. The time taken for water level to fall down from 4 m to zero is

(A) 15 sec   (B) 24.14 sec   (C) 25.3 sec   (D) 20 sec

Q.52. If K is the thermal conductivity, C_p is the heat capacity, ρ is the density and μ is the viscosity, then thermal diffusivity is

(A) $C_p\mu/K$ (B) $K\rho/C_p\mu$ (C) $C_p\mu/K\mu$ (D) $K/C_p\rho$

Q.53. The relative humidity is defined as the ratio of

(A) Partial pressure of water vapor in the mixture to the total pressure
(B) Partial pressure of water vapor to the saturation pressure of water at system temperature
(C) Saturation pressure of water vapor to the total pressure at the system temperature
(D) Saturation pressure of water to the partial pressure of water vapor at system temperature

Q.54. The loss in available energy associated with a given process is

(A) $T_0\Delta S_{uni}$ (B) $Q-T_0\Delta S_{uni}$ (C) $Q+T_0\Delta S_{uni}$ (D) $T_0\Delta S_{system}$

Q.55. A thermodynamic cycle consisting of two reversible, constant temperature and two reversible, constant pressure processes is

(A) Air Standard Carnot Cycle   (B) Air Standard Stirling Cycle
(C)) Air Standard Brayton Cycle   (D)) Air Standard Ericsson Cycle

Q.56. A 1-ton air conditioning unit, with a seasonal energy efficiency rate of 10 is used for 1000 hr per year. If the cost of electricity is Rs.5 per kW-h, the annual cost of power consumption by the air conditioner is

(A) Rs. 10,000   (B) Rs. 5,000   (C) Rs. 6,000   (D) Rs. 12,000

Q.57. The detrimental property of a material for shock load application is

(A) High density   (B) low toughness   (C) High strength   (D) Low hardness

Q.58. Materials which are strong and ductile

(A) Polymers   (B) Ceramics   (C) Metals   (D) Semiconductors

Q.59. Alloy steel as compared to carbon steel is more

(A)Tough   (B) Strong   (C) Fatigue resistance   (D) All of the above

Q.60. When a body vibrates under the influence of an external force, it is said to have

(A) Free vibrations   (B) Forced vibrations
(C) Damped vibrations   (D) Under damped vibrations

Q.61. A shaft having one end fixed and a disc oscillating forcely at the other end. With increase in shaft stiffness, the natural frequency of vibration wills
(A) Increase   (B) Decrease   (C) Remains same   (D) Both (A) and (B)

Q.62. A steel cube of volume $8 \times 10^6 mm^3$ is subjected to all round stress of 135 N/mm^2. The bulk modulus of material is 1.35×10^5N/mm^2.The volumetric change is

(A)8000 mm^3 (B) 800 mm^3 (C) 80 mm^3 (D) 8 mm^3

Q.63. A steel bar 2 m length is fixed at both ends at 20 ^{o}C. The coefficient of thermal expansion is 12×10^{-6}/^{o}C. The modulus of elasticity is 2×10^5N/mm^2.If the temperature is reduced to 18 ^{o}C, the bar will experience a stress of

(A) 2.4 MPa (compressive)   (B) 2.4 MPa (tensile)
(C) 4.8 MPa (tensile)   (D) 4.8 MPa (compressive)

Q.64. A rectangular beam is to be cut from a circular log of diameter D. The ratio of breadth to depth for strongest section in bending should be

(A) 1/√3   (B) 1/√2   (C) √2   (D) √2/√3

Q.65. A beam A carries a point load at mid span. Another identical beam B carries the same load but as uniformly distributed load over the entire span. The ratio of maximum bending moment in beam A to that in beam B will be

(A) 3/2   (B) 1/2   (C) 3   (D) 2

Q.66. The Shear stress developed at a radial distance r is q. The shear stress developed at a radial stress r/2 is

(A) 0.75q   (B) 0.5q   (C) q   (D) 0.25q

Q.67. A bar of 40 mm diameter is subjected to an axial load of 4 kN. The extension of bar over a gauge length of 200 mm is 0.3 mm. The decrease in diameter is 0.018 mm. The Poisson's ratio is

(A) 0.33   (B) 0.35   (C) 0.30   (D) 0.25

Q.68. Two long columns A and B are of the same material, the same length, and the same cross-section. Column A is hinged at both ends, while column B is fixed at one end and hinged at the other. The ratio of the Euler-crippling loads for A and B is

(A) 2   (B) 1   (C) √2   (D) 1/2

Q.69. A cantilever beam of uniform EI has a span equal to l . An upward force P acts upwards at the free end and a downward load W acts at mid-section. If the free-end deflection is zero, the relation between P and W is

(A) P = 2W/3   (B) P = W/5   (C) P = 5W/16   (D) P = W/2

Q.70. The power saved by fitting air vessel to a single-acting reciprocating pump is

(A) 88.4%   (B) 84.8%   (C) 39.2%   (D) 48.8%

Q.71. When I add 4 times my age 4 years from now to 5 times my age 5 years from now, I got 10 times my current age. How old will be I 3 years from now?

(A) 41   *(B) 44*   *(C) 46*   *(D) 42*

Q.72. There are two circles, one circle is inscribed and another circle is circumscribed over a square. What is the ratio of area of inner circle to outer circle?

(A) 3:4   *(B) 5:7*   *(C) 3:1*   *(D) 1:2*

Q.73. Sakshi can do a piece of work in 20 days. Tanya is 25% more efficient than sakshi. The number of days taken by Tanya to do the same piece of work is

*(A) 15*   *(B) 16*   *(C) 18*   *(D) 25*

Q.74. A train passes a station platform in 36 sec. and a man standing on the platform in 20 sec. If the speed of the train is 54 Km/hr, what is the length of the platform?

(A) 120 m   *(B) 300 m*   *(C) 500 m*   *(D) 240 m*

Q.75. Let $f(x) = ax^2 + bx + c$, where a, b, c are certain constants and a ≠ 0. It is known that $f(5) = -3f(2)$ and that 3 is rot of $f(x) = 0.2$. What is other root of $f(x) = 0$?

(A) -7   *(B) -4*   *(C) 2*   *(D) 6*

Q.76. Find the number which comes in place of a question mark
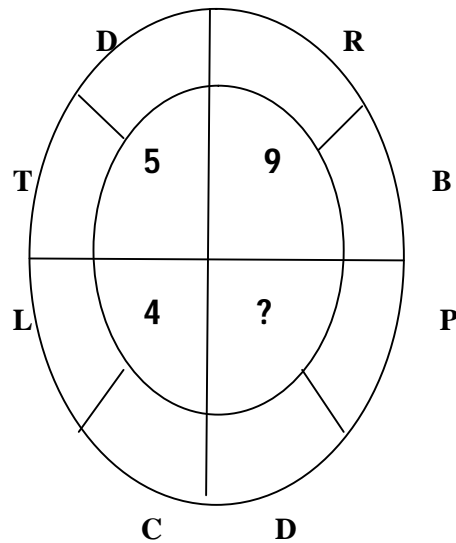
(A) 3   *(B) 4*   *(C) 6*   *(D) 8*

Q.77. 8, 11, 18, 33, 64,?

(A) 126   (B) 127   (C) 125   (D) 128

Q.78. If $(5x)^4 = 5^{4)4}$, then x= ?

(A) 5^4 (B) 5^{60} (C) 5^{63} (D) 5^{15}

Q.79. If $\sqrt{1}+x+\sqrt{x} = \sqrt{x}+\sqrt{x}+5$

(A) 4   (B) 6   (C) 8   (D) 12

Q.80. PS : DG:: ?

(A) CE : TR   (B) KM : OQ   (C) EH : TW   (D) FH : JL

Q.81. Identify the missing number 12, 32, 72, 152, ?, 632

(A) 515   (B) 613   (C) 815   (D) 312

Q.82. A four letter code has to be formed using the alphabets form the set (a, b, c, d) such that the codes formed have odd number of a's. how many different codes can be formed satisfying the mentioned criteria ?

(A) 24   (B) 96   (C) 120   (D) 60

Q.83. $(ABCD)_a = D^*a^{\wedge}0+C^*a^{\wedge}1+B^*a^{\wedge}2+A^*a^{\wedge}3$. If $(1101)_2*(2202)_3 = (abcd)_6$, then (a+b+c+d)=

(A) 12   (B) 24   (C) 36   (D) 72

Q.84. The number of terms common in the two sequences 2, 6, 12, 20, ………. 930 and 4, 8, 12, 16, ………. 960 is

(A) 8   (B) 14   (C) 16   (D) 18

 Q.85. TWO

  *TWO
_____

  THREE
_____

(TWO is a 3 digit number), with T, W, and O being distinct digits. Find the value of T+O+W, all the alphabets will have distinct values of digits

 A) 13   (B) 23   (C) 33   (D) 18

Q.86. In a three digit number, the middle digit equals the average of extreme digits. The sum of its digits is 9. How many possibilities can it take?

A) 8   (B) 6   (C) 7   (D) 4

Q.87. The difference between the length and breadth of a rectangle is 23m. its perimeter is 206m, then its area is

A) 1520 m^2 (B) 2420 m^2 (C) 2480 m^2 (D) 2520 m^2

Q.88. A man walked diagonally across a square lot. Approximately what was the percent saved by not walking along the edges.

A) 20   (B) 24   (C) 30   (D) 33

Q.89. If $p^{-1}+q^{-1} = 5/6$, $q^{-1}+r^{-1} = 7/12$ and $r^{-1}+p^{-1} = ¾$ then p = ?

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

Q.90. ALCHEMIST: GOLD:: _____ : _____

A) Druggist: Chemistry   (B) Computer: COBOL
(C) Abrasion: Oil   (D) Insignia: segregation

Q.91. A cuboidal metal of dimensions 44 cm x 30 cm x 15 cm was melted and cast into a cylinder of height 28 cm. the radius of cylinder is
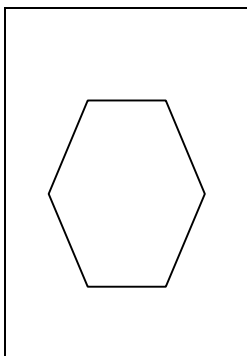
A) 25 cm   (B) 35 cm   (C) 15 cm   (D) 5 cm

Q.92. A liquid is full in a hemisphere of inner diameter 9 cm. This is to be poured into cylindrical bottles of diameter 3 cm and height 4 cm. The number of bottles required are

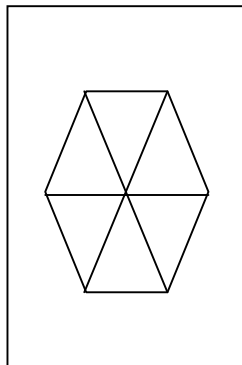A) 54   (B) 27   (C) 37   (D) 44

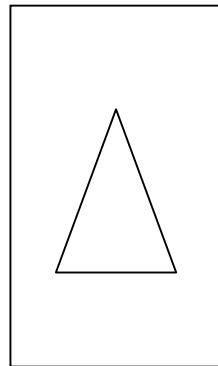**Q.93. Find the answer figure which should come at the end of problem figure?**

Problem figures

1   2   3   4

Answer figures

(A)　　　　　　(B)　　　　　　(C)　　　　　　(D)

Q.94. If 'DEAR' is coded as '7' and 'BEARS' as '9', the code for 'WAX' is

A) 10　　　　　(B) 12　　　　　(C) 16　　　　　(D) 19

Q.95. By investing in 16⅔% stock at 64, one earns Rs. 1,500. The investment made is

A) 5640　　　　　(B) 5760　　　　　(C) 7500　　　　　(D) 9600

Q.96. Find the number which should come in place of question mark?

A) 31　　　　　(B) 40　　　　　(C) 38　　　　　(D) 22

Q.97. Find the number which should come in place of question mark?
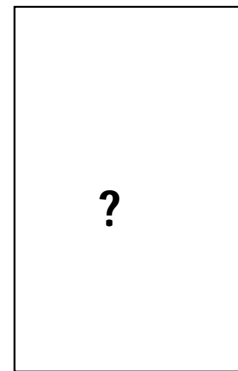

A) 225　　　　　(B) 522　　　　　(C) 252　　　　　(D) 961

Q.98. In a code language   'min tin zin' means "very good study" . 'zin pin jin' means "good health want" . 'jin min kin' means "want study always" . According to this language what is the code for kin?
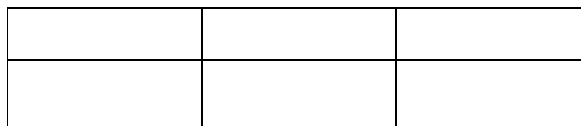
A) Health   (B) Study   (C) Always   (D) Very

Q.99. Identify the number which should come in place of question mark?

M	R	62
K	P	54
J	T	?

A) 80   (B) 60   (C) 70   (D) 50

Q.100. In the following diagram, how many rectangles are there

A) 16   (B) 17   (C) 18   (D) 20

ANSWERS:

1.(D)   2.(C)   3.(D)   4.(D)   5.(C)   6.(C)   7.(D)   8.(A)   9.(B)   10.(C)

11.(B)   12.(D)   13.(D)   14.(A)   15.(B)   16.(A)   17.(C)   18.(A)   19.(A)   20.(B)

21.(C)   22.(C)   23.(C)   24.(A)   25.(C)   26.(D)   27.(A)   28.(B)   29.(C)   30.(C)

31.(C)   32.(B)   33.(D)   34.(D)   35.(B)   36.(C)   37.(A)   38.(A)   39.(B)   40.(D)

41.(A)   42.(B)   43.(C)   44.(C)   45.(A)   46.(B)   47.(A)   48.(D)   49.(C)   50.(C)

51.(B)   52.(D)   53.(B)   54.(A)   55.(D)   56.(C)   57.(B)   58.(C)   59.(D)   60.(B)

61.(A)   62.(A)   63.(C)   64.(B)   65.(D)   66.(B)   67.(C)   68.(D)   69.(C)   70.(B)

71.(B)   72.(D)   73.(B)   74.(D)   75.(B)   76.(B)   77.(B)   78.(C)   79.(A)   80.(C)

81.(D)   82.(C)   83.(A)   84.(B)   85.(A)   86.(B)   87.(D)   88.(C)   89.(B)   90.(B)

91.(C)   92.(A)   93.(C)   94.(C)   95.(B)   96.(A)   97.(A)   98.(C)   99.(B)   100.(C)