

Question Paper and Final Answer Keys for the post of Junior Engineer (E&M)

Written Recruitment Examination for filling up of the post of Junior Engineer (E&M) in APWD was held on 26/02/2023 from 2.30 pm to 4.30 pm at Port Blair. The Question Paper and the Final Answer Keys of the written examination received from the agency engaged for conduct of examination based on the claims & objections is hereby published.

FINAL ANSWER KEY FOR THE POST OF JUNIOR ENGINEER (E & M)

SET-A

Q.No	Correct Option	Q.No	Correct Option	Q.No	Correct Option	Q.No	Correct Option
1	A	26	D	51	D	76	D
2	B	27	B	52	B	77	C
3	B	28	D	53	B-D	78	B
4	A	29	C	54	A	79	B
5	B	30	D	55	B	80	D
6	C	31	C	56	B	81	B
7	A	32	C	57	D	82	B
8	B	33	D	58	C	83	A
9	-	34	B	59	C	84	B
10	A	35	A	60	B	85	D
11	D	36	C	61	A	86	D
12	A	37	B	62	C	87	A
13	B	38	C	63	D	88	D
14	B	39	B	64	A	89	D
15	C	40	B	65	C	90	B
16	C	41	B	66	C	91	B
17	A	42	C	67	A	92	B
18	B	43	B	68	D	93	D
19	B	44	D	69	A	94	B
20	A	45	D	70	B	95	A
21	C	46	D	71	B-D	96	C
22	D	47	D	72	B	97	D
23	B	48	C	73	B	98	D
24	-	49	B	74	B	99	D
25	B	50	A	75	B	100	-

Note: Q. No. 9, 24 & 100 are treated as Null & Void due to Error in the Question/Option, hence evaluation of OMR is done out of 97 Questions

ELECTRICAL ENGINEERING

1. What is the range of a 3 ½ digit meter?

- (a) 0 to 1999 (b) 0 to 9999 (c) 0 to 999 (d) 0 to 199

2. What is the series resistance required to extend the 0-100V range of a 20000 Ω/V meter to 0-1000V?

- (a) 22 MΩ (b) 18 MΩ (c) 0.18 MΩ (d) 2.02 MΩ

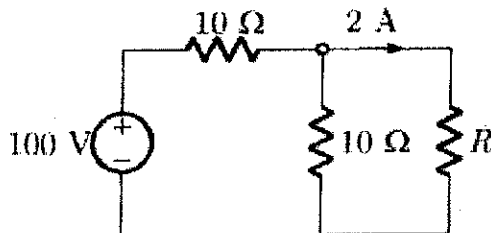
3. In a dual trace integrating type digital voltmeter the first integration is carried out for 10 periods of the supply frequency of 50Hz. If the reference voltage used is 2V, the total conversion time for an input of 1V is _____.

- (a) 0.01 s (b) 0.1 s (c) 1 ms (d) 0.1 ms

4. An n-channel JFET having a pinch-off voltage (V_p) of -5V shows a transconductance (g_m) of 1mA/V when the applied gate to source voltage (V_{GS}) is -3V. Its maximum transconductance (in mA/V) will be _____.

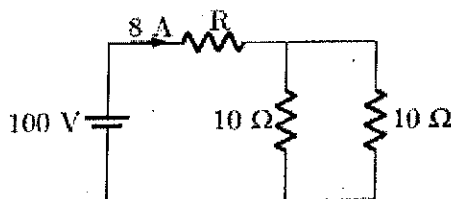
- (a) 2.5 mA/V (b) 0.4 mA/V (c) 2.0 mA/V (d) 1.0 mA/V

5. In the given figure what is the value of resistor R in Ω?



- (a) 10 (b) 20 (c) 30 (d) 40

6. In the figure given below, calculate the value of R in Ω.

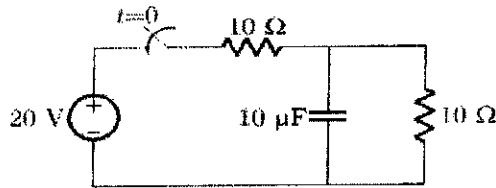


- (a) 2.5 (b) 5 (c) 7.5 (d) 10

7. An over-excited synchronous motor acts as

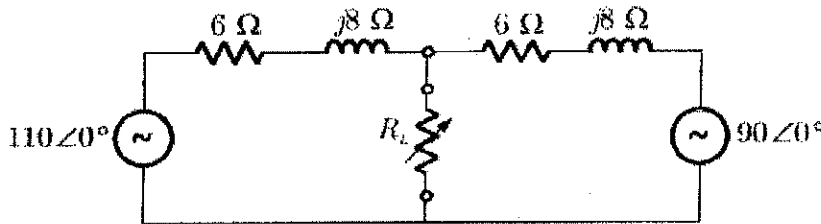
- (a) a capacitor (b) an inductor (c) a resistor (d) a filter

8. In the figure given below the initial capacitor voltage is zero and the switch is closed at $t=0$. What is the final steady state voltage across the capacitor?



- a) 20 (b) 10 (c) 05 (d) 00

9. Two ac sources feed a common variable resistive load as shown in the figure. Under the maximum power transfer condition, the power absorbed by the load resistance R_L is _____



- a) 2200 W (b) 1250 W (c) 1000 W (d) 625 W

10. A three phase synchronous generator is synchronised with the grid supply and is driven by a DC shunt motor. The field resistance of the motor is slightly increased while operating. What happens to the power exchange with the grid?

- a) Real power is pumped into the grid
- b) Real power is consumed by the generator
- c) Reactive power is pumped into the grid
- d) Reactive power is consumed by the generator

11. At low slip region the torque-slip characteristics of an induction motor varies as

- (a) $torque \propto \frac{1}{slip^2}$ (b) $torque \propto slip^2$ (c) $torque \propto \frac{1}{slip}$ (d) $torque \propto slip$

12. A single-phase, 100 kVA, 1000/100 V transformer gave the following test results:

Open-circuit Test: 100 V, 6 A, 400 W

Short-circuit Test : 50 V, 100 A, 1800 W

The copper loss and core loss of the transformer at it 50% loading respectively are

- (a) 450 W and 400 W
- (b) 1800 W and 200 W
- (c) 900 W and 400 W
- (d) 900 W and 100 W

13. A 8-pole, DC generator has armature conductors with 32 coils of 6 turns each. When the flux per pole is 0.06 Wb and rotates at 250 rpm, the generated emf at no-load is 384 V. The type of winding and type of parallel paths respectively are

- (a) Lap and 8 (b) Wave and 2 (c) Lap and 2 (d) Wave and 8

14. A 50 kW DC shunt motor is loaded to draw rated armature current at any given speed. When driven at

(i) at half the rated speed by armature speed control and

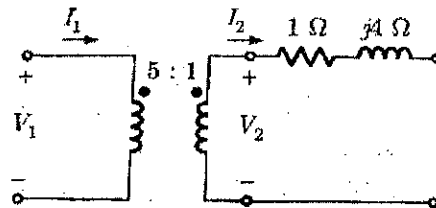
(ii) at 1.5 times the rated speed by field control, the respective output powers delivered by the motor are approximately

- (a) 25 kW in (i) and 75 kW in (ii) (b) 25 kW in (i) and 50 kW in (ii)
 (c) 50 kW in (i) and 75 kW in (ii) (d) 50 kW in (i) and 50 kW in (ii)

15. The size of a conductor used in power cable depends on the

- a) Operating voltage b) Power factor c) Current to be carried d) All the above

16. The value of impedance when referred to the primary side, while the secondary impedance is given as $(1+j4) \Omega$ as given in the figure below

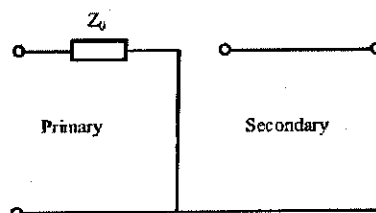


- (a) $(5+j20) \Omega$ (b) $(0.2+j0.8) \Omega$ (c) $(25+j100) \Omega$ (d) $(0.04+j0.16) \Omega$

17. A 33 kV/6.6 kV, three-phase transformer is connected as star/delta and the protecting CTs on the LV side have a ratio of 400/5. The ratio of the CTs on the HV side is

- (a) $16\sqrt{3}$ (b) $80/\sqrt{3}$ (c) $400\sqrt{3}$ (d) $100/\sqrt{3}$

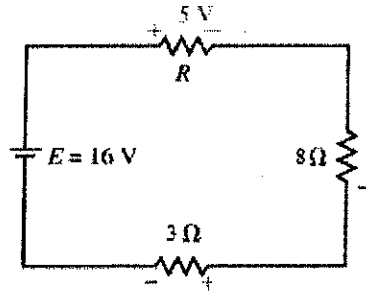
18. A zero-sequence network of a 3-phase transformer is given below. Z_0 is the zero sequence impedance of the transformer. What is the type of transformer connections?



- a) ungrounded star-delta b) solidly grounded star-delta
 c) delta- solidly grounded star d) star- solidly grounded star

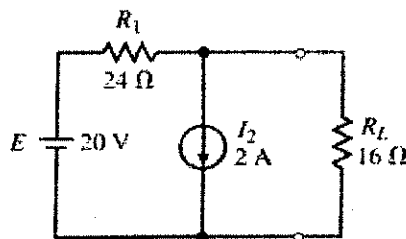
19. A low utilization factor for a plant indicates that the plant is used for
- a) Base load b) Peak load c) No time d) Peak & Base load
20. For economic operation of power system, the load factor and diversity factor should be
- a) Maximized b) Minimized
c) Maximized & minimized respectively d) Minimized & maximized respectively
21. Bundled conductors are mainly used in high voltage overhead transmission lines to
- a) Reduce line losses b) Increase mechanical strength
c) Reduce corona d) Reduce sag
22. If the number of turns of a coil wound over a core is halved, the inductance of the coil will become:
- (a) doubled (b) halved (c) quadrupled. (d) $\frac{1}{4}$ th
23. 1 Candela is equal to
- (a) 2π Lumens (b) 4π Lumens (c) $4\pi^2$ Lumens (d) π Lumens
24. Space height ratio should ideally be equal to
- (a) 2 (b) 1 (c) 0.5 (d) 3
25. In order to increase the ampere-hour (Ah) of the battery, the cells are connected in
- (a) Series (b) Parallel (c) Star (d) Delta
26. A 12 V battery is rated for 48 Ah. If it must deliver an average of 2 A, how long the battery last before it needs recharging?
- (a) 48 hours (b) 2 hours (c) 4 hours (d) 24 hours
27. In order to improve the power factor of equipment operating at lagging power factor, a capacitor is connected
- (a) In series with the equipment (b) In parallel with the equipment
(c) (a) and (b) (d) In series with the supply
28. In a particular circuit connection, AWG 18 preferred over AWG 22. The reason is that it has
- (a) Lesser weight (b) Lesser current carrying capacity
(c) Higher weight (d) Higher current carrying capacity
29. SCR turn OFF from conducting state to blocking state on
- (a) Reducing gate current (b) Reversing gate voltage
(c) Reducing anode current below holding current value (d) Applying AC to the gate

30. The value of 'R' in the circuit shown in Figure is



- (a) 2 Ω (b) 11 Ω (c) 1 Ω (d) 5 Ω

31. The value of Norton's resistance seen across the load resistance of 16 Ω in the circuit shown in Figure.



- (a) 0 Ω (b) 50 Ω (c) 24 Ω (d) ∞ Ω

32. In the magnetic circuit shown in Figure-3, the second coil carries a current of 2 A. If flux in the core is to be made zero, the current I in the first coil should be

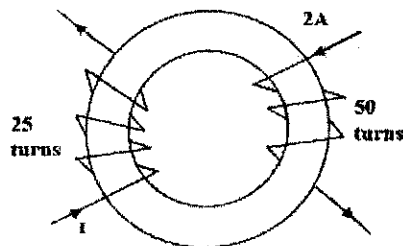


Figure-3

- (a) + 4 A (b) - 2 A (c) - 4 A (d) + 2 A

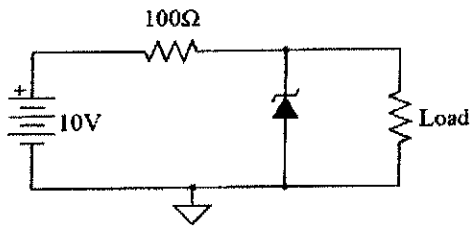
33. Thermal expansion of materials arises from

- (a) strong bonds (b) weak bonds
(c) thermal vibrations (d) asymmetry of potential energy curve

34. What is minimum number of two-input NAND gates required to implement two-input OR gate?

- (a) 2 (b) 3 (c) 4 (d) 5

35. In the circuit in figure, the 5V Zener diode requires a minimum current of 10 mA. For obtaining a regulated output of 5 V, the maximum permissible load current I_L is _____ mA and the minimum power rating of Zener diode is _____ W.



- (a) 40 mA and 0.05 W (b) 10 mA and 0.20 W
(c) 25 mA and 0.10 W (d) 5 mA and 0.15 W

36. The ON voltage and forward breakover voltage of an SCR depend on the

- (a) gate current alone
(b) bandgap of the semiconductor alone
(c) gate current and the semiconductor bandgap respectively
(d) semiconductor bandgap and the gate current respectively

37. Dielectric materials are used primarily for

- (a) insulation (b) charge storage
(c) reducing dielectric loss (d) none of these

38. As compared to Si, the electron mobility in GaAs is

- (a) slower by about five times (b) same
(c) faster by about six times (d) faster by about 200 times

39. As compared to full wave rectifier using two diodes, the four diode bridge rectifier has the dominant advantage of

- (a) higher current carrying capacity (b) lower peak inverse voltage requirement
(c) lower ripple factor (d) higher efficiency

40. When a semiconductor bar is heated at one end, a voltage across the bar is developed. If the heated end is positive, the semiconductor is

- (a) p-type (b) n-type (c) intrinsic (d) Highly degenerate

MECHANICAL ENGINEERING

41. The maximum wavelength of radiation emitted by blackbody at a temperature of 141°C , when a solar radiation falls on the surface of the blackbody is
(a) $14\ \mu\text{m}$ (b) $7\ \mu\text{m}$ (c) $21\ \mu\text{m}$ (d) $28\ \mu\text{m}$
42. In a standalone photo voltaic system design, inverter size depends on
(a) Panel peak power (b) Solar radiation (c) Connected load (d) Panel efficiency
43. In Bell-colemann refrigerator for the same temperature limits
(a) COP of dense air system is lower than COP of open-air system
(b) COP of dense air system is higher than COP of open-air system
(c) COP of dense air system is equal than COP of open-air system
(d) COP depends on pressure ratio
44. A reversed Carnot cycle has a COP of 5. The ratio of higher temperature to lower temperature will be
(a) 0.8 (b) 1.5 (c) 6 (d) 1.2
45. The Bell-Coleman Cycle is an example of
(a) Brayton Cycle (b) Vapor Compression Refrigeration Cycle
(c) Vapor absorption refrigeration Cycle (d) Air refrigeration cycle
46. Assume the moist air to be ideal fluid and possess 50% relative humidity. If the same air is reduced to half of its volume by maintaining its temperature constant, what will be the relative humidity
(a) 25 % (b) 50 % (c) 75 % (d) 100 %
47. Which one of the following pumps is NOT a rotating machine
(a) Gear pump (b) Centrifugal pump (c) Vane pump (d) Jet pump
48. A ratio of flow to throat velocity of a venturi meter is found to be 5. The velocity at the throat velocity if the pressure differential between throat to pipe is 40 kPa is
(a) 5 m/s (b) 0.5 cm/s (c) 25 m/s (d) 0.25 cm/s
49. In a shaper machine, the mechanism for tool feed is
(a) Geneva mechanism (b) Whitworth mechanism
(c) Ratchet and Pawl mechanism (d) Ward-Leonard system
50. Which of the following welding process uses non-consumable electrodes?
(a) TIG welding (b) MIG welding
(c) Manual arc welding (d) Submerged arc welding

Written Examination for the Post: Junior Engineer (E&M) (SET A)

51. Pre-ignition in SI engines is caused due to the presence of

- | | |
|------------------------------|----------------------|
| (a) Lubrication oil droplets | (b) Hot surfaces |
| (c) Carbon deposits | (d) All of the above |

52. In a four-stroke engine, the inlet valve is closed _____ and exhaust valve is opened _____

- | | |
|------------------------------|------------------------------|
| (a) before BDC and after BDC | (b) after BDC and before BDC |
| (c) before TDC and after TDC | (d) after TDC and before TDC |

53. The reference fuels used for determining the ignition quality of compression ignition engine fuels are

- | | |
|------------------------------|-----------------------------------|
| (a) iso-octane and n-heptane | (b) cetane and alpha-methylnonane |
| (c) Hexadecane and n-heptane | (d) cetane and iso-cetane |

54. Which type of calorimeter is used to measure the calorific value of gaseous fuels

- | | |
|---------------------------|--------------------------------------|
| (a) Junker calorimeter | (b) Bomb calorimeter |
| (c) Adiabatic calorimeter | (d) Isothermal titration calorimeter |

55. Three-way catalytic converter are employed in a SI engine to reduce

- | | |
|--|--|
| (a) CO, CO ₂ , and Soot emissions | (b) CO, NO _x , and HC emissions |
| (c) CO ₂ , NO _x , and HC emissions | (d) CO, HC, and Soot emissions |

56. The frictional power (F.P) in engines can be determined from brake power (B.P) and indicated power (I.P) as

- | | |
|-----------------------|-----------------------|
| (a) $F.P = B.P - I.P$ | (b) $F.P = I.P - B.P$ |
| (c) $F.P = B.P / I.P$ | (d) $F.P = I.P / B.P$ |

57. The air resistance of a four wheeler vehicle depends on

- | | |
|--------------------------|----------------------|
| (a) Vehicle frontal area | (b) Wind velocity |
| (c) Vehicle Speed | (d) All of the above |

58. A 4 x 2 drive system in an automobile refers to

- | | |
|---|---|
| (a) It has 4x2 = 8 wheels | (b) It has 4 drive and 2 auxiliary wheels |
| (c) It has 4 wheels out of which 2 are drive wheels | (d) None of the above |

59. If there are 9 clutch plates in a multi-plate clutch, what is the number of contact surface pairs?

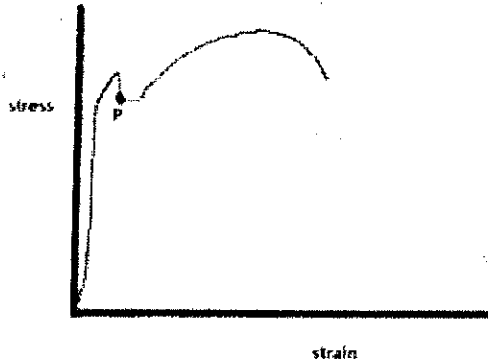
- | | | | |
|-------|-------|-------|--------|
| (a) 7 | (b) 9 | (c) 8 | (d) 10 |
|-------|-------|-------|--------|

60. Double declutching technique is used with _____ gearbox
- (a) Sliding-mesh (b) Constant-mesh (c) Synchromesh (d) Epicyclical
61. The angle between the steering axis and the vertical centre line in the wheel plane is known as the
- (a) Castor (b) Steering axis inclination (c) Camber (d) Kingpin inclination
62. Which condition shall lead to skidding of the wheels?
- (a) Braking force < Adhesive force (b) Braking force = Adhesive force
(c) Braking force > Adhesive force (d) None of the above
63. The major purpose of adding detergent-dispersant with lubrication oil is to
- (a) Increase fire point (b) Prevent foaming
(c) Reduce viscosity (d) Prevent sludge formation
64. The maximum pressure in the lubrication system of an automobile is controlled by
- (a) Relief valve (b) Oil pump (c) Oil filter (d) Voltage supply
65. What does the code 195/65 R 15 91 T in a tire designation represent?
- a) 195" width, 15" diameter, cross-ply b) 195" width, 15cm diameter, radial-ply
c) 195mm width, 15" diameter, radial-ply d) 195mm width, 15cm diameter, cross-ply
66. For a wire wheel, the vehicle weight is supported by the wire in _____
- (a) Shear (b) Compression (c) Tension (d) Bending
67. The major purpose of an intercooler in multi-stage compressor is to
- (a) Minimizes compression work (b) Cool the air at delivery
(c) Enable multi-stage compression (d) All of the above
68. Which of the following applications is best suited for a rotary compressor?
- (a) Large quantity of air at high pressure (b) Small quantity of air at high pressure
(c) Small quantity of air at low pressure (d) Large quantity of air at low pressure
69. Checklist for Job Safety Analysis (JSA) consists of
- (a). Work area, material, machine, tools (b) Men, machine, material, tools
(c) Men, machine, work area, tools (d) Men, work area, material tools

Written Examination for the Post: Junior Engineer (E&M) (SET A)

70. Economic Order Quantity is the quantity at which the cost of carrying is:
- (a) Minimum (b) Equal to the cost of ordering
(c) Less than the cost of ordering (d) Cost of overstocking
71. Which of the following is an unsafe condition.
- (a) Improper material handling (b) Hazardous arrangement of material
(c) Poor house keeping (d) Long working hours
72. Buying according to the requirements is called _____
- (a) Seasonal Buying (b) Hand to mouth buying
(c) Scheduled Buying (d) Tender Buying
73. _____ is the time that elapses between issuing replenishment order and receiving the material in stores.
- (a) Replenishment time (b) Lead time (c) Idle-time (d) None of the above
74. The Four R's of Total Improvement was given by _____
- (a) Deming (b) Huffman (c) Taguchi (d) Crosby
75. Which is the only standard in the ISO 9000 family to which organizations can certify?
- (a) ISO 9000 (b) ISO 9001 (c) ISO 14000 (d) ISO 9004
76. Pumps used in hydraulic applications are
- (a) Positive displacement pumps (b) Variable displacement pumps
(c) Fixed displacement pumps (d) All the above
77. Which of the following reasons make water unsuitable to use as a fluid in hydraulic systems?
1. poor lubrication 2. high viscosity 3. more leakage 4. quickly evaporates
- (a) 1 and 3 (b) 2 and 4 (c) 1, 3 and 4 (d) all the above
78. The S-N curve for steel becomes asymptotic nearly at
- (a) 10^3 cycles (b) 10^6 cycles (c) 10^9 cycles (d) 10^{12} cycles

79. What is the point shown in the stress-strain curve?



- (a) Elastic limit
(b) Lower yield point
(c) Yield plateau
(d) Lower strain point

80. Ergonomics principle suggests that

- (a) Monitoring displays should be placed outside peripheral limitations.
(b) Glow-in-the-dark dials made of reflective substances are good for viewing at night.
(c) Visual systems should be preferred over auditory systems in noisy locations.
(d) All of the above

GENERAL INTELLIGENCE AND GENERAL AWARENESS

81. Nobel Prize is NOT given in?

- (a) Physics (b) Mathematics (c) Chemistry (d) Medicine

82. The pH of human blood is between

- (a) 6.5-7 (b) 7.4-8 (c) 8-9 (d) 4.5-5

83. The outer most layer of atmosphere is called

- (a) Exosphere (b) Ionosphere (c) Stratosphere (d) Troposphere

84. Where were the High Courts in India first set up

- (a) Delhi and Calcutta (b) Bombay, Madras, Calcutta
(c) Bombay, Delhi, Calcutta (d) Madras and Bombay

85. Zero hour in Parliament refers to

- (a) Lunch Hour (b) The first hour of a joint session
(c) The last hour of a joint session (d) The hour to ask unscheduled questions

86. Which of the following animal has longest life span?

- (a) Elephant (b) Crocodile (c) Dog (d) Tortoise

87. Which space-vehicle put man on the moon first time?

- (a) Apollo (b) Challenger (c) Columbia (d) Explorer

88. Which of the following countries first gave women the right to vote

- (a) Australia (b) Finland (c) Norway (d) New Zealand

89. Which of the following vitamins helps in the normal clotting of blood

- (a) E (b) G (c) H (d) K

90. The constitution of India came into force on 26th January 1950. When was it adopted by Constituent Assembly?

- (a) 26th January 1947 (b) 26th November 1949
(c) 15th August 1947 (d) 20th September 1948

91. She lived _____ the expectations.

- (a) as per (b) up to (c) on (d) at

92. Arrange the words properly and choose the correct sequence

1. not 2. Maria 3. run 4. did 5. away

- (a) 24153 (b) 24135 (c) 21354 (d) 41235

93. Out of the given answer figures, which is the correct one to replace the question mark?



Answer Figures



- (a) A (b) B (c) C (d) D

94. Synonym of Brief is

- (a) Partial (b) Short (c) Limited (d) Little

95. _____ Indus River is the longest river in India.

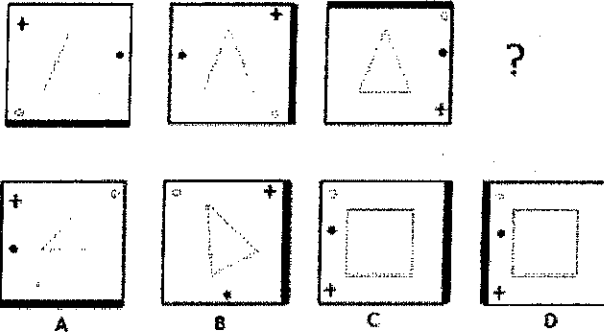
- (a) The (b) An (c) A (d) None of the above

96. Correct the underlined part in the following sentence

He was very tired as he is working since 6 O' clock in the morning.

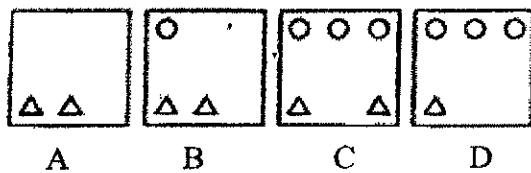
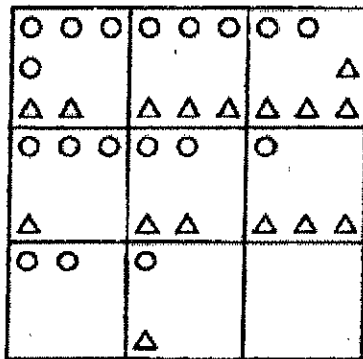
- (a) he was working
- (b) he had been working
- (c) he has been working
- (d) he will be working

97. What will replace the question mark?



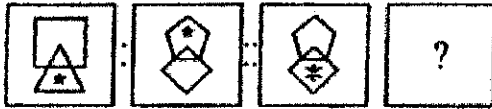
- (a) B
- (b) A
- (c) C
- (d) D

98. Out of the given answer figures, which is the correct one to replace the empty box?



- (a) D
- (b) C
- (c) B
- (d) A

99. Out of the given answer figures, which is the correct one to replace the question mark?



Answer Figures



(A) (B) (C) (D)

(a) D

(b) C

(c) A

(d) B

100. Out of the given answer figures, which is the correct one to replace the question mark?

Problem figures :



Answer figures :



A B C D

(a) B

(b) D

(c) C

(d) A

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