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Test Booklet Number	Subject Code : 2401	Roll Number
00236	**MATHEMATICS AND SCIENCE**	

Time Allowed : 2 Hours **Maximum Marks : 300**

INSTRUCTIONS FOR CANDIDATES

Read the following instructions carefully before you answer the questions given in this Test Booklet :

1. Answers to questions in this Test Booklet are to be given on an **OMR Answer Sheet** provided to the candidate **separately**.
2. Candidate must fill up Name, Category, Test Booklet Number, Subject Code and Roll Number in the **OMR Answer Sheet** carefully as per instructions given.
3. This Test Booklet consists of **75 questions**. **All** questions are compulsory and carry equal marks.
4. Each question in this Test Booklet has four possible alternative answers namely, [A], [B], [C] and [D], one of which is correct. Candidate should choose the correct answer against each question out of four alternative answers.
5. Candidate is instructed to answer the questions by **darkening (●)** with **Ballpoint pen** only in the circle bearing the correct answer.
6. Candidate should not attempt more than one answer in each question. More than one attempt in any form against a question shall be treated as incorrect.
7. Marking of answer other than darkening shall be cancelled and darkening should remain within the circle otherwise computer shall not accept during evaluation of the **OMR Answer Sheet.**
8. Rough work must not be done on the **OMR Answer Sheet.** Use the blank space given in this Test Booklet for rough work.
9. Candidate is to hand over the **OMR Answer Sheet** to the Invigilator before leaving the Examination Hall.
10. **NEGATIVE MARKING** : Each question carries **4 (four)** marks for correct response. For each incorrect response, **1 (one)** mark will be deducted from the total score. More than one answer indicated against a question will be deemed as incorrect response and will be negatively marked.

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MATHEMATICS

1. 3 bells toll together at 8.00 a.m. They toll after 8, 11 and 12 seconds respectively. How many times will they toll together in the next 30 minutes?

[A] 5

[B] 6

[C] 7

[D] 8

2. $49y^2 - 14y - 25x^2 + 1$ is equal to :

[A] $(7y - 1 + 5x)(7y - 1 - 5x)$

[B] $(5x - 1 + 7y)(5x - 1 - 7y)$

[C] $(7y - 1 + 5x)(7y - 1 + 5x)$

[D] $(5x + 7y + 1)(5x + 7y - 1)$

3. If α, β are the zeroes of the polynomial $p(x) = x^2 - p(x + 1) - c$, then $(\alpha + 1)(\beta + 1)$ is equal to :

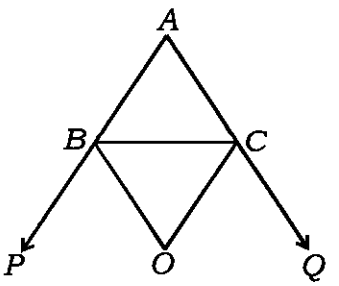
[A] $c - 1$

[B] $1 - c$

[C] c

[D] $1 + c$

4. In the given figure, BO and CO are the angle bisectors of external angles of ΔABC, then $\angle BOC$ is :



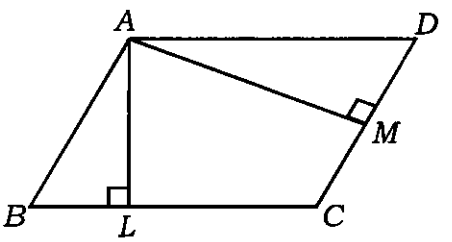
[A] $90° - \frac{1}{2}\angle A$

[B] $90° + \frac{1}{2}\angle A$

[C] $180° - \frac{1}{2}\angle A$

[D] $180° + \frac{1}{2}\angle A$

5. In the given figure, $ABCD$ is a parallelogram, $AL \perp BC$, $AM \perp CD$, $AL = 4$ cm and $AM = 5$ cm. If $BC = 6.5$ cm, then length of CD is



[A] 5.2 cm

[B] 8.7 cm

[C] 6.5 cm

[D] 3.3 cm

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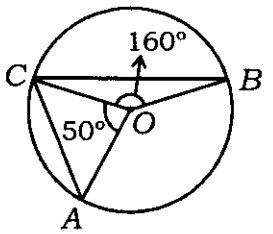
6. In the given figure, angles subtended by chords AC and BC at the centre O of the circle are 50° and 160° respectively. The measure of $\angle ACB$ is :



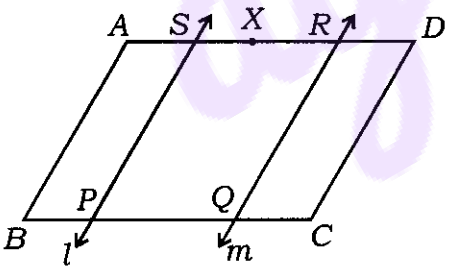
[A] 150°

[B] 75°

[C] 62°

[D] 60°

7. $ABCD$ is a parallelogram. Two lines l and m are parallel to AB. Line l meets BC and AD at P and S respectively, and line m meets BC and AD at Q and R respectively. X is any point on AD between R and S. If ar(ΔAPX) + ar(ΔDQX) = K ar($ABCD$) then the value of K is



[A] $\frac{2}{3}$

[B] $\frac{3}{2}$

[C] $\frac{1}{2}$

[D] $\frac{1}{3}$

8. The capacities of two hemispherical vessels are 6.4 litres and 21.6 litres. The areas of inner curved surfaces of the vessels will be in the ratio :

[A] $\sqrt{2} : \sqrt{3}$

[B] 2 : 3

[C] 4 : 9

[D] 16 : 81

9. Mean of 11 observations is 17.5. If one observation value 15 is deleted, then the mean of the remaining observations is :

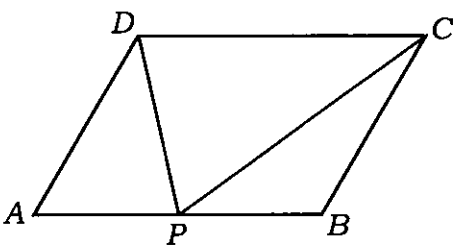
[A] 15.75

[B] 16.75

[C] 17.75

[D] 18.75

10. $ABCD$ is a parallelogram as shown. If $AB = 2AD$ and P is mid-point of AB, then $\angle CPD$ is equal to



[A] 90°

[B] 60°

[C] 45°

[D] 135°

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11. In what ratio is the segment joining the points A (4, 6) and B (–7, –1) divided by X axis?

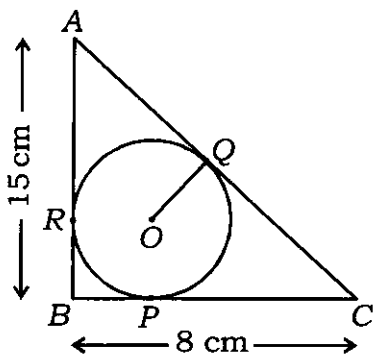
[A] 1 : 6

[B] 6 : 2

[C] 2 : 6

[D] 6 : 1

12. The sides of a right angled triangle are 8 cm and 15 cm, as shown in the figure. The radius of the circle inscribed in the triangle (in cm) is:



[A] 1

[B] 2

[C] 3

[D] 4

13. The ratio between a two digit number and the sum of its digits is 4 : 1. If the digit in the unit place is 3 more than the digit in the ten's place, then the number is

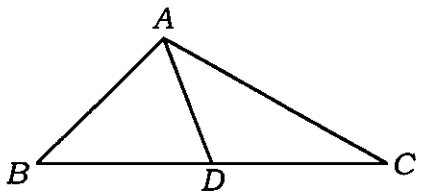
[A] 63

[B] 58

[C] 25

[D] 36

14. In ΔABC, AD is the median, then $AB^2 + AC^2$ is equal to



[A] $AD^2 + BD^2$

[B] $2(AD^2 + BD^2)$

[C] $\frac{1}{2}(AD^2 + BD^2)$

[D] $AD^2 + 2BD^2$

15. If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, then $\cos\theta - \sin\theta$ is equal to :

[A] $\sqrt{2}\tan\theta$

[B] $\sqrt{2}\sin\theta$

[C] $\frac{\sqrt{2}}{\cos\theta + \sin\theta}$

[D] $\sqrt{2}\cos\theta$

16. If $x = r\sin\theta\cos\alpha$, $y = r\sin\theta\sin\alpha$ and $z = r\cos\theta$, then

[A] $x^2 + y^2 + z^2 = r^2$

[B] $x^2 + y^2 - z^2 = r^2$

[C] $x^2 - y^2 + z^2 = r^2$

[D] $z^2 + y^2 - x^2 = r^2$

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17. In a given AP, if the p-th term is 'q' and the q-th term is 'p', then its n-th term is

[A] $p + q - n$

[B] $p + q + n$

[C] $p - q + n$

[D] $p - q - n$

18. If the circumference of a circle is $\frac{30}{\pi}$, then the diameter of the circle is :

[A] 60π

[B] $\frac{15}{\pi}$

[C] $\frac{30}{\pi^2}$

[D] 30

19. The number of solid spheres, each of diameter 6 cm that could be moulded to form a solid cylinder of height 45 cm and diameter 4 cm, is :

[A] 3

[B] 4

[C] 5

[D] 6

20. A card is drawn from a packet of 100 cards numbered 1 to 100. The probability of drawing a card with a number, which is a perfect square, is :

[A] $\frac{1}{10}$

[B] $\frac{9}{100}$

[C] $\frac{1}{100}$

[D] $\frac{2}{100}$

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SCIENCE

21. Arrange the following in the correct decreasing order of forces of attraction between them :

[A] Smoke, Oxygen, Water

[B] Air, Salt, Oil

[C] Sugar, Vinegar, Air

[D] Salt, Oxygen, Water

22. A mixture of liquid A (Boiling point 323K) and liquid B (Boiling point 308K) has been separated by using a distillation flask fitted with a fractionating column. At the end of the process which liquid will be left in the flask and which liquid will be collected as a distillate?

[A] Liquid A as distillate, liquid B in the flask.

[B] Liquid B as distillate, liquid A in the flask.

[C] Both the liquids obtained as distillate.

[D] The liquids can not be separated by this process.

23. Which of the following are chemical changes?

(i) Decaying of wood

(ii) Burning of wood

(iii) Melting of wax

(iv) Digestion of food

[A] (i), (ii) & (iv)

[B] (ii), (iii) & (iv)

[C] (ii), (iv) only

[D] (i), (iv) only

24. How many moles of Al^{+3} ions and SO_4^{2-} ions are present in 3 moles of aluminium sulphate?

[A] 3 moles of Al^{+3} and 3 moles of SO_4^{2-}.

[B] 6 moles of Al^{+3} and 9 moles of SO_4^{2-}.

[C] 9 moles of Al^{+3} and 6 moles of SO_4^{2-}.

[D] 2 moles of Al^{+3} and 3 moles of SO_4^{2-}.

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25. 4 g of Hydrogen gas is burnt in 50 g of Oxygen gas. How many gram of water will be formed?

[A] 54 g

[B] 36 g

[C] 20 g

[D] 28 g

26. Study the following set of elements and classify them into Isotopes and Isobars :

	e^-	p^+	n^0
A	1	1	0
B	18	18	22
C	1	1	2
D	20	20	20

[A] A & C are isotopes

[B] B & D are isobars

[C] B & D are isotopes

[D] Both [A] & [B] are correct

27. Aluminium has 13 protons and 14 neutrons. Nitrogen has 7 protons and 7 neutrons. What will be the formula of Aluminium nitride?

[A] Al_3N

[B] AlN_3

[C] AlN

[D] $Al(NO_3)_3$

28. Which of the following is an exothermic process?

[A] Sublimation of ammonium chloride

[B] Reaction of hydrogen gas with oxygen gas to form water.

[C] Passing electricity through water to form Hydrogen gas & Oxygen gas.

[D] Evaporation of water.

29. In order to write a balanced chemical equation for the following reaction :

$a\ C_2H_2 + b\ O_2 \longrightarrow c\ CO_2 + d\ H_2O$

What are the correct values of *a*, *b*, *c*, *d* respectively?

[A] 2, 5, 4, 2

[B] 1, 3, 1, 2

[C] 1, 2, 1, 1

[D] 2, 4, 5, 2

30. Which of the following indicators changes its colour in both acids as well as bases?

[A] Phenolphthalein

[B] Turmeric

[C] Methyl orange

[D] Red Litmus

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31. A farmer got the soil of his field tested by a lab. Soil was dissolved in water and filtered. The filtrate when tested with a pH paper showed orange colour. Which of the following should be added to the soil to make it neutral?

[A] Slaked lime

[B] Baking powder

[C] Common salt

[D] Gypsum

32. Which of the following reagents can be used to distinguish between a saturated and an unsaturated hydrocarbon :

[A] Bromine water

[B] Conc. Sulphuric acid

[C] Ethanol

[D] Acetone

33. Substance '*A*' burns with a sooty flame whereas substance '*B*' burns with a blue flame. Which of the following statement/s is/are correct :

(i) Substance '*A*' produces unburnt carbon particles.

(ii) Substance '*A*' is unsaturated, substance '*B*' is saturated.

(iii) Substance '*A*' is saturated, substance '*B*' is unsaturated.

[A] (i) & (iii) are correct

[B] (i) & (ii) are correct

[C] Only (iii) is correct

[D] Only (ii) is correct

34. Arrange the following metals in the decreasing order of their reactivity:

Au, Ca, Zn, Mg

[A] Ca, Mg, Zn, Au

[B] Mg, Ca, Zn, Au

[C] Au, Zn, Mg, Ca

[D] Au, Zn, Ca, Mg

35. A non-metal '*X*' reacts vigorously with oxygen and can catch fire. A metal '*Y*' reacts vigorously with oxygen and moisture and can catch fire. How should we store the non metal '*X*' & metal '*Y*' in our laboratory?

[A] '*X*' in kerosene, '*Y*' in water

[B] '*X*' in water, '*Y*' in kerosene

[C] Both '*X*' & '*Y*' in water

[D] '*X*' in alcohol, '*Y*' in water

36. A sample of soft water can be distinguished from hard water by using :

[A] blue or red litmus solution

[B] sodium bicarbonate solution

[C] a soap solution

[D] a detergent solution

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37. Green tomatoes turn red when kept at room temperature after some days. The organelle responsible for the change in the colour of tomato from green to red is

[A] Leucoplasts

[B] Chromoplasts

[C] Chloroplasts

[D] Tonoplast

38. Which of the following is an incorrect statement?

Smooth Endoplasmic Reticulum plays an important role in

[A] providing surface for the synthesis of lipids

[B] the manufacture of proteins

[C] detoxifying many poisons and drugs

[D] building the cell membrane

39. A permanent tissue which makes the husk of a coconut is :

[A] Aerenchyma

[B] Parenchyma

[C] Sclerenchyma

[D] Collenchyma

40. The mode of nutrition exhibited by Lichens grouped under Kingdom Fungi is

[A] Autotrophic

[B] Symbiotic

[C] Saprophytic

[D] Parasitic

41. Phylum Porifera includes

[A] Musca, Paleomon, Periplaneta

[B] Euplectella, Spongilla, Sycon

[C] Unio, Chiton, Pila

[D] Planaria, Liverfluke, Tapeworm

42. Gymnosperms are

[A] Seedless plants

[B] Flower bearing plants

[C] Plants with naked seeds

[D] Non vascular plants

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43. Choose the correct statements from the following

1. Nitrogen is an essential element used in the synthesis of proteins and other compounds.

2. Nitrogen is obtained by the plants from the atmosphere as air in earth's atmosphere is made up of approximately 78%.

3. Nitrogen can be fixed by the plants with the help of bacteria into organic compounds.

4. Nitrogen is taken up by the plants from the soil in the form of nitrates and nitrites.

[A] 1 and 2

[B] 1 and 3

[C] 1, 2 and 4

[D] 1, 3 and 4

44. Consider the following statements:

1. Veins carry blood away from the heart to various organs of the body.

2. Arteries collect the blood from different organs and bring it back to the heart.

3. Veins are thin walled as blood is not flowing under high pressure.

4. Arteries have thick walls as blood emerges under high pressure

The correct statements are :

[A] 1 and 2

[B] 1, 2 and 3

[C] 2 and 4

[D] 3 and 4

45. Saliva in our mouth contains an enzyme called salivary amylase. In case this enzyme is not present there which of the events will not take place in our mouth cavity?

[A] Breakdown of fats into fatty acids and glycerol.

[B] Breakdown of proteins into amino acids.

[C] Breakdown of starch into sugars.

[D] Absorption of vitamins and minerals.

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46. What is the correct order of steps in a reflex arc?

[A] Receptors → Motor Neuron → Spinal cord → Sensory Neuron → Muscles

[B] Receptors → Sensory Neuron → Spinal cord → Motor Neuron → Muscles

[C] Receptors → Muscles → Sensory Neuron → Motor Neuron → Spinal cord

[D] Receptors → Spinal cord → Sensory Neuron → Motor Neuron → Muscles

47. The hormone which promotes cell division and the hormone which helps in the growth of stem are

[A] Gibberellins and Auxins respectively

[B] Cytokinins and Auxins respectively

[C] Gibberellins and Abscicic acid respectively

[D] Abscicic acid and Auxins respectively

48. Two organisms having the ability to reproduce by regeneration are

[A] Hydra and Plasmodium

[B] Hydra and Planaria

[C] Spirogyra and Planaria

[D] Spirogyra and Rhizopus

49. A microorganism in which binary fission in a definite orientation is a means of asexual reproduction is

[A] Amoeba

[B] Plasmodium

[C] Leishmania

[D] Yeast

50. Mendel crossed a tall pea plant with a short pea plant to get an F_1 generation. What did Mendel do to obtain F_2 generation from F_1 generation?

[A] Cross fertilised both the parents

[B] Self-fertilised F_1 generation plants

[C] Cross fertilised F_1 generation plants with dominant plants

[D] Cross fertilised F_1 generation plants with recessive plants

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51. The pair of sex chromosomes found in a human male is

[A] XX

[B] XY

[C] YY

[D] XO

52. The displacement-time (s-t) graph for two objects P and Q are straight lines inclined at the angles of 30° and 45° with the time axis. The ratio of velocities of P and Q $\left(v_p / v_q\right)$ is

[A] $\frac{3}{2}$

[B] $\frac{2}{3}$

[C] $\sqrt{3}$

[D] $\frac{1}{\sqrt{3}}$

53. "A moving object is covering distances in direct proportion to the square of time elapsed". From this statement it may be concluded that the acceleration of the moving object is

[A] zero

[B] increasing

[C] decreasing

[D] constant

54. While driving on a national highway a person computes the average speed of his trip to be 72 km/h. On his return trip the average speed is recorded as 48 km/h along the same path. The average speed of the whole trip is

[A] 62.2 km/h

[B] 59.8 km/h

[C] 57.6 km/h

[D] 56.4 km/h

55. "An object is moving along a circular path with a constant speed." This statement means that the object is moving such that its

[A] velocity and acceleration both are changing their directions

[B] velocity is constant and acceleration is changing direction

[C] velocity and acceleration both are increasing

[D] velocity is constant and acceleration is zero

56. A scooter running on a straight road with a velocity of 15 m/s slows down to 5 m/s over a distance of 10 m. The time for which brakes are applied is

[A] 0.5 s

[B] 1.0 s

[C] 2.0 s

[D] 4.0 s

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57. A passenger sitting in Rajdhani Express train which is moving due north tosses a coin to observe whether the train is accelerating or not. If the coin falls about 50 cm right in front of him, the correct conclusion about the motion of the train at that instant would be that the motion of the train is

[A] retarded

[B] uniform

[C] accelerated

[D] along a curved track

58. The meaning of impulse is

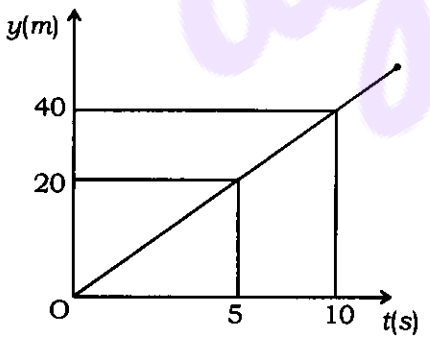
[A] stopping a fast moving object

[B] change in force

[C] change in momentum

[D] change in acceleration

59. The displacement-time graph for an object of mass 2 kg is as shown. The force required to move the object for the first 5 s is



[A] 0

[B] 20 N

[C] 100 N

[D] 200 N

60. Two objects A and B, each of mass m, moving along a straight line towards each other with velocity $3v$ and v respectively collide. If after the collision they combine, the velocity of the combination will be

[A] v

[B] $2v$

[C] $3v$

[D] $4v$

61. The SI unit of universal gravitational constant is

[A] $N\ m^2\ kg^{-2}$

[B] $N\ m^2\ kg^2$

[C] $N\ m^{-2}\ kg^2$

[D] $N\ m^{-2}\ kg^{-2}$

62. An object falls freely in air. If the vertical distances fall by the object in the first 3s and the next 3s are h_1 and h_2 respectively, then the value of $\frac{h_1}{h_2}$ is

[A] 1

[B] $\frac{1}{2}$

[C] $\frac{1}{3}$

[D] $\frac{1}{4}$

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63. Two objects of masses M_1 and M_2 are released simultaneously from heights h_1 and h_2 respectively. If they reach the ground after a time t_1 and t_2 and strike the ground with velocities of v_1 and v_2 respectively, then $\frac{t_1}{t_2}$ is

[A] $\sqrt{\frac{M_1 h_1}{M_2 h_2}}$

[B] $\sqrt{\frac{M_1 h_2}{M_2 h_1}}$

[C] $\frac{h_1 v_1}{h_2 v_2}$

[D] $\sqrt{\frac{h_1}{h_2}}$

64. An object of density ρ_1 and volume V is floating on the surface of a liquid of density ρ_2, then

[A] the true weight of the object is $V\rho_2$ g

[B] apparent loss in weight of the object is $V\rho_2$ g

[C] apparent weight of the object is zero

[D] $\rho_1 > \rho_2$

65. An object weighs x newton in air, y newton in liquid and z newton in water. If the relative density of the object is ρ_1 and that of the liquid is ρ_2, then $\frac{\rho_2}{\rho_1}$ is

[A] $\frac{x-y}{x}$

[B] $\frac{x-z}{x-y}$

[C] $\frac{x-y}{x-z}$

[D] $\frac{x}{x-y}$

66. An object weighs 400 N in air. When immersed fully in a fluid it weighs 340 N. The weight of the fluid displaced by the object is

[A] 400 N

[B] 340 N

[C] 60 N

[D] 740 N

67. If the momentum of an object is increased by 100% its kinetic energy is increased by

[A] 400%

[B] 300%

[C] 200%

[D] 100%

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68. In which one of the following cases no physical work is done?

[A] A windmill lifting water from a pond

[B] A girl swimming in a swimming pool

[C] A soil boat moving in the direction of wind

[D] A porter holding a load over his head

69. An object of mass m is moving with a constant velocity v. The amount of work donw to bring the object to rest is

[A] $\frac{1}{2}mv$

[B] mv^2

[C] $\frac{1}{2}mv^2$

[D] $2mv^2$

70. A source produces 20 crests and 20 troughs in 0.1 second. The frequency of the wave produced is

[A] 20 hertz

[B] 100 hertz

[C] 200 hertz

[D] 1200 hertz

71. Consider the following statements about the images formed by a convex mirror.

(A) Image is erect

(B) Image is real

(C) The image lies between the pole and the focus

(D) The image is diminished in size

The correct statements are

[A] (A) and (B) only

[B] (C) and (D) only

[C] (A), (B) and (C)

[D] (C), (D) and (A)

72. The phenomena of light involved in the formation of a rainbow in the sky are

[A] refraction, dispersion and reflection

[B] refraction, dispersion and scattering

[C] dispersion, total internal reflection and refraction

[D] dispersion, internal reflection and refraction

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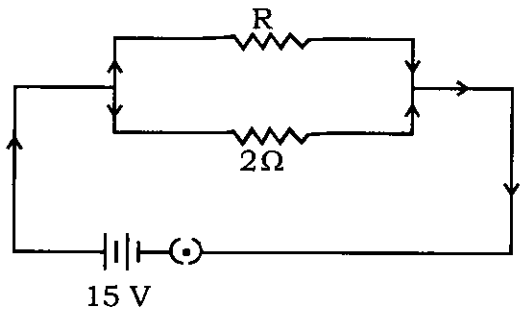
73. In the adjoining circuit the power discipation is 150W. The value of R is



[A] 2Ω

[B] 4Ω

[C] 6Ω

[D] 8Ω

74. Two bulbs A and B have following ratings

A – 40W ; 220V

B – 20W ; 110V

The ratio of their resistances $\frac{R_A}{R_B}$ is

[A] 4 : 1

[B] 1 : 4

[C] 1 : 2

[D] 2 : 1

75. Consider the following statements

(A) Magnetic field lines are closed curves.

(B) Parallel and equidistant magnetic field lines represent zero field strength

(C) The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic needle points.

(D) Relative strength of magnetic field is shown by the degree of closeness of the field lines.

The correct statement(s) is/are

[A] only A

[B] A and B only

[C] C and D only

[D] C, D and A

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