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PART - I : MENTAL ABILITY

1.

Sol. (b) A leap year has 366 days

Now if we divide 366 by 7 it gives 2 as remainder.

hence number of odd days in 366 days is 2.

2.

Sol. (a) The only son of Bhaskar's father is the Bhaskar himself. This means that Bhaskar is the father of Asha. Hence, Asha is the daughther of Bhaskar. Therefore, answer is (A).

3.

Sol. (d) Clearly, the given sequence is a combination of two series :

I. 1, 3, 7, ?, 21 and II. 3, 6, 9, 12

The pattern followed in I is + 2, + 4, ...; and the pattern followed in II is +3. Thus, missing number = 7 + 6 = 13.

Hence, the answer is (D).

4.

Sol. (d) This questions is of direct substitution method. Letters of the basic words are substituted as under.

Basic Word : T E A R S

↓ ↓ ↓ ↓ ↓

Coded Word : V W X Y Z

Basic Word : M A N

↓ ↓ ↓

Coded Word : 1 2 3

Therefore, the coding for the word RESENTMENT will be YWZW3V1W3V.

5.

Sol. (d) (9 – 5) + (16 –12) = 8 (Ist Circle)

(11 - 9) + (15 – 13) = 4 (IInd Circle)

So, (9 – 7) + (18 – 15) = 5 (IIIrd Circle)

6.

Sol. (b) Clearly, the number inside the circle is equal to the sum of the product of the upper three numbers and the product of the lower three numbers. Thus,

In fig.

A, (5 × 6 × 8) + (7 × 4 × 9) = 240 + 252 = 492.

In fig.

B, (7 × 5 × 4) + (6 × 8 × 9) = 140 + 432 = 572.

In fig C, missing number

= (4 × 3 × 5) + (7 × 2 × 5) = 60 + 70 = 130.

Hence, the answer is (B).

7.

Sol. (c) Here, the number 2 appears in three dice, namely

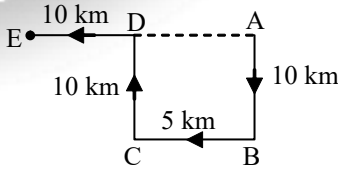
(i), (ii) and (iv). In these dice, we obsrve that the numbers 2, 4, 1 and 6 appear adjacent to 3,

So, none of these numbers can be present opposite 2. The only number left is 5.

Hence, 5 is present on the face oppsoite 2

8

Sol. (b)



Clearly, Anil starts from home at A, moves 10 km Southwards upto B, turns right and moves 5 km upto C, turns right again and moves 10 km upto D and finally turns left and moves 10 km upto E. Thus, his distance from initial position A

= AE = AD + DE

= BC + DE = (5 + 10) km = 15 km.

Hence, the answer is (B).

9.

Sol. (c) Study of Coin is known as 'Numismatic'. 'Paleontology' is the science dealing with study of history of mankind with the help of fossils. Hence, the answer is (C).

10.

Sol. (c) Second no. is one less than the half of first number. So, option (C) is out answer.

11.

Sol. (a) Clearly, the numerators of the fractions in the given sequence form the series 1, 3, 5, 7, in which each term is obtained by adding 2 to the previous term. The denominators of the fractions form the series 2, 4, 8, 16,

i.e. $2^1, 2^2, 2^3, 2^4$.

So, the numerator of the next fraction will be

(7 + 12) i.e., 9 and the denominator will be 2^5 i.e. 32.

The next term is $\frac{9}{32}$

Hence, the answer is (A).

12.

Sol. (b) The letter that represents the set of persons who play all three games is C.

In a Venn diagram where three overlapping circles represent different groups, the area where all three circles intersect represents the individuals who are part of all three groups.

13.

Sol. (d) letter represents the set of persons who play Tennis and Volley Ball but no Badminton b.

14.

Sol. (a) letter represents the set of persons who play Tennis but neither Bad minton nor Volley Ball a.

15.

Sol. (c) letter represents the set of persons who play Tennis and Badminton but not Volley Ball d.

PART - II : MATHEMATICS

1.

Sol. (b) Let the number of questions answered correctly be x and that of those answered wrongly be y.

$x + y = 60$ (1)

$2x + \left(\frac{-1}{2}\right)y = 80 \Rightarrow 2x - \frac{y}{2} = 80$ (2)

$4x - y = 160$

Eq. $(1) \times 4$ – Eq (2)

$4x + 4y = 240$

$4x - y = 160$

$- \quad + \quad \_\_\_\_\_$

$5y = 80$

$y = 16$

$\therefore$ Number of questions answered wrongly = 16

2.

Sol. (a) $\frac{4+x}{3} + \frac{7}{4} = \frac{3-x}{2} + \frac{5}{4}$

$\frac{16+4x+21}{12} = \frac{6-2x+5}{4}$

$\frac{4x+37}{12} = \frac{11-2x}{4}$

$4x + 37 = 33 - 6x$

$10x = -4$

$x = -2/5$

3.

Sol. (c) Volume of a sphere $(v) = \frac{4}{3}\pi r^3$

$\frac{4}{3} \times \frac{22}{7} \times r^3 = 38,808 cm^3$

$r^3 = \frac{38,808 \times 3 \times 7}{4 \times 22} \Rightarrow r = 21$

Surface area of the sphere

$4\pi r^2 = 4 \times \frac{22}{7} \times (21)^2$

$= 4 \times 22 \times 3 \times 21 = 88 \times 63 = 5544 sq.cm$

4.

Sol. (c) Inner dimensions of the box are $28cm \times 16cm \times 12$ cm.

Number of cakes of soaps is maximum.

$\therefore$ Number of cakes of soaps along length $= \frac{28}{4} = 7$

Number of cakes of soaps along breadth $= \left(\frac{16}{8}\right) = 2$

Number of cakes of soaps along height $= \left(\frac{12}{6}\right) = 2$

$\therefore$ Total number of cakes of soaps $= 7 \times 2 \times 2 = 28$

5.

Sol. (c)

$\pi r^2 = 2\pi r^2$

r=2

Circumference of the circle $2\pi r = 4\pi cm$

6.

Sol. (b) Given, perimeter of a regular hexagon

(6a) = 36 cm

a = 6cm

Area of a regular hexagon

$= 6 \times \frac{\sqrt{3}}{4} \times a^2 = \frac{3\sqrt{3}}{2} \times (6)^2 = 65\sqrt{3} sq.cm =$ 54sqrt(3) sq. cm

7.

Sol. (a) $(16x^2 + 40xy + 25y^2) - (4x^2 - 4xy + y^2)$

$= (4x + 5y)^2 - (2x - y)^2$

$= (4x + 5y + 2x - y)(4x + 5y - 2x + y)$

$= (6x + 4y)(2x + 6y) = 2(3x + 2y)(2)(x + 3y)$

$= 4(3x + 2y)(x + 3y)$

8.

Sol. (a) $\dfrac{(x+y)(x^2+xy+y^2)}{(x^3-y^3)}$

$= \dfrac{(x+y)(x^2+xy+y^2)}{(x-y)(x^2+xy+y^2)} = \dfrac{(x+y)}{(x-y)}$

9.

Sol. (c) $x - \dfrac{1}{x} = 4$

$\Rightarrow \left(x - \dfrac{1}{x}\right)^2 = 4^2$

$\Rightarrow x^2 - 2x\left(\dfrac{1}{x}\right) + \dfrac{1}{x^2} = 16$

$\Rightarrow x^2 + \dfrac{1}{x^2} = 16 + 2$

$\Rightarrow x^2 + \dfrac{1}{x^2} = 18$

10.

Sol. (b) $2.7p=0.09q \Rightarrow 30p = q$

$\therefore \quad \dfrac{q + 6p}{q - 6p} = \dfrac{36p}{24p} = \dfrac{3}{2}$

11.

Sol. (d) Let the maximum marks be x.

Given that $0.4x - 0.3x = 30$.

$\Rightarrow 0.1x = 30 \qquad \Rightarrow x = 300$

12.

Sol. (d) For every 900 g that the trader sells, he earns a profit of 100 g.

Therefore, percentage of profit

$= \dfrac{100}{900} \times 100 = 11\dfrac{1}{9}\%$

13.

Sol. (c) Given, successive discounts are 25% and 28%.

The required single discount

$= \left(25 + 28 - \dfrac{25 \times 28}{100}\right)\%$

$= (53 - 7)\% = 46\%$

14.

Sol. (b) $13^{15} \times 15^{17} \times 17^{19}$.

The units digit of the product

= The units digit of $7 \times 5 \times 3 = 5$

Alternative method: The product of an odd num-ber and a number ending with 5 ends in 5.

15.

Sol. (b) $2.\overline{648} = \dfrac{2648 - 2}{999} = \dfrac{2646}{999} = \dfrac{98}{37}$

16.

Sol. (a) HCF of $\left(\dfrac{2}{3}, \dfrac{2}{5}, \dfrac{3}{5}\right) = \dfrac{\text{HCF }(2,2,3)}{\text{LCM }(3,5,5)} = \dfrac{1}{15}$

LCM of $\left(\dfrac{2}{3}, \dfrac{2}{5}, \dfrac{3}{5}\right) = \dfrac{\text{LCM }(2,2,3)}{\text{HCF }(3,5,5)} = \dfrac{6}{1}$

$\text{HCF} \times \text{LCM} = \dfrac{1}{15} \times 6 = \dfrac{2}{5}$

17.

Sol. (b) $36 = 2^2 \times 3^2$

The sum of the factors

$$= \frac{\left(2^{2+1}-1\right)}{(2-1)} \times \frac{\left(3^{2+1}-1\right)}{(3-1)}$$

$$= \frac{\left(2^3-1\right)}{1} \times \frac{\left(3^3-1\right)}{2} = (8-1) \times \frac{(27-1)}{1}$$

$$= 7 \times \frac{26}{2} = 91$$

18.

Sol. (b)

2	32, 48
2	16, 24
2	8, 12
2	4, 6
	2, 3

LCM=2×2×2×2×2×3= 96

19.

Sol. (c) $\sqrt{50.41} + \sqrt{34.81} = \sqrt{\frac{5041}{100}} + \sqrt{\frac{3481}{100}}$

$$= \frac{71}{10} + \frac{59}{10} = \frac{130}{10} = 13$$

20.

Sol. (c) $(729)^{x+3} = (27)^{5+x}$

$\Rightarrow$ $(3^6)^{x+3} = (3^3)^{(5+x}$

$\Rightarrow$ $3^{6x+18} = 3^{15+3x}$

$\Rightarrow$ $6x + 18 = 15 + 3x$

$\Rightarrow$ $6x - 3x = 15 - 18$

$\Rightarrow$ $3x = -3$

$\Rightarrow$ $x = -1$

$\therefore$ $x^x = (-1)^{(-1)} = \frac{1}{-1} = -1$

21.

Sol. (b) $\sqrt[3]{4096, 3} - \sqrt[3]{1331, 3}$

$\Rightarrow$ $\sqrt[3]{(16)^3} - \sqrt[3]{(11)^3} = 16 - 11 = 5 = \sqrt{25}$

22.

Sol. (b) $\sqrt{\sqrt[3]{343} - \sqrt{784}} = \sqrt{7 \times 28}$

$= \sqrt{7 \times 7 \times 4} = 7 \times 2 = 14$

23.

Sol. (b) $\sqrt[3]{17576} - \sqrt[3]{4913} = 26 - 17 = 9$

24.

Sol. (b) $432 = 2 \times 216$

$\Rightarrow$ $2 \times 2 \times 108$

$\Rightarrow$ $2 \times 2 \times 2 \times 54$

$\Rightarrow$ $2 \times 2 \times 2 \times 2 \times 27$

$\Rightarrow$ $2^4 \times 3^2 \times 3$

$\therefore$ 432 should be multiplied by 3 so that the product is a perfect square.

25.

Sol. (c)

	64
6	4091
	36
124	491
	496
	–5

$4092 + 5 = (64)^2$

26.

Sol. (b)

$$\begin{array}{l} 5x + 2y = 13 \\ \underline{2x + 5y = 1} \\ 7x + 7y = 14 \end{array}$$

$\Rightarrow$ $x + y = 2$

27.

Sol. (c) Given, $2(3x - 5) + 6(x - 7) = 7(x + 5) - 15$

$\Rightarrow$ $6x - 10 + 6x - 42 = 7x + 35 - 15$

$\Rightarrow$ $12x - 7x = 20 + 52 \Rightarrow 5x = 72$

$\Rightarrow$ $x = 14.4$

28.

Sol. (a) Radius of each small lead ball = 2 cm

The required number of balls

$$= \frac{\frac{4}{3}\times\pi\times8\times8\times8}{\frac{4}{3}\times\pi\times2\times2\times2} = 64$$

29.

Sol. (a) Let the speed of the boat in still water be x kmph.

Let the speed of the stream be y kmph.

$(x + y)\ 3 = 48 \Rightarrow x + y = 16$ (1)

$(x - y)\ 4 = 40 \Rightarrow x - y = 10$ (2)

The speed of the boat in still water is given by $\frac{1}{2}$ (Its upstream speed + Its downstream speed)

$$= \frac{1}{2}(10+16) = 13\text{kmph}$$

30.

Sol. (b) 720 units = 6 cm

1 cm = 120 units

$\therefore$ K = 120

PART - III : PHYSICS & CHEMISTRY

1.

Sol. (a) The height of the mercury column in a barometer is determined by the **a**tmospheric pressure pressing down on the mercury in the reservoir.

As you go up a mountain, the atmospheric pressure decreases because there's less air above you. This reduced pressure pushes less on the mercury in the reservoir, so the mercury column falls, causing 'h' to decrease in the Partial Vacuum Barometer.

In the other barometer also, the atmospheric pressure decreases and the column height 'h' decreases, causing the trapped air to expand.

2.

Sol (c) The angle between the incident ray and the reflected ray is always **twice the angle of incidence** i.e. 2i.

When the mirror is inclined at 40°, the angle of incidence is 90° – 40°=50°

Therefore angle between incident and reflected rays = $2 \times i_1 = 2 \times 50° = 100°$.

When the mirror inclined at 50° the angle of incidence becomes 40°.

Angle between incident and reflected rays

$= 2 \times I_2 = 2 \times 40° = 80°$

Change = (Initial angle) - (Final angle)

= 100° – 80°=20°.

3.

Sol. (d) An echo is the sound that returns after reflecting off a surface. The total distance the sound travels is twice the distance to the reflecting surface,

Speed of sound (v) = 342 m/s and Time taken for the echo to return (t) = 3 s

Total distance traveled by the sound

= 342 m/s×3 s=1026 m.

Therefore, the distance to the reflecting surface is half of the total distance.

Distance of reflecting surface

= 1026 m÷2 = 513 m.

4.

Sol. (a) **Tube with a vacuum:** In a vacuum, there is no air resistance. All objects, regardless of their mass or size, fall with the same constant acceleration due to gravity (g).

Tube with air: Air resistance (also known as drag) is a force that opposes motion through the air, which reduces its net acceleration.

Since one ball is affected by air resistance and the other isn't, they will not reach the bottom at the same time or with the same speed. The ball in the vacuum will have a greater net acceleration and will reach the bottom first, with a higher speed.

5.

Sol. (d) A virtual image is an image formed by light rays that appear to diverge from a point, but do not actually pass through that point. Virtual images cannot be projected onto a screen.

(A) Plane mirror: A plane mirror always produces a virtual, upright, image of the same size as the object.

(B) Concave lens: A concave lens is a diverging lens. It always produces a virtual, upright, and diminished image, regardless of the object's position.

(C) Convex lens: A convex lens can produce a virtual, upright, and magnified image when the object is placed between the focal point and the optical centre of the lens.

6.

Sol. (b) This is a example of static electricity generated by friction.

When two different materials are rubbed against each other, electrons from one material are transferred to the other. The glass rod tends to lose electrons, and the silk cloth tends to gain electrons.

The glass rod acquires a net positive charge and the silk cloth acquires a net negative charge.

7.

Sol. (c) Friction is the force that opposes motion between two surfaces in contact. friction prevents us from slipping when we walk.

When you walk, you push backward on the ground with your foot. The ground pushes forward on your foot with a frictional force, which propels you forward.

The coefficient of friction for ice is very low, meaning the maximum frictional force it can provide is small. By taking small steps the friction increases relatively than what is provided in case of larger steps.

8.

Sol. (b) Pressure is defined as force per unit area (P=F/A). The force here is the weight of the lady, and the area is the surface area of the heel.

Force (Weight):

$F=m\times g=45\ kg\times 10\ m/s^2=450\ N$

Since the lady's weight is equally distributed on her two feet.

The total area is $2 \times 0.01\ m^2$

Pressure: $P = F/A = 450/(2 \times 0.01)$

$= 225 \times 100\ Pa = 22500\ Pa.$

9.

Sol. (b) This is a direct application of Newton's Third Law of Motion, which states that for every action, there is an equal and opposite reaction.

- Action: The duster, due to its weight, exerts a downward force on the table.
- Reaction: The table exerts an equal and opposite upward force on the duster.

10.

Sol. (c) The twinkling effect of stars is caused by the **refraction of light** as it passes through the Earth's atmosphere.

The atmosphere is in constant motion, with varying densities and temperatures, creating different layers with different refractive indices.

Stars: Stars are incredibly far away and appear as point sources of light. As the starlight passes through the turbulent atmosphere, it is continuously bent (refracted) in different directions. This constant change in the path of light makes the starlight appear to fluctuate in brightness, causing the twinkling effect.

Planets: Planets are much closer to Earth than stars. Even though they are also very far, they appear as extended sources of light, not points. They can be considered a collection of many point sources. When the light from a planet passes through the atmosphere, the light from one part of the planet might be bent away while the light from another part is bent towards the observer. These changes average out, and the total amount of light reaching the eye remains relatively constant, so planets do not appear to twinkle.

11.

Sol. (d) Silver conducts heat the fastest, so its other end will be the hottest. Glass conducts heat very slowly, so its other end will be the coolest.

12.

Sol. (a) Metals like copper have millions of free electrons that can move easily, so they conduct electricity very well. Electrolytes like salt water have ions, but there are far fewer of them compared to electrons in metals. That's why salt water conducts electricity, but much weaker than metals.

13.

Sol. (d) In candle I, less air goes inside the chimney, so the flame shakes and makes smoke.

14.

Sol. (b) Reaction happens only in (i) and (v) because Fe and Zn are more reactive than Cu.So, colour change and brown copper deposit are seen in (i) and (v) only

15.

Sol. (c) Sodium bicarbonate or potassium bicarbonate release CO_2 , CO_2, from cylinders cuts off oxygen and cools the fire, and sand can stop electrical fires, but water should never be used on cooking oil fires.

16.

Sol. (c) The caterpillar secretes a protein called fibroin which hardens on exposure to air and become silk fibres.

17.

Sol. (a) Usually petroleum and natural gas occur at the same place. Petroleum occurs as liquid, whereas natural gas is in the gaseous state above petroleum.

18.

Sol. (b) The minimum temperature at which a substance catches fire is called ignition temperature. The ignition temperature of sodium is very low. Hence, it catches fire easily at room temperature. It reacts vigorously with oxygen at room temperature. To prevent its spontaneous combustion, it is stored under kerosene. The correct answer is B.

19.

Sol. (a) In electroplating, the object to be coated is the cathode. So, it is connected to the negative terminal of the battery

20.

Sol. (b) Aluminium foil is prepared by beating it into sheets, i.e., property of malleability. Hence, aluminium foil is used for the given application.

PART - IV : BIOLOGY

1.

Sol. (b) Budding

Hydra reproduces asexually through budding, where a small bud forms and develops into a new individual.

2.

Sol. (c) Human

In humans, fertilization takes place inside the female body, which is called internal fertilization.

3.

Sol. (c) Hen

Hens are oviparous animals (egg-laying). Others listed are viviparous (give birth to young ones).

4.

Sol. (c) Yeast

Yeast ferments sugar to produce alcohol and carbon dioxide. It is widely used in the alcohol and baking industry.

5.

Sol. (a) Malaria

Malaria is caused by Plasmodium, a protozoan parasite, transmitted by the bite of female Anopheles mosquito.

6.

Sol. (c) Mushroom

Mushrooms are fungi but not microorganisms because they are visible to the naked eye.

7.

Sol. (d) Wildlife sanctuary

A wildlife sanctuary is an area where animals are protected in their natural habitats. Hunting is strictly prohibited here, and conservation of wild animals is the main focus.

8.

Sol. (c) Soil erosion

Trees hold the topsoil with their roots. Cutting them down (deforestation) leads to loosening of soil, causing erosion.

9.

Sol. (c) Tilling

Tilling (also called ploughing) loosens the soil to allow air and nutrients to reach plant roots.

10.

Sol. (c) Drip system

Drip system is a modern method of irrigation. Traditional methods include moat, chain pump, and dhekli.