CLASS TEST

S.No. : 01 SPME_A+B_050124

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GENERAL APTITUDE

MECHANICAL ENGINEERING

Date of Test : 05/01/2024

ANSWER KEY ➤

1.	(b)	7.	(d)	13.	(a)	19.	(c)	25.	(d)
2.	(c)	8.	(b)	14.	(b)	20.	(a)	26.	(b)
3.	(d)	9.	(a)	15.	(d)	21.	(b)	27.	(a)
4.	(a)	10.	(b)	16.	(d)	22.	(b)	28.	(d)
5.	(c)	11.	(b)	17.	(a)	23.	(d)	29.	(a)
6.	(a)	12.	(d)	18.	(d)	24.	(c)	30.	(d)

DETAILED EXPLANATIONS

2. (c)

As code must include all the three letters then pattern of the code word is *ABCX* where *X* can be any letter out of *A*, *B*, and *C*. So we can have the code word consisting of letters:

ABCA;

ABCB;

ABCC.

We can arrange letters in each of above 3 cases in $\frac{4!}{2!}$ number of ways (as each case has 4 letters out of which one is repeated twice), so total number of code words is $3 \times \frac{4!}{2!} = 36$.

3. (d)

Initial solution is "half water/half alcohol mix" means it's 50% (0.5) alcohol solution.

Let the portion replaced be x and the volume of initial solution be 1 unit.

Then the amount of alcohol after removal of a portion will be 0.5 $(1 - x)$ and the amount of alcohol added will be $\mathbf{0.25}x$, so total amount of alcohol will be $(1 - x) + 0.25x$. On the other hand as in the end 30% alcohol solution was obtained then the amount of alcohol in the end was 0.3×1.

So $0.5 (1 - x) + 0.25x = 0.3 \Rightarrow x = 0.8$, or 80%.

4. (a)

From figures, we conclude that 2, 3, 5 and 6 are adjacent to 1. Therefore, 4 lies opposite 1. Hence, when 4 is at the bottom, then 1 must be on the top.

5. (c)

Let the number of children in the lift is x

Now, $$\frac{6}{18} + \frac{10}{24} + \frac{x}{32} = 1$$

$$\frac{x}{32} = 1 - \frac{1}{3} - \frac{5}{12}$$

Maximum number of children that can board the lift $x = \frac{32}{4} = 8$ children

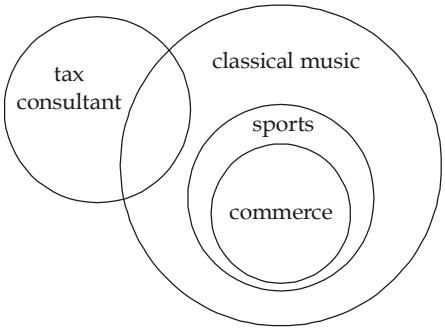
6. (a)

$$lb = 12$$
$$bh = 18$$
$$lh = 24$$

Multiplying the three equations,

$$(lbh)^2 = 12 \times 18 \times 24$$
$$= 2 \times 2 \times 3 \times 2 \times 3 \times 3 \times 2 \times 2 \times 2 \times 3$$
$$= (2)^6 \times (3)^4$$
$$lbh = (2)^3 \times (3)^2$$
$$= 8 \times 9 = \mathbf{72}$$

7. (d)



From the Venn diagram, we can see that only option (d) is possible.

8. (b)

Each person out of 4 has 6 floors (options) to get out of (since no one gets out on the ground floor), hence total ways is $6 \times 6 \times 6 \times 6 = 6^4 = 1296$.

9. (a)

Since 96% of the 20 kg watermelon is water, 4% of the 20 kg is non-water : (0.04) (20) = 0.8 kg
Since 95% of the post-evaporation watermelon is water, the remaining 5% must be composed of the 0.8 kg of non-water : $0.05x = 0.8$

$$\Rightarrow \qquad x = \frac{0.8}{0.05} = \frac{80}{5} = 16\,\text{kg}$$

10. (b)

$$2^x = 4^y = 8^z \Rightarrow 2^x = 2^{2y} = 2^{3z}$$

$$\Rightarrow \qquad x = 2y = 3z = k \text{ (say)}$$

Then $$xyz = \frac{k^3}{6} = 288 \Rightarrow k = 12$$

$$\therefore \qquad x = 12,\ y = 6,\ z = 4$$

$$\Rightarrow \qquad \frac{1}{2x} + \frac{1}{4y} + \frac{1}{8z} = \frac{11}{96}$$

11. (b)

The series will be of the form : 101, 104, 107.....995, 998.

It will have a total of 300 terms (999 – 100 + 1 = 900. Take $\frac{1}{3}$ of this, since only 1 term is there in every 3)

Now, $$\text{Sum} = \frac{(1^{\text{st}}\ \text{number} + n^{\text{th}}\ \text{number}) \times n}{2}$$

$$= \frac{(101 + 998) \times 300}{2}$$

$$= \frac{1099 \times 300}{2}$$

$$= 164{,}850$$

12. (d)

There are a total of 18 shirts : 8 blue and 10 non blue.

P (selecting at least 1 blue shirt) = 1 – P (selecting no blue shirts)

Assuming no replacement

P (selecting first non-blue shirt) = $\frac{10}{18}$

P (selecting second non-blue shirt) = $\frac{9}{17}$

P (selecting no blue shirts) = $\frac{10}{18}\times\frac{9}{17}=\frac{10}{34}$

$\therefore$ P (selecting at least 1 blue shirt) = $1-\left(\frac{10}{34}\right)=\frac{24}{34}=\frac{12}{17}$

13. (a)

Milk = m litres;

Water = w litres;

Cost of $(m + w)$ litres = 6.4 m;

Selling price of $(m + w)$ litres = 8 $(m + w)$.

Given that 6.4 m × 1.375 = 8 $(m + w) \Rightarrow \frac{w}{m}=\frac{1}{10}$.

14. (b)

Since the two semi circles are congruent, they intersect at the top of the arc.

We can divide this into 3 regions

I. A quarter circle with radius 2 (Area = $\frac{\pi\times2\times2}{4}=\pi$)

II. A square with side 2 (Area = 2 × 2 = 4)

III. Another quarter circle with radius 2 (Area = $\frac{x\times2\times2}{4}=\pi$)

Total = 4 × 4 = 16

Shaded Area = Total Area – I – II – III

$\therefore$ Shaded Area = 16 – π – 4 – π = 12 – 2π

15. (d)

Let the weight of 24% solution used be x grams, weight of alcohol in it would be 0.24x.

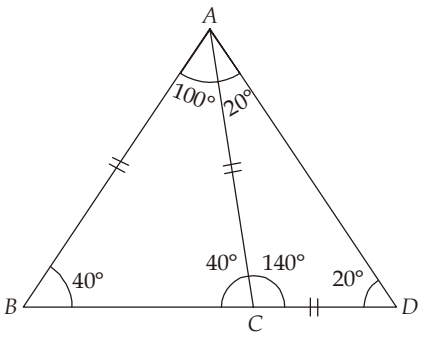
As in final solution strength decreased by $\frac{1}{3}$ thus it became $24\times\frac{2}{3}=16\%$.

Set the equation : 0.24x = 0.16 $(x + 200)$, the weight of 16% alcohol in $(x + 200)$ grams of new solution comes only from (equal to) 24% alcohol in x grams of strong (initial) solution, as there is 0 grams of alcohol in water (0% alcohol solution)

$\Rightarrow$ 0.08x = 32

$\Rightarrow$ x = 400

16. (d)



$$AB = AC = CD \Rightarrow \angle CAD = \angle CDA = 20°$$

and $\angle ABC = \angle ACB$

In ΔACD

$$\Rightarrow \angle ACD + \angle CAD + \angle CDA = 180°$$
$$\Rightarrow \angle ACD = 180° - 20° - 20° = 140°$$
$$\Rightarrow \angle ACB = 180° - 140° = 40° = \angle ABC$$

Similarly in ΔABC

$$\Rightarrow \angle BAC = 180° - 40° - 40° = 100°$$
$$\therefore \angle BAD = 100° + 20° = 120°$$

17. (a)

Let radius of in circle $= r \Rightarrow$ Radius of circumcircle $= 2r$

Difference in area $= \pi[(2r)^2 - (r)^2] = 2156$

$$\Rightarrow 3 \times \frac{22}{7} \times r^2 = 2156$$

$$\Rightarrow r^2 = \frac{2156 \times 7}{66}$$

$$\Rightarrow r = \sqrt{\frac{686}{3}}$$

Now, height of equilateral triangle $= 3r = \frac{\sqrt{3}}{2}a$ (where a is side of triangle)

$$\Rightarrow 3 \times \sqrt{\frac{686}{3}} = \frac{\sqrt{3}}{2}a$$

$$\Rightarrow a = 2\sqrt{686}$$

$$\therefore \text{Area of triangle} = \frac{\sqrt{3}}{4}a^2$$

$$= \frac{\sqrt{3}}{4} \times 4 \times 686 = 686\sqrt{3}\,\text{cm}^2$$

18. (d)

$$p^q = q^p$$

It has been given that $q = 9p$.

Substituting, we get,

$$p^{9p} = (9p)^p$$

$$(p^p)^9 = 9^p \times p^p$$
$$\Rightarrow \quad (p^p)^8 = 9^p$$
$$p^{8p} = 9^p$$

Raising the power to $\frac{1}{p}$ on the both sides, we get,

$$p^8 = 9$$
$$p = \sqrt[8]{9}$$

19. (c)

Let d = Total distance

divide each case into 3 segments:

1. first 50 km
2. next 24 km
3. last d – 74 km

let s = Speed of train

for segment 1, in each case, time = $\frac{50}{s}$

for segment 3, in each case, time = $\frac{d-74}{\left(\frac{3s}{4}\right)}$

Therefore, segment 2 must account for the 10 minute total time difference between the two cases

$$\frac{24}{\left(\frac{3s}{4}\right)} - \frac{24}{s} = \frac{1}{6}$$

$$\Rightarrow \quad s = 48 \text{ km/hr}$$

20. (a)

Let cost price be c and selling price be s

$$s = 1.2c$$
$$\Rightarrow \quad s + 1.2 = 1.4c$$
$$\Rightarrow \quad 1.2c + 1.2 = 1.4c$$
$$\Rightarrow \quad c = 6$$
$$\Rightarrow \quad s = 7.2$$

21. (b)

AB = 54 cm and ΔANM, ΔOCP, ΔOPX are equilateral triangles.

$$\Rightarrow \quad MN = MR = NO = OP = PQ = QR = \frac{54}{3} = 18 \text{ cm}$$

Thus, MNOPQRM is regular hexagon with side 18 cm

$$\therefore \quad \text{Area of MNOPQRM} = \frac{3\sqrt{3}}{2}(\text{side})^2$$

$$\frac{3\sqrt{3}}{2}(18)^2 = 486\sqrt{3} \text{ sq.cm.}$$

22. (b)

The series is an *A.P.* with common difference, $d = -66 - (-64) = -2$

First term, $a = -64$ and last terms $a_n = -100$

n^{th} term of the series, $a_n = a + (n-1)d$

$\Rightarrow \quad -100 = -64 + (n-1)(-2)$

$\Rightarrow \quad n - 1 = \dfrac{-36}{-2} = 18$

$\Rightarrow \quad n = 18 + 1 = 19$

$\therefore \quad \text{Sum} = \dfrac{n}{2}(a + a_n)$

$= \dfrac{19}{2} \times (-64 - 100) = \dfrac{19}{2} \times (-164)$

$= 19 \times (-82) = -1558$

23. (d)

Total books = 240

I. 80 books at the rate of ₹x per book

II. 78 books at the rate of ₹$(x + a)$ per book

III. $[240 - (78 + 80)] = 82$ books at the rate of ₹$(x - a)$ per book.

Total sale = ₹14384

Now, $80 \times x + 78(x + a) + 82(x - a) = 14384$

$240x - 4a = 14384$

$60x - a = 3596 \quad \ldots.(1)$

This equation has two variables and only one equation. So it can be solved by putting option value.

Putting, $x = 60$

$60 \times 60 - a = 3596$

$a = 4$

Hence,

Maximum price of book = 60 + 4 = ₹64/book

Minimum price of book = 60 – 4 = ₹56/book

Note : Reason behind putting $x = 60$ is that in any option a value is not more that 4. According to that nearest integer value of x should be 60.

24. (c)

An integer is divisible by 9 if the sum of its digits is divisible by 9.

Since the sum of first 9 natural number is $\dfrac{9(9+1)}{2} = 45$, which is divisible by 9, it must be the case that the sum of the two integers that we don't pick to form the seven digit number is divisible by 9.

Number of ways of choosing two integers from 9 integers : ${}^9C_2 = 36$

Number of two digit pairs whose sum is divisible by 9 : {(1, 8), (2, 7), (3, 6), (4, 5)} = 4

Simply take the ratio to get the probability that the seven digit number so formed is divisible by 9 : $\dfrac{4}{36} = \dfrac{1}{9}$

25. (d)

Let us assume the amount of work to be finished = LCM of {10, 12, 15, 18} = 180 units.

The amount of work which A can complete in a day = $\frac{180}{10}$ = 18 units.

The amount of work which B can complete in a day = $\frac{180}{12}$ = 15 units.

The amount of work which C can complete in a day = $\frac{180}{15}$ =12 units.

The amount of work which D can complete in a day = $\frac{180}{18}$ =10 units.

It is given that 50 percent of the total work gets completed after 3 days. Therefore, we can say that 90 units of work was completed in 3 days.

Let us check options.

Option (a) : Each of them worked for exactly 2 days.

In this case amount of work completed = 2 × (10 + 15 + 12 + 18) = 110 units.

Option (b) : B and D worked for 1 day each, C worked for 2 days and A worked for all 3 days. In this case amount of work completed = 1 × (10 + 15) + 2 × (12) + 3 × (18) = 103 units.

Option (c) : A and C worked for 2 days each, D worked for 1 day and B worked for all 3 days. In this case amount of work completed = 2 × (18 + 12) + 1 × (10) + 3 × (15) = 115 units.

Option (d) : A and C worked for 1 day each, B worked for 2 days and D worked for all 3 days. In this case amount of work completed = 1 × (18 + 12) + 2 × (15) + 3 × (10) = 90 units.

Therefore, we can say that option (d) is the correct answer.

26. (b)

The possible ways are

i. (25 × 4)
ii. (22 × 4 + 2 × 6)
iii. (19 × 4 + 4 × 6)
iv. (16 × 4 + 6 × 6)
v. (13 × 4 + 8 × 6)
vi. (10 × 4 + 10 × 6)
vii. (7 × 4 + 12 × 6)
viii. (4 × 4 + 14 × 6)
ix. (1 × 4 + 16 × 6)

Hence there are total 9 ways.

27. (a)

The terms x, 17, $3x - y^2 - 2$ and $3x + y^2 - 30$ are in A.P.

Common difference : $d = 17 - x$ .....(i)

$d = 3x - y^2 - 19$ .....(ii)

$d = 2y^2 - 28$ .....(iii)

From equation (i) & (ii),

$17 - x = 3x - y^2 - 19$

$\Rightarrow \quad 4x - y^2 = 36$ .....(iv)

From equation (ii) & (iii),

$$3x - y^2 - 19 = 2y^2 - 28$$

$$\Rightarrow \quad x - y^2 = -3 \qquad \text{.....(v)}$$

Solving equation (iv) & (v), we get :

$$x = 13,\ y^2 = 16$$

$$\Rightarrow \quad \text{Terms are} = 13, 17, 21, 25$$

$$\therefore \quad \text{Sum} = 13 + 17 + 21 + 25 = 76$$

Which is divisible by 2. (among the given options)

28. (d)

Let Manufacturing Cost of the product = ₹100

$$\Rightarrow \text{Maximum Retail Price (MRP)} = 100 + \frac{55}{100} \times 100 = ₹\,155$$

Retailer gives 10% discount on MRP

$$\Rightarrow \text{Retailer's selling price} = 155 - \frac{10}{100} \times 155 = ₹\,139.5$$

It is given that the Retailer earned 23% profit on his purchase price, say ₹x

$$\Rightarrow \quad \frac{123x}{100} = 139.5$$

$$\Rightarrow \quad x = \frac{13950}{123} = 113.41$$

Now, the purchase price of Retailer = x = selling price of Manufacturer

$\therefore$ Profit earned by Manufacturer = 113.41 – 100 = ₹13.41 ≈ 13%

29. (a)

Point $A(-1, 7)$ does not lie outside the circle. So, point can lie on the circle or inside the circle. Distance of A from center = 5 units. So, for the points to lie inside the circle, the distance of given points from center has to be less than 5 units.

Point (i) – Distance between (0, 7) and (2, 3) = $\sqrt{20}$, which is less than 5

Point (ii) – Distance between (5, –1) and (2, 3) = 5

Point (iii) – Distance between (–2, 7) and (2, 3) = $4\sqrt{2}$, which is more than 5

So, option (a).

30. (d)

At least 3 out of 4 throws means 3 or 4 throws

So,
$$P = {}^4C_3 \times \left(\frac{1}{5}\right)^3 \times \frac{4}{5} + \left(\frac{1}{5}\right)^4 = \frac{17}{5^4}.$$

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