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REASONING AND APTITUDE

MECHANICAL ENGINEERING

Date of Test : 20/02/2025

ANSWER KEY ➤

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

DETAILED EXPLANATIONS

1. (c)

$$C = \frac{A+D}{2},\ D > B > C$$

$$B = \frac{A+E}{2}$$

$$A + D = 2C$$

$$A + E = 2B$$

Since $B > C \Rightarrow E > D$

$$C < B < D < E$$

Since C is average of A and D, so $A < C$

$\Rightarrow$ The correct sequence is $A < C < B < D < E$

The middle number is B.

2. (a)

Let the age of Rohini in 2014 is x years,

His brother's age = $x - 6$ years

In 2004,

$$3(x - 6 - 10) = x - 10$$
$$3x - 48 = x - 10$$
$$2x = 38$$
$$x = 19$$

Rohini's age in 2014 is 19 years.

$\Rightarrow$ She was born in 2014-19 = 1995

3. (b)

Let, The full fare = ₹ x

The reservation charge = ₹ y

$$x + y = 362$$

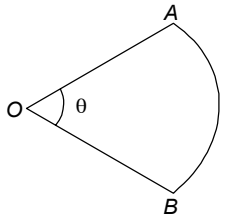
$$\frac{3}{2}x + 2y = 554$$

From here, $x = 340$ and $y = 22$

$\Rightarrow$ Reservation charge is ₹ 22.

4. (b)

The area of sector $OAB = \pi r^2 \times \frac{\theta}{360^\circ} = \pi(10)^2 \times \frac{\theta}{360^\circ} = 80$



From here, $\left(\frac{\theta}{360^\circ}\right) = \frac{80}{\pi \times (10)^2}$

$$\text{Length of arc } AB = 2\pi r \times \frac{\theta}{360^\circ} = 2\pi \times 10 \times \frac{80}{\pi \times (10)^2} = 16 \text{ cm}$$

Perimeter of platform = 16 + 10 + 10 = 36 cm
Length of the wire required = 3 × 36 = 108 cm

5. (a)

According to the given information,

$$\frac{23}{100} = \frac{10 \times 2 + 20 \times 3 + 30 \times x}{100 \times (2 + 3 + x)}$$

$$23 = \frac{20 + 60 + 30 \times x}{5 + x}$$

$$23(5 + x) = 80 + 30x$$
$$7x = 35$$
$$x = 5$$

6. (d)

$$(7 + 2) \times 4 = 36$$
$$(6 + 8) \times 3 = 42$$
$$(9 + 4) \times x = 26$$

From here, $x = 2$

7. (c)

The number of boys in 6^{th} class

$$= \frac{20}{100} \times \frac{3}{5} \times 1000 = 120$$

The number of boys in 9^{th} class

$$= \frac{18}{100} \times \frac{3}{5} \times 1000 = 108$$

Total boys in 6^{th} & 9^{th} class= 120 + 108 = 228

8. (c)

Series follows the pattern,

$$a_{n+1} = a_n \times a_{n+2}$$
$$a_2 = 4 = 2 \times 2$$
$$a_3 = 2 = 4 \times 0.5$$
$$a_4 = 0.5 = 2 \times 0.25$$
$$a_5 = 0.25 = 0.5 \times 0.5$$
$$a_6 = 0.5 = 0.25 \times x$$

$$\Rightarrow \quad x = \frac{0.5}{0.25} = 2$$

9. (c)

Work done by the waste pipe in 1 min = $\frac{1}{20}-\left(\frac{1}{30}+\frac{1}{36}\right)=-\frac{1}{90}$ (–ve means emptying)

$\therefore$ Volume of $\frac{1}{90}$ part = 50 litre

$\Rightarrow$ Volume of tank = 50 × 90 = 4500 litre

10. (b)

Let the quantity of wine in the cast originally be x litres.

Then, quantity of wine left in the cast after 5 operation

$$= \left[x\left(1-\frac{24}{x}\right)^5\right]\text{litres}$$

$\therefore$ $$\frac{x\left(1-\frac{24}{x}\right)^5}{x} = \frac{32}{32+211}=\frac{32}{243}$$

$\Rightarrow$ $$\left(1-\frac{24}{x}\right)^5 = \left(\frac{2}{3}\right)^5$$

$\Rightarrow$ $$x = 72 \text{ litres}$$

11. (a)

First month's saving = ₹ 20

Second month's saving = ₹ 20 + 4

Saving after n months = ₹ 20 + $(n-1)4$

$$\frac{n}{2}(2\times 20+(n-1)\times 4) \geq 1000$$

$$40n + n(n-1)\times 4 \geq 2000$$

$$40n + 4n^2 - 4n \geq 2000$$

$$4n^2 + 36n - 2000 \geq 0$$

$$n \geq 18.30, -27.30$$

$\Rightarrow$ $n = 19$

$\Rightarrow$ After 19 months his savings will be greater than ₹ 1000.

12. (b)

Let the cost prices are x, $2x$, $4x$

Let the quantities are $2y$, $5y$, $2y$

Total cost price = $2xy + 10xy + 8xy = 20xy$

$$\text{Total profit} = \frac{10}{100}\times 2xy+\frac{20}{100}\times 10xy+\frac{25}{100}\times 8xy$$

$$= 0.2xy + 2xy + 2xy = 4.2xy$$

$$\text{Profit percentage} = \frac{4.2xy}{20xy}\times 100 = 21\%$$

13. (a)

According to given data,

$$20 \times t + 12(10 - t) = 150$$

$$8t + 120 = 150$$

$$t = \frac{30}{8} = \frac{15}{4}$$

The ratio of distance,

$$20 \times \frac{15}{4} \; : \; 12 \times \left(10 - \frac{15}{4}\right)$$

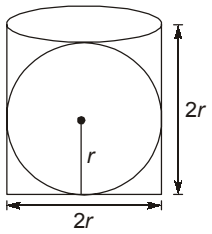
$$75 : 75$$

$$1 : 1$$

14. (a)

Volume of total wood $= \pi r^2 \times h$

$= \pi r^2 \times 2r$ $[\because h = \text{diameter} = 2r]$



The radius of largest sphere possible = r

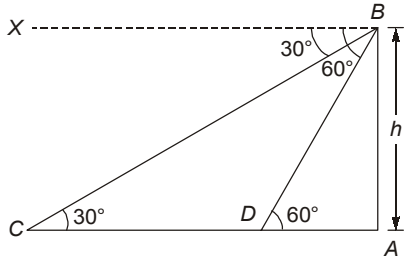
volume of sphere = volume of wood used

$$= \frac{4}{3}\pi r^3$$

Volume of wood wasted $= 2\pi r^3 - \frac{4}{3}\pi r^3 = \frac{2}{3}\pi r^3$

Required ratio $= \frac{4}{3}\pi r^3 : \frac{2}{3}\pi r^3 = 2:1$

15. (a)



From figure, $\tan 30° = \frac{h}{AC}$

$$AC = h\sqrt{3} \quad \text{...(i)}$$

$$\tan 60° = \frac{h}{AD}$$

$$AD = \frac{h}{\sqrt{3}} \quad \text{...(ii)}$$

Also, $CD = AC - AD$

$$= h\sqrt{3} - \frac{h}{\sqrt{3}} = \frac{2h}{\sqrt{3}}$$

Time taken to cover CD is 10 min,

$$\text{we know speed} = \frac{\text{Distance}}{\text{time}}$$

$$\therefore \quad S = \frac{\frac{2h}{\sqrt{3}}}{10} = \frac{h}{5\sqrt{3}}$$

$$\therefore \text{ time taken to cover, } AD = \frac{(\text{Distance } AD)}{\text{Speed}} = \frac{\left(\frac{h}{\sqrt{3}}\right)}{\frac{h}{(5\sqrt{3})}} = 5 \text{ minutes}$$

16. (c)

Probability that either one of them is lying

$$= \frac{90}{100}\times\frac{20}{100} + \frac{10}{100}\times\frac{80}{100}$$

$$\text{Chances that he is first one} = \frac{\frac{10}{100}\times\frac{80}{100}}{\frac{90}{100}\times\frac{20}{100} + \frac{10}{100}\times\frac{80}{100}} \times 100 = \frac{\frac{800}{10000}}{\frac{1800}{10000} + \frac{800}{10000}} = \frac{800}{2600} = \frac{8}{26} = \frac{4}{13}$$

17. (c)

Let the number of trucks to be used initially = x

Let capacity of one truck = y

$$xy = 60$$

$$(x + 4)(y - 0.5) = 60$$

$$xy + 4y - 0.5x - 2 = 60$$

$$4y - 0.5x - 2 = 0 \qquad \because xy = 60$$

$$4\left(\frac{60}{x}\right) - 0.5x - 2 = 0$$

$$240 - 0.5x^2 - 2x = 0$$

$$x^2 + 4x - 480 = 0$$

$$x = 20, -24$$

By neglecting the negative value, we get, $x = 20$.

18. (b)

Let the cost price of the item = ₹ x

$$\text{selling price} = x \times \frac{125}{100} = 1.25x$$

$$\text{discount} = 25\%$$

$$\Rightarrow \quad \text{marked price} = 1.25x \times \frac{100}{75} = ₹\frac{5}{3}x$$

$$\text{New rate of discount} = 10\%$$

$$\text{New selling price} = \frac{5x}{3} \times \frac{90}{100} = ₹\frac{3x}{2}$$

$$\text{New profit} = \frac{3x}{2} - x = \frac{x}{2}$$

$$\text{Profit percentage} = \frac{x/2}{x} \times 100 = 50\%$$

19. (d)

Let the number of fruits be $2k$, $5k$ and $8k$

Given, $5k - 2k$ = multiple of 6 and 8

LCM of 6 and 8 is 24

Let's say $5k - 2k = 24n$

$3k = 24n$

For k to be a natural number and have minimum value, n should be equal to 1

$3k = 24$

Or $k = 8$

Hence, the minimum number of fruits = $2k + 5k + 8k = 15 \times 8 = 120$

20. (c)

Given, $x^2 + 5x - 7 = 0$ has roots a and b. We know that,

Sum of roots in a quadratic equation = $a + b = \frac{(-5)}{1} = -5$

Product of the roots = $ab = \frac{(-7)}{1} = -7$.

Now, The second equation $2x^2 + px + q = 0$ has roots $a + 1$ and $b + 1$.

Sum of the roots = $a + 1 + b + 1 = a + b + 2 = \frac{(-p)}{2} = -5 + 2 \Rightarrow -3 = \frac{(-p)}{2} \Rightarrow -p = -6 \Rightarrow p = 6$

Product of the roots = $(a + 1)(b + 1) = ab + a + b + 1 = \frac{q}{2}$.

We know the values of ab and $a + b$. Substituting this, we get, $-7 + (-5) + 1 = \frac{q}{2} \Rightarrow q = -22$.

$\therefore \quad p + q = 6 - 22 = -16$

21. (a)

First, the n^{th} term of *L.H.S* need to be defined by observing the pattern :–

It is $\log_{2^n} 2.2^n$

$\log_2 4 \times \log_4 8 \times \log_8 16 \times \ldots\ldots\ldots\ldots \log_{2^n} 2.2^n = 49$

Whenever solving a logarithm equation, generally one should approach towards making the base same.

Making the base 2 :–

$$\log_2 4 \times \frac{\log_2 8}{\log_2 4} \times \frac{\log_2 16}{\log_2 8} \times \ldots\ldots \frac{\log_2 2.2^n}{\log_2 2^n}$$

$$\log_{2^n} 2 + \log_{2^n} 2^n = 49$$

$\Rightarrow \quad 1 + n = 49$

$\Rightarrow \quad n = 48$

22. (a)

Ways to select 2 females $= {}^5C_2$

Ways to select 1 male $= {}^7C_1$

$\therefore$ Required probability $= \frac{{}^5C_2 \times {}^7C_1}{{}^{12}C_3} = \frac{7}{22}$

23. (a)

Sum of angles in n sided polygon = $(n - 2)\,180°$

In hexagon $n = 6$

$\therefore \quad$ Sum $= (6 - 2)180 = 720°$

Each angle $= \frac{720°}{6} = 120°$

Now, in ΔCDE. $CD = DE$, so it is an isosceles triangle. The angle at $D = 120°$, so other two angles must be 30° each. So $\angle DEC = \angle DCE = 30°$.

Now, $\angle CDG = \angle DCG = 30°$

$\therefore \quad \angle DGC = 180° - 30° - 30° = 120°$

$\angle DGE = 180° - \angle DGC = 180° - 120° = 60°$

24. (a)

With no restrictions, the six children can be arranged in 6! ways i.e. 720 ways.

In all these arrangements it is just as likely for E to be on the left of F as it is for E to be on the right of F.

Therefore, exactly half must have E to the right of F, and exactly half must have E to the left of F.

Therefore, exactly $\frac{720}{2} = 360$ of the arrangements have E to the left of F.

25. (c)

So, $(13^7 - 7^7) + (2^6 - 4^6)$, both are divisible by 6

$\Rightarrow$ Remainder $= -2 + 6 = 4$

$(a^n - b^n)$ is divisible by $(a - b)$

$(a^n - b^n)$ is divisible by $(a + b)$ if 'n' is even natural number

26. (d)

$$\text{SP} = 1026$$
$$\text{Profit} = 14\%$$
$$\text{CP} = \frac{1026}{1 + 0.14} = \text{Rs.}900$$

If it had been sold for 693 then,

$$\text{Loss} = 900 - 693 = \text{Rs. } 207$$

27. (c)

Suppose, the quantity sold at loss be y kg.

Let CP per kg = x

$$\text{Total SP} = 1.1 \times (20 - y)x + 0.95 \times y \times x$$
$$= (22 - 1.1y + 0.95y) \times x = (22 - 0.15y) \times x = 1.08x \times 20$$
$$22 - 0.15y = 21.6$$
$$y = \frac{0.4}{0.15} = 2.67 \text{ kg}$$

28. (d)

2	11880
2	5940
2	2970
3	1485
3	495
3	165
5	55
11	11
	1

$$11880 = 2^3 \times 3^3 \times 5 \times 11$$

$$\text{Sum of all factors} = \frac{(2^4 - 1)(3^4 - 1)(5^2 - 1)(11^2 - 1)}{(2 - 1)(3 - 1)(5 - 1)(11 - 1)}$$

$$= \frac{15 \times 80 \times 24 \times 120}{1 \times 2 \times 4 \times 10} = 43200$$

Since unity is excluded,
The net sum of all factors = 43200 – 1 = 43199

29. (d)

Let equal sides of the isosceles triangle be x,

Then $x^2 + x^2 = 10^2$

$$x = 5\sqrt{2}\text{ cm}$$

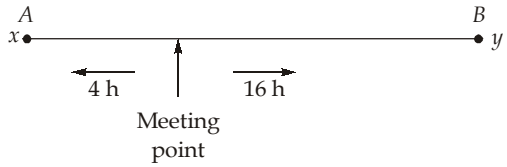
So, $$\text{Final area} = 8 \times \left(\frac{1}{8} \times \pi \times 10^2 - \frac{1}{2} 5\sqrt{2} \times 5\sqrt{2}\right)$$

$$= \pi \times 10^2 - 4 \times 25 \times 2$$

$$= 100\pi - 200$$

$$\text{Area} = 114.16\text{ cm}^2$$

30. (a)



In this case, $$\frac{S_1}{S_2} = \frac{\sqrt{T_2}}{\sqrt{T_1}}$$

$$\frac{40}{S_2} = \frac{\sqrt{4}}{\sqrt{16}}$$

$$S_2 = 80\text{ kmph}$$

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