

2022 - 23



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### CLASS 11 (PCM)

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**PAPER CODE**

**UN487**



**UCN/QP-11(PCM)/01**



**01** If  $X = \{4^n - 3n - 1 : n \in \mathbb{N}\}$  and  $Y = \{9(n - 1) : n \in \mathbb{N}\}$ , where  $\mathbb{N}$  is the set of natural numbers. then  $X \cup Y$  is equal to

- (A)  $X$  (B)  $Y$   
(C)  $\mathbb{N}$  (D)  $Y - X$

**02** If  $f : A \rightarrow B$ ,  $g : B \rightarrow C$  are functions such that  $g \circ f : A \rightarrow C$  is onto, then

- (A)  $f$  is onto  
(B)  $g$  is onto  
(C) both  $f, g$  are onto  
(D) neither  $f$  nor  $g$  is onto

**03** If  $-3 + ix^2y$  and  $x^2 + y + 4i$  are conjugate complex numbers, then  $x =$

- (A)  $0$  (B)  $\pm 1$   
(C)  $\pm 3$  (D)  $\pm 4$

Space for rough work

- 04 Let  $a, b, c, d \in \mathbb{R}$ . If the equations  $2bx^2 + 3cx - d = 0$  and  $2ax^2 + 3bx + 4c = 0$  have a common root and

$$\frac{4bc + ad}{k(b^2 - ac)} = \frac{bd + 4c^2}{4bc + ad}, \text{ then } k =$$

- (A)  $\frac{9}{2}$  (B)  $\frac{2}{9}$   
(C)  $\frac{1}{9}$  (D)  $\frac{1}{3}$

- 05 The number of natural numbers less than 7,000 which can be formed by using the digits 0, 1, 3, 7, 9 (repetition of digits allowed) is equal to

- (A) 250 (B) 374  
(C) 372 (D) 375

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**06**

Number of ways of forming a committee of 6 members out of 5 Indians, 5 Americans and 5 Australians such that there will be at least one member from each country in the committee is

- (A) 3375 (B) 4375  
(C) 3875 (D) 4250

**07**

Let  $S_k = \frac{1+2+3+\dots+k}{k}$ , If  $S_1^2 + S_2^2 + \dots + S_{10}^2 = \frac{5}{12}A$ ,

then A =

- (A) 303 (B) 283  
(C) 156 (D) 301

**08**

The coefficient of  $x^7$  in the expansion of  $(1 - x - x^2 + x^3)^6$  is

- (A) -144 (B) 132  
(C) 144 (D) -132

Space for rough work

09 If  $x_1, x_2, \dots, x_n$  and  $\frac{1}{h_1}, \frac{1}{h_2}, \dots, \frac{1}{h_n}$  are two A.P.s such that  $x_3 = h_2 = 8$  and  $x_8 = h_7 = 20$ , then  $x_5 h_{10} =$

- (A) 2560 (B) 2650  
(C) 3200 (D) 1600

10  $\lim_{x \rightarrow 0} \frac{x \cot(4x)}{\sin^2 x \cot^2(2x)} =$

- (A) 2 (B) 0  
(C) 4 (D) 1

11 If  $f(x) = \begin{cases} ax + b & \text{if } x \leq 1 \\ ax^2 + c & \text{if } 1 < x \leq 2 \\ \frac{dx^2 + 1}{x} & \text{if } x \geq 2 \end{cases}$

is differentiable on  $\mathbb{R}$ , then  $ad - bc =$

- (A) 0 (B) 1 (C) -1 (D) 2

Space for rough work



14 
$$\frac{\sin(-660^\circ)\tan(1050^\circ)\sec(-420^\circ)}{\cos(225^\circ)\operatorname{cosec}(315^\circ)\cos(510^\circ)}$$

(A)  $\frac{\sqrt{3}}{4}$       (B)  $\frac{\sqrt{3}}{2}$       (C)  $\frac{2}{\sqrt{3}}$       (D)  $\frac{4}{\sqrt{3}}$

15 If  $\cos(\alpha + \alpha) = \frac{3}{5}$ ,  $\sin(\alpha - \beta) = \frac{5}{13}$  and  $0 < \alpha, \beta < \frac{\pi}{4}$ ,  
then  $\tan(2\alpha) =$

(A)  $\frac{21}{16}$       (B)  $\frac{63}{52}$       (C)  $\frac{33}{52}$       (D)  $\frac{63}{16}$

16 If  $\cos A = -\frac{60}{61}$  and  $\tan B = -\frac{7}{24}$  and neither A nor B is

in the second quadrant, then the angle  $\left(A + \frac{B}{2}\right)$  lies in  
the quadrant

(A) 1                                      (B) 2  
(C) 3                                      (D) 4

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Space for rough work

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**17** If  $\sin B = \frac{1}{5} \sin(2A + B)$ , then  $\frac{\tan(A+B)}{\tan A}$  is equal to

- (A)  $\frac{5}{3}$       (B)  $\frac{2}{3}$       (C)  $\frac{3}{2}$       (D)  $\frac{3}{5}$

**18** In  $\Delta ABC$ , if  $a \cos^2 \frac{C}{2} + c \cos^2 \frac{A}{2} = \frac{3b}{2}$  then  $a, b, c$  are in

- (A) A.P      (B) G.P  
(C) H.P      (D) none

**19** A pole of height  $h$  stands at one-corner of a park in the shape of an equilateral triangle. If  $\alpha$  is the angle which the pole subtends at the midpoint of the opposite side, the length of each side of the park is

- (A)  $\left(\frac{\sqrt{3}}{2}\right) h \cot \alpha$       (B)  $\left(\frac{2}{\sqrt{3}}\right) h \cot \alpha$   
(C)  $\left(\frac{\sqrt{3}}{2}\right) h \tan \alpha$       (D)  $\left(\frac{2}{\sqrt{3}}\right) h \tan \alpha$

Space for rough work



20 If  $\Delta ABC$  has vertices  $A(-1, 7)$ ,  $B(-7, 1)$  and  $C(5, -5)$ , then its orthocenter has coordinates:

(A)  $\left(-\frac{3}{5}, \frac{3}{5}\right)$  (B)  $(-3, 3)$

(C)  $\left(\frac{3}{5}, -\frac{3}{5}\right)$  (D)  $(3, -3)$

21 Which of the following is a tautology ?

(A)  $(\sim p) \wedge (p \vee q) \rightarrow q$  (B)  $(q \rightarrow p) \vee \sim (p \rightarrow q)$

(C)  $(\sim q) \vee (p \wedge q) \rightarrow q$  (D)  $(p \rightarrow q) \wedge \sim (q \rightarrow p)$

22 The equation of a tangent to the parabola,  $x^2 = 8y$ , which makes an angle  $\theta$  with the positive direction of X-axis is:

(A)  $y = x \tan\theta + 2 \cos\theta$

(B)  $y = x \tan\theta - 2 \cos\theta$

(C)  $x = y \cot\theta + 2 \tan\theta$

(D)  $x = y \cot\theta - 2 \tan\theta$

Space for rough work

**23** Consider the two sets:

$A = \{m \in \mathbb{R} : \text{both the roots of } x^2 - (m + 1)x + m + 4 = 0 \text{ are real}\}$  and  $B = [-3, 5)$

Which of the following is not true ?

(A)  $A - B = (-\infty, -3) \cup (5, \infty)$

(B)  $A \cap B = \{-3\}$

(C)  $B - A = (-3, 5)$

(D)  $A \cup B = \mathbb{R}$

**24** Let  $A(2, 3, 5)$ ,  $B(-1, 3, 2)$  and  $C(\lambda, 5, \mu)$  be the vertices of a  $\Delta ABC$ . If the median through  $A$  is equally inclined to the coordinate axes, then

(A)  $5\lambda - 8\mu = 0$

(B)  $8\lambda - 5\mu = 0$

(C)  $10\lambda - 7\mu = 0$

(D)  $7\lambda - 10\mu = 0$

**25**  $\log_{10} \tan 40^\circ + \log_{10} \tan 41^\circ + \dots + \log_{10} \tan 50^\circ = ?$

(A) 1

(B) 0

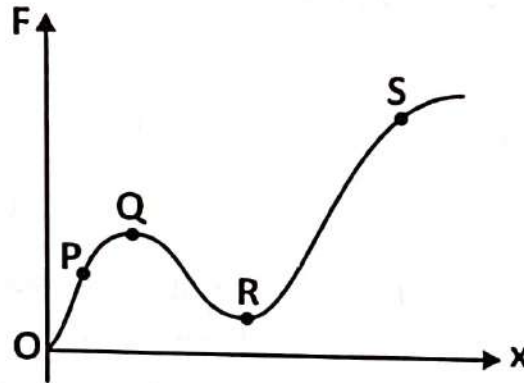
(C) -1

(D) none

Space for rough work

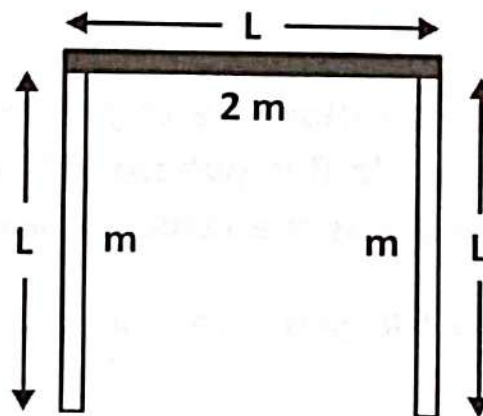
- 26** Identify a correct statement.
- (A) When the total area of the acceleration-time graph is negative, it always mean that the final velocity of the particle is negative.
  - (B) When the total area of the velocity-time graph is negative, it always mean that the final displacement of the particle is negative.
  - (C) When the total area of the velocity-time graph is negative, it may happen that the particle returns to its original position.
  - (D) When the total area of the acceleration-time graph is negative, it may happen that the final velocity of the particle is zero.
- 27** A person who weighs 800 N steps onto a scale that is on the floor of an elevator car. If the elevator accelerates upward at a rate of  $5 \text{ m/s}^2$ , what will the scale read ?
- (A) 400 N
  - (B) 800 N
  - (C) 1000 N
  - (D) 1200 N
- 28** A bullet of mass 0.01 kg is fired horizontally into a 4 kg wooden block at rest on a horizontal surface. The coefficient of kinetic friction between the block and the surface is 0.25. The bullet remains embedded in the block and the combination moves 20 m before coming to rest. With what speed did the bullet strike the block ?
- (A) 157.16 m/s
  - (B) 173.28 m/s
  - (C) 185.65 m/s
  - (D) 198.24 m/s

- 29 The diagram given below represents the applied force per unit area ( $F$ ) with the strain ( $x$ ) produced in a thin wire of uniform cross-section in the curve shown.



The region in which the wire behaves like a viscous liquid is

- (A) PQ      (B) QR      (C) RS      (D) OP
- 30 Three thin, uniform rods each of length  $L$  are arranged in the shape of an inverted U.



The two rods on the arms of the U each have mass  $m$ , the third rod has mass  $2m$ . How far below the midpoint of the horizontal rod is the center of mass of this assembly ?

- (A)  $\frac{L}{8}$       (B)  $\frac{L}{4}$       (C)  $\frac{3L}{8}$       (D)  $\frac{L}{2}$

**31** The unit of length convenient on the atomic scale is known as an angstrom and is denoted by Å :  $1 \text{ \AA} = 10^{-10} \text{ m}$ . The size of a hydrogen atom is about  $0.5 \text{ \AA}$ . What is the total atomic volume in  $\text{m}^3$  of a mole of hydrogen atoms ?

- (A)  $2.95 \times 10^{-5} \text{ m}^3$       (B)  $3.16 \times 10^{-7} \text{ m}^3$   
(C)  $5.74 \times 10^{-9} \text{ m}^3$       (D)  $8.01 \times 10^{-11} \text{ m}^3$

**32** Two identical balls X and Y are thrown simultaneously from the same point with the same speed at different angles. Ball X is thrown at  $60^\circ$  with the horizontal and it takes 4 s to reach a point at a horizontal distance of 40 m. If the ball Y is thrown at  $30^\circ$ , then

- (A) it travels a horizontal distance of 40 m.  
(B) it takes 2 s to reach the ground.  
(C) both the balls reach the ground at the same instant.  
(D) both (A) and (B)

**33** If  $g_0$  is the acceleration due to gravity at poles, then its value at a latitude  $\theta$  is (where  $\omega$  is the angular speed of rotation and  $R$  is the radius of earth).

- (A)  $g = g_0 - \omega^2 R \cos \theta$       (B)  $g = g_0 - \omega^2 R \sin \theta$   
(C)  $g = g_0 - \omega^2 R \cos^2 \theta$       (D)  $g = g_0 - \omega^2 R \sin^2 \theta$

Space for rough work

**34** A hemispherical bowl just floats without sinking in a liquid of density  $1.2 \times 10^3 \text{ kg m}^{-3}$ . If outer diameter and the density of the bowl are 1 m and  $6 \times 10^3 \text{ kg m}^{-3}$  respectively, then the inner diameter of the bowl will be

- (A) 0.93 m                      (B) 0.2 m  
(C) 0.43 m                      (D) 0.6 m

**35** A bomb of mass 1 kg is thrown vertically upwards with a speed of 100 m/s. After 5 seconds, it explodes into two fragments. One fragment of mass 400 gram is found to go down with a speed of 25 m/s. What will happen to the second fragment just after the explosion ? ( $g = 10 \text{ m/s}^2$ ).

- (A) It will go upwards with speed 100 m/s  
(B) It will go upwards with speed 40 m/s  
(C) It will go upwards with speed 60 m/s  
(D) It will go downwards with speed 40 m/s

**36** An ideal gas is confined to a container whose volume is fixed. If the container holds  $n$  moles of gas, by what factor will the pressure increase if the absolute temperature is increased by a factor of 2 ?

- (A)  $\frac{2}{(nR)}$       (B) 2      (C)  $2nR$       (D)  $\frac{2}{n}$

**37** The sum of magnitudes of two forces acting at a point is 16 and magnitude of their resultant is  $8\sqrt{3}$ . If the resultant is at  $90^\circ$  with the force of smaller magnitude, then their magnitudes are :

- (A) 3, 13                      (B) 2, 14  
(C) 5, 11                      (D) 4, 12

- 38 If  $T_A, T_B, T_C$  and  $T_D$  are the respective temperatures at A, B, C and D. Then, choose the correct statement if  $T_A = T_0$ .
- (A) The maximum temperature during the cycle occurs at C
- (B)  $T_D = 3T_0$
- (C)  $T_B = 2T_0$
- (D) All the above

- 39 Two astronauts have deserted their space ships in a region of space far from the gravitational attraction of any other body. Each has a mass of 100 kg and they are 100 m apart. They are initially at rest relative to one another. How long will it be before the gravitational attraction brings them 1 cm closer together ?

- (A) 2.52 days                      (B) 1.41 days
- (C) 0.70 days                      (D) 1.41 hr

- 40 Given below are some physical quantities.

1. Stefan's constant
2. Coefficient of volume expansion
3. Work done
4. Velocity gradient

Identify the correct order in which the dimensions of time decreases in the given physical quantities.

- (A) 2, 4, 3, 1                      (B) 1, 2, 3, 4
- (C) 4, 3, 2, 1                      (D) 3, 2, 4, 1

Space for rough work





- 43 Match the species in column I with the geometry in column II.

	Column I (Species)		Column II (Geometry)
P.	$H_3O^+$	1.	Planar
Q.	$H_2C = NH$	2.	Angular
R.	$ClO_2^-$	3.	Tetrahedral
S.	$NH_4^+$	4.	Trigonal bipyramidal
T.	$PCl_5$	5.	Pyramidal

- (A) P-2, Q-1, R-3, S-5, T-4  
 (B) P-1, Q-5, R-2, S-3, T-4  
 (C) P-5, Q-1, R-2, S-3, T-4  
 (D) P-3, Q-1, R-4, S-5, T-2
- 44 Vinylcarbinol formula is
- (A)  $HO-CH_2-CH = CH_2$   
 (B)  $CH_3CH(OH) = CH_2$   
 (C)  $CH_3-CH = CH-OH$   
 (D)  $CH_3-C(CH_2OH) = CH_2$
- 45 Find the percentage purity of sodium chloride, 6.5 g of which when dissolved in water and treated with excess of silver nitrate solution gave 14.35 g of silver chloride.
- (A) 35 (B) 56  
 (C) 82 (D) 90

**46** Excess of KI reacts with  $\text{CuSO}_4$  solution and then  $\text{Na}_2\text{S}_2\text{O}_3$  solution is added to it. Which of the given statements is incorrect for this reaction ?

- (A)  $\text{Cu}_2\text{I}_2$  is formed      (B) Evolved  $\text{I}_2$  is reduced  
(C)  $\text{Na}_2\text{S}_2\text{O}_3$  is oxidised      (D)  $\text{CuI}_2$  is formed

**47** Calculate the energy in kJ/g atom emitted when electrons in 1.0 g atom of hydrogen undergo transition giving spectral line of the lowest energy in the visible region of its atomic spectrum.

$[R_H = 1.1 \times 10^7 \text{ m}^{-1}; c = 3 \times 10^8 \text{ m s}^{-1}; h = 6.62 \times 10^{-34} \text{ J s}]$

- (A) 155.8      (B) 163.2  
(C) 182.6      (D) 194.7

**48** The  $\text{pK}_a$  of acetyl salicylic acid (aspirin) is 3.5. The pH of gastric juice in human stomach is about 2—3 and pH in the small intestine is about 8. Aspirin will be

- (A) unionised in the small intestine and in the stomach.  
(B) completely ionised in the small intestine and in the stomach.  
(C) ionised in the stomach and almost unionised in the small intestine.  
(D) ionised in the small intestine and almost unionised in the stomach.

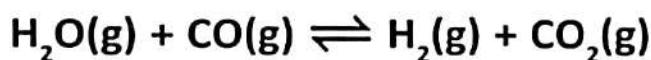
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**53** Which of the following is correct ?

- (A)  ${}^1_1\text{H}$  and  ${}^3_2\text{He}$  are isotopes
- (B)  ${}^{14}_6\text{C}$  and  ${}^{14}_7\text{N}$  are isotones
- (C)  ${}^{39}_{19}\text{K}$  and  ${}^{40}_{20}\text{Ca}$  are isotones
- (D)  ${}^{19}_9\text{F}$  and  ${}^{24}_{11}\text{Na}$  are isobars

**54** 1 mole of  $\text{H}_2\text{O}$  and 1 mole of  $\text{CO}$  are taken in a 10 litre vessel and heated to 725 K. At equilibrium 40 percent of water (by mass) reacts with carbon monoxide according to the equation:



Calculate the equilibrium constant for the given reaction.

- (A) 0.16
- (B) 0.38
- (C) 0.44
- (D) 0.56

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- 55 Following statements represent the periodic trends of chemical reactivity of the alkali metals and the halogens. Which of these statements is correct about them ?
- (A) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens
- (B) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group
- (C) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number
- (D) In both the alkali metals and the halogens, the chemical reactivity decreases with increase in atomic number down the group

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**56** Given question contains a process with an input diagram. One or more 'operators', and an output diagram. The effect of the operators is described in the key to question. Study the process and decide which is the correct output from the options ?

<p>Rotates all symbols 90° clockwise</p>	<p>Rotates middle symbol 180°</p>
<p>Each symbol moves one place to the right</p>	<p>Reflects all symbols in X axis</p>

Which option replaces the question mark ?

(A)

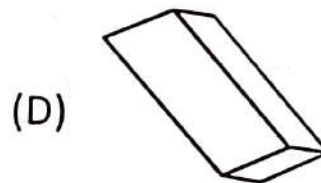
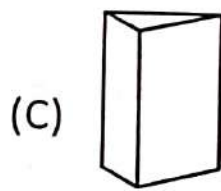
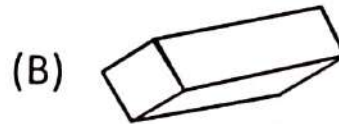
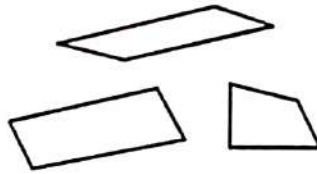
(B)

(C)

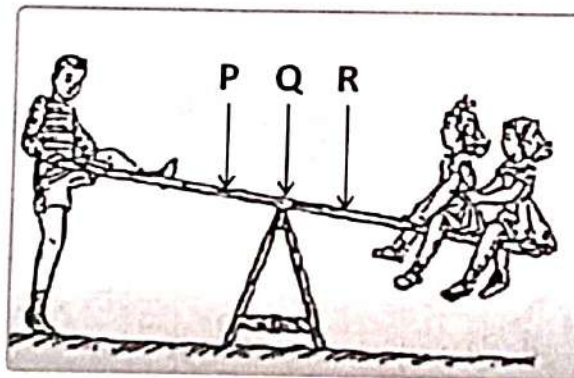
(D)

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**57** Which figure could be assembled using each of the provided pieces ?



**58** At which point is the sea-saw most likely to break ?



(A) P

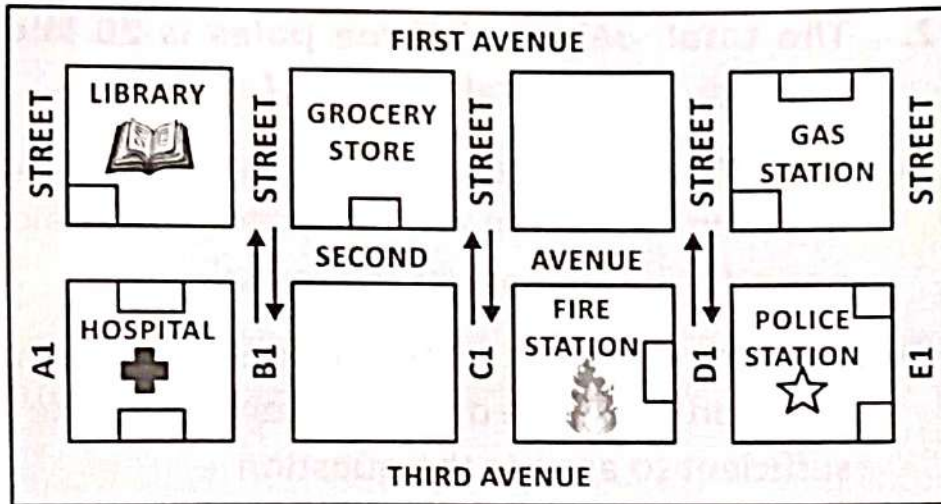
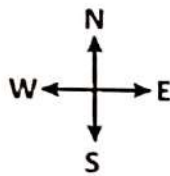
(B) Q

(C) R

(D) Can't be determine

Space for rough work

59 Study the map and answer the question.



The delivery boy from the grocery store calls to ask directions to the firehouse so that he can delivery the order. You should direct him to walk.

- (A) West on Second Avenue to D1 Street, make a left, and go half a block to the firehouse.
- (B) East on Second Avenue to D1 Street, make a right, and go half a block to the firehouse.
- (C) West on Second Avenue to D1 Street, make a right, and go half a block to the firehouse.
- (D) East on First Avenue to D1 Street, make a left, and go half a block to the firehouse.

Space for rough work



- 60** What will be the total weight of 10 poles, each of the same weight ?

Statements:

1. One fourth of the weight of each pole is 5 kg.
  2. The total weight of three poles is 20 kilograms more than the total weight of two poles.
- (A) Statement I alone are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question
- (B) Statement II alone are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question
- (C) Statement I alone or in statement II alone are sufficient to answer the question
- (D) Both statements I and II together are not sufficient to answer the question

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