

Current Electricity — NEET Physics PYQ (2005-2021)

Class 12 Physics · 39 real NEET & AIPMT questions, year-tagged · answers checked by RankUp

NEET 2021

1. Column - I gives certain physical terms associated with flow of current through a metallic conductor. Column - II gives some mathematical relations involving electrical quantities. Match Column - I and Column - II with appropriate relations.

Column - I | Column - II

(a) Drift Velocity | (P) $m/(ne^2\rho)$

(b) Electrical Resistivity | (Q) nev_d

(c) Relaxation Period | (R) $(eE/m)\tau$

(d) Current Density | (S) E/J

(A) (a)-(R), (b)-(S), (c)-(P), (d)-(Q)

(B) (a)-(R), (b)-(S), (c)-(Q), (d)-(P)

(C) (a)-(R), (b)-(P), (c)-(S), (d)-(Q)

(D) (a)-(R), (b)-(Q), (c)-(S), (d)-(P)

NEET 2021

2. In a potentiometer circuit a cell of EMF 1.5 V gives balance point at 36 cm length of wire. If another cell of EMF 2.5 V replaces the first cell, then at what length of the wire, the balance point occurs ?

(A) 60 cm

(B) 21.6 cm

(C) 64 cm

(D) 62 cm

NEET 2021

3. The effective resistance of a parallel connection that consists of four wires of equal length, equal area of cross-section and same material is $0.25\ \Omega$. What will be the effective resistance if they are connected in series ?

(A) $0.25\ \Omega$

(B) $0.5\ \Omega$

(C) $1\ \Omega$

(D) $4\ \Omega$

NEET 2020 · Q144

4. The solids which have the negative temperature coefficient of resistance are :

(A) metals

(B) insulators only

(C) semiconductors only

(D) insulators and semiconductors

NEET 2020 · Q164

5. The color code of a resistance is given below : bands Yellow, Violet, Brown, Gold. The values of resistance and tolerance, respectively, are :

(A) $470\ \text{k}\Omega$, 5%

(B) $47\ \text{k}\Omega$, 10%

(C) $4.7\ \text{k}\Omega$, 5%

(D) $470\ \Omega$, 5%

NEET 2020 · Q173

6. A charged particle having drift velocity of $7.5 \times 10^{-4}\ \text{m s}^{-1}$ in an electric field of $3 \times 10^{-10}\ \text{V m}^{-1}$, has a mobility in $\text{m}^2 \text{V}^{-1} \text{s}^{-1}$ of :

(A) 2.25×10^{15}

(B) 2.5×10^6

(C) 2.5×10^{-6}

(D) 2.25×10^{-15}

NEET 2020 · Q179

7. A resistance wire connected in the left gap of a metre bridge balances a $10\ \Omega$ resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of $1\ \Omega$ of the resistance wire is :

- (A) 1.0×10^{-2} m
- (B) 1.0×10^{-1} m
- (C) 1.5×10^{-1} m
- (D) 1.5×10^{-2} m

NEET 2019 · Q23

8. Which of the following acts as a circuit protection device?

- (A) conductor
- (B) inductor
- (C) switch
- (D) fuse

NEET 2018 · Q5

9. A carbon resistor of $(47 \pm 4.7)\ \text{k}\Omega$ is to be marked with rings of different colours for its identification. The colour code sequence will be

- (A) Yellow – Green – Violet – Gold
- (B) Yellow – Violet – Orange – Silver
- (C) Violet – Yellow – Orange – Silver
- (D) Green – Orange – Violet – Gold

NEET 2018 · Q6

10. A set of 'n' equal resistors, of value 'R' each, are connected in series to a battery of emf 'E' and internal resistance 'R'. The current drawn is I. Now, the 'n' resistors are connected in parallel to the same battery. Then the current drawn from battery becomes 10 I. The value of 'n' is

- (A) 20
- (B) 11
- (C) 10
- (D) 9

NEET 2017 · Q142

11. The resistance of a wire is 'R' ohm. If it is melted and stretched to 'n' times its original length, its new resistance will be:

- (A) nR
- (B) R/n
- (C) n^2R
- (D) R/n^2

NEET 2017 · Q154

12. A potentiometer is an accurate and versatile device to make electrical measurements of E.M.F. because the method involves:

- (A) cells
- (B) potential gradients
- (C) a condition of no current flow through the galvanometer
- (D) a combination of cells, galvanometer and resistances

NEET 2016 Phase 2 · Q26

13. A filament bulb (500 W, 100 V) is to be used in a 230 V main supply. When a resistance R is connected in series, it works perfectly and the bulb consumes 500 W. The value of R is

- (A) $230\ \Omega$
- (B) $46\ \Omega$
- (C) $26\ \Omega$
- (D) $13\ \Omega$

NEET 2016 Phase 1 · Q14

14. The charge flowing through a resistance R varies with time t as $Q = at - bt^2$, where a and b are positive constants. The total heat produced in R is:

- (A) $a^3R/6b$
- (B) $a^3R/3b$
- (C) $a^3R/2b$
- (D) a^3R/b

AIPMT 2015

15. A potentiometer wire has length 4 m and resistance $8\ \Omega$. The resistance that must be connected in series with the wire and an accumulator of e.m.f. 2 V, so as to get a potential gradient 1 mV per cm on the wire is:

- (A) $48\ \Omega$
- (B) $32\ \Omega$
- (C) $40\ \Omega$
- (D) $44\ \Omega$

AIPMT 2015

16. Across a metallic conductor of non-uniform cross section a constant potential difference is applied. The quantity which remains constant along the conductor is:

- (A) electric field
- (B) current density
- (C) current
- (D) drift velocity

AIPMT 2014

17. The resistances in the two arms of the meter bridge are $5\ \Omega$ and $R\ \Omega$, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at $1.6 l_1$. The resistance ' R ', is: (l_1 is the initial balance length measured from end A, on the side of the $5\ \Omega$ resistance)

- (A) $15\ \Omega$
- (B) $20\ \Omega$
- (C) $25\ \Omega$
- (D) $10\ \Omega$

AIPMT 2014

18. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is $0.5\ \Omega$. The power loss in the wire is:

- (A) 19.2 kW
- (B) 19.2 J
- (C) 12.2 kW
- (D) 19.2 W

AIPMT 2014

19. A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery, used across the potentiometer wire, has an emf of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4 m long. When the resistance, R , connected across the given cell, has values of (i) infinity (ii) 9.5Ω , the 'balancing lengths', on the potentiometer wire are found to be 3 m and 2.85 m, respectively. The value of internal resistance of the cell is:

- (A) 0.95Ω
- (B) 0.5Ω
- (C) 0.75Ω
- (D) 0.25Ω

NEET 2013

20. A wire of resistance 4Ω is stretched to twice its original length. The resistance of stretched wire would be -

- (A) 2Ω
- (B) 4Ω
- (C) 8Ω
- (D) 16Ω

NEET 2013

21. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10Ω is

- (A) 0.2Ω
- (B) 0.5Ω
- (C) 0.8Ω
- (D) 1.0Ω

AIPMT 2012 Prelims

22. A ring is made of a wire having a resistance $R_0 = 12 \Omega$. Points A and B on the ring divide it into two arcs of lengths l_1 and l_2 . At which points A and B should a current carrying conductor be connected so that the resistance R of the sub circuit between these points is equal to $8/3 \Omega$?

- (A) $l_1/l_2 = 1/2$
- (B) $l_1/l_2 = 5/8$
- (C) $l_1/l_2 = 1/3$
- (D) $l_1/l_2 = 3/8$

AIPMT 2012 Prelims

23. If voltage across a bulb rated 220 V-100 W drops by 2.5% of its rated value, the percentage of the rated value by which the power would decrease is

- (A) 10%
- (B) 20%
- (C) 2.5%
- (D) 5%

AIPMT 2011 Mains

24. A galvanometer of resistance G is shunted by a resistance S ohm. To keep the main current in the circuit unchanged, the resistance to be put in series with the galvanometer is

- (A) $G^2/(S + G)$
- (B) $G/(S + G)$
- (C) $S^2/(S + G)$
- (D) $SG/(S + G)$

25. A thermocouple of negligible resistance produces an e.m.f. of $40 \mu\text{V}/^\circ\text{C}$ in the linear range of temperature. A galvanometer of resistance 10 ohm whose sensitivity is $1 \mu\text{A}/\text{div}$, is employed with the thermocouple. The smallest value of temperature difference that can be detected by the system will be

- (A) 0.1°C
- (B) 0.25°C
- (C) 0.5°C
- (D) 1°C

26. A current of 2 A flows through a 2Ω resistor when connected across a battery. The same battery supplies a current of 0.5 A when connected across a 9Ω resistor. The internal resistance of the battery is

- (A) 1Ω
- (B) 0.5Ω
- (C) $1/3 \Omega$
- (D) $1/4 \Omega$

27. Consider the following two statements:

(A) Kirchhoff's junction law follows from the conservation of charge.

(B) Kirchhoff's loop law follows from the conservation of energy.

Which of the following is correct?

- (A) Both (A) and (B) are correct
- (B) Both (A) and (B) are wrong
- (C) (A) is correct and (B) is wrong
- (D) (A) is wrong and (B) is correct

28. In producing chlorine by electrolysis 100 kW power at 125 V is being consumed. How much chlorine per minute is liberated? (E.C.E. of chlorine is $0.367 \times 10^{-6} \text{ kg/C}$)

- (A) $3.67 \times 10^{-3} \text{ kg}$
- (B) $1.76 \times 10^{-3} \text{ kg}$
- (C) $9.67 \times 10^{-3} \text{ kg}$
- (D) $17.61 \times 10^{-3} \text{ kg}$

29. A student measures the terminal potential difference (V) of a cell (of emf ϵ and internal resistance r) as a function of the current (I) flowing through it. The slope, and intercept, of the graph between V and I , then, respectively, equal:

- (A) $-r$ and ϵ
- (B) r and $-\epsilon$
- (C) $-\epsilon$ and r
- (D) ϵ and $-r$

30. The mean free path of electrons in a metal is $4 \times 10^{-8} \text{ m}$. The electric field which can give on an average 2 eV energy to an electron in the metal will be in units of V/m :

- (A) 5×10^{-11}
- (B) 8×10^{-11}
- (C) 5×10^7
- (D) 8×10^7

31. A wire of a certain material is stretched slowly by ten per cent. Its new resistance and specific resistance become respectively

- (A) 1.1 times, 1.1 times
- (B) 1.2 times, 1.1 times
- (C) 1.21 times, same
- (D) Both remain the same

32. An electric kettle takes 4 A current at 220 V. How much time will it take to boil 1 kg of water from temperature 20°C? The temperature of boiling water is 100°C.

- (A) 4.2 min
- (B) 6.3 min
- (C) 8.4 min
- (D) 12.6 min

33. A galvanometer of resistance 50 Ω is connected to a battery of 3 V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be

- (A) 4450 Ω
- (B) 5050 Ω
- (C) 5550 Ω
- (D) 6050 Ω

34. Three resistances P, Q, R each of 2 Ω and an unknown resistance S form the four arms of a Wheatstone bridge circuit. When a resistance of 6 Ω is connected in parallel to S the bridge gets balanced. What is the value of S?

- (A) 3 Ω
- (B) 6 Ω
- (C) 1 Ω
- (D) 2 Ω

35. The resistance of an ammeter is 13 Ω and its scale is graduated for a current upto 100 amps. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 amperes by this meter. The value of shunt-resistance is

- (A) 2 Ω
- (B) 0.2 Ω
- (C) 2 k Ω
- (D) 20 Ω

36. Two cells, having the same emf, are connected in series through an external resistance R. Cells have internal resistances r_1 and r_2 ($r_1 > r_2$) respectively. When the circuit is closed, the potential difference across the first cell is zero. The value of R is :

- (A) $r_1 - r_2$
- (B) $(r_1 + r_2)/2$
- (C) $(r_1 - r_2)/2$
- (D) $r_1 + r_2$

37. Kirchhoff's first and second laws for electrical circuits are consequences of :

- (A) conservation of energy
- (B) conservation of electric charge and energy respectively
- (C) conservation of electric charge
- (D) conservation of energy and electric charge respectively

38. When a wire of uniform cross-section a , length l and resistance R is bent into a complete circle, resistance between two of diametrically opposite points will be :

- (A) $R/4$
- (B) $2R$
- (C) $4R$
- (D) $R/2$

39. A 5-A fuse wire can withstand a maximum power of 1 W in circuit. The resistance of the fuse wire is :

- (A) 0.02Ω
- (B) 0.2Ω
- (C) 0.4Ω
- (D) 0.04Ω

Answer key and explanations

1. Answer: (A) (a)-(R), (b)-(S), (c)-(P), (d)-(Q)

Drift velocity $v_d = (eE/m)\tau$; resistivity $\rho = E/J$; relaxation time $\tau = m/(ne^2\rho)$; current density $J = nev_d$.
So drift velocity $-(eE/m)\tau$, resistivity $-E/J$, relaxation period $-m/(ne^2\rho)$, current density $-nev_d$.

2. Answer: (A) 60 cm

With the same driver circuit, the balancing length is proportional to the EMF: $l_2 = 36 \times (2.5/1.5) = 60$ cm. 21.6 cm results from inverting the ratio.

3. Answer: (D) 4 Ω

Four identical wires of resistance R in parallel give $R/4 = 0.25 \Omega$, so $R = 1 \Omega$. In series the resistance is $4R = 4 \Omega$ (16 times the parallel value).

4. Answer: (D) insulators and semiconductors

In semiconductors and insulators, heating frees more charge carriers across the band gap, so resistance falls with temperature (negative coefficient). In metals the carrier number is fixed and increased lattice scattering raises resistance, giving a positive coefficient.

5. Answer: (D) 470 Ω , 5%

Yellow = 4 and violet = 7 give the digits 47, brown is the multiplier 10^1 , so $R = 470 \Omega$; a gold band means $\pm 5\%$ tolerance. The $k\Omega$ values use the wrong multiplier, and 10% tolerance would need a silver band.

6. Answer: (B) 2.5×10^6

Mobility $\mu = v_d/E = 7.5 \times 10^{-4} / 3 \times 10^{-10} = 2.5 \times 10^6 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$. The 2.25 values come from multiplying the two quantities, which is dimensionally wrong.

7. Answer: (B) $1.0 \times 10^{-1} \text{ m}$

At balance $R/10 = 3/2$, so $R = 15 \Omega$. The wire is 1.5 m long, so 1Ω corresponds to $1.5/15 = 0.1 \text{ m} = 1.0 \times 10^{-1} \text{ m}$. Taking R as 10Ω (forgetting the balance ratio) gives $1.5 \times 10^{-1} \text{ m}$.

8. Answer: (D) fuse

A fuse melts and breaks the circuit when the current exceeds a safe value, protecting the circuit. A switch only opens or closes the circuit manually and does not respond to overload.

9. Answer: (B) Yellow - Violet - Orange - Silver

$47 \text{ k}\Omega = 47 \times 10^3 \Omega$: first digit 4 is yellow, second digit 7 is violet, multiplier 10^3 is orange. The tolerance $4.7/47 = 10\%$ is silver (gold would be 5%).

10. Answer: (C) 10

Series: $I = E/(nR + R)$. Parallel: $10I = E/(R/n + R) = nE/((n + 1)R)$. Dividing, $10 = n(n + 1)R/((n + 1)R) = n$, so $n = 10$.

11. Answer: (C) n^2R

Melting and redrawing keeps the volume constant, so if length becomes nl the area becomes A/n . $R = \rho l/A$ then becomes $\rho(nl)/(A/n) = n^2R$. Taking only the length change gives nR .

12. Answer: (C) a condition of no current flow through the galvanometer

At the balance point no current flows through the galvanometer, so no current is drawn from the cell being measured and its terminal voltage equals its emf. This null method is what makes the potentiometer accurate; a voltmeter always draws some current.

13. Answer: (C) 26 Ω

Rated current $I = P/V = 500/100 = 5$ A and bulb resistance $= 100^2/500 = 20 \Omega$. To draw 5 A from 230 V the total resistance must be $230/5 = 46 \Omega$, so $R = 46 - 20 = 26 \Omega$. 46Ω is the total resistance, not the series resistor.

14. Answer: (A) $a^3R/6b$

Current $i = dQ/dt = a - 2bt$, which falls to zero at $t = a/2b$. Heat $H = \int_0^{a/2b} (a - 2bt)^2 R dt = R \cdot a^3/(6b)$. Forgetting to square the time-varying current (using an average current) gives the larger wrong values.

15. Answer: (B) 32 Ω

1 mV/cm = 0.1 V/m, so 0.4 V must drop across the 4 m, 8Ω wire: $I = 0.4/8 = 0.05$ A. Total resistance $= 2/0.05 = 40 \Omega$, so the series resistance is $40 - 8 = 32 \Omega$. 40Ω is the total, not the added resistance.

16. Answer: (C) current

The conductor is a single series path, so charge conservation makes the current the same at every cross-section. Current density, field and drift velocity all vary inversely with the local area.

17. Answer: (A) 15 Ω

Initially $5/R = I_1/(100 - I_1)$. After shunting, the arm becomes $R/2$: $10/R = 1.6I_1/(100 - 1.6I_1)$. Dividing, $2 = 1.6(100 - I_1)/(100 - 1.6I_1)$ gives $I_1 = 25$ cm, so $R = 5 \times 75/25 = 15 \Omega$.

18. Answer: (A) 19.2 kW

Over 150 km, the voltage drop is $150 \times 8 = 1200$ V and the resistance is $150 \times 0.5 = 75 \Omega$. Power lost $= V^2/R = 1200^2/75 = 19\,200$ W = 19.2 kW.

19. Answer: (B) 0.5 Ω

With $R = \infty$ the balancing length gives the emf, and with R connected it gives the terminal voltage, so $r = R(I_1/I_2 - 1) = 9.5 \times (3/2.85 - 1) = 9.5 \times 0.15/2.85 = 0.5 \Omega$.

20. Answer: (D) 16 Ω

Stretching keeps the volume constant, so doubling the length halves the cross-section. $R = \rho l/A$ becomes $\rho(2l)/(A/2) = 4R = 4 \times 4 = 16 \Omega$. 8Ω only accounts for the change in length.

21. Answer: (B) 0.5 Ω

$I = E/(R + r)$: $0.2 = 2.1/(10 + r)$, so $10 + r = 10.5$ and $r = 0.5 \Omega$.

22. Answer: (A) $I_1/I_2 = 1/2$

The two arcs have resistances R_1 and R_2 with $R_1 + R_2 = 12 \Omega$, and they are in parallel between A and B: $R_1R_2/12 = 8/3$, so $R_1R_2 = 32$. Then $R_1 = 4 \Omega$ and $R_2 = 8 \Omega$, and since resistance is proportional to length, $I_1/I_2 = 1/2$.

23. Answer: (D) 5%

For a fixed resistance, $P = V^2/R$, so $\Delta P/P \approx 2\Delta V/V = 2 \times 2.5\% = 5\%$. (Exactly, $(0.975)^2 = 0.951$, a 4.9% drop.) 2.5% wrongly assumes power proportional to voltage.

24. Answer: (A) $G^2/(S + G)$

For the main current to stay unchanged, the shunted galvanometer plus the series resistance must still equal G . The shunted combination is $GS/(G + S)$, so $R = G - GS/(G + S) = G^2/(G + S)$. The answer $GS/(G + S)$ is only the shunted combination itself, not the extra resistance needed.

25. Answer: (B) 0.25°C

The smallest detectable current is 1 μ A (one division), so the smallest detectable emf is $1 \mu\text{A} \times 10 \Omega = 10 \mu\text{V}$. With 40 μV per °C, $\Delta T = 10/40 = 0.25^\circ\text{C}$. Answers like 0.1°C or 0.5°C come from mixing up the ratio.

26. Answer: (C) 1/3 Ω

The emf is the same in both cases: $\varepsilon = 2(2 + r) = 0.5(9 + r)$. So $4 + 2r = 4.5 + 0.5r$, giving $1.5r = 0.5$ and $r = 1/3 \Omega$ ($\varepsilon = 4.67$ V). Checking $1/3 \Omega$: $2 \times 2.333 = 4.67$ and $0.5 \times 9.333 = 4.67$, consistent.

27. Answer: (A) Both (A) and (B) are correct

The junction rule says charge does not pile up at a node: conservation of charge. The loop rule says the net potential change round a closed loop is zero, i.e. work per unit charge round a loop is zero: conservation of energy. Both statements are correct.

28. Answer: (D) 17.61×10^{-3} kg

$I = P/V = 100000/125 = 800$ A. In one minute $m = Zit = 0.367 \times 10^{-6} \times 800 \times 60 = 17.6 \times 10^{-3}$ kg. 3.67×10^{-3} kg would need a far smaller charge.

29. Answer: (A) $-r$ and ϵ

Terminal voltage $V = \epsilon - Ir$, a straight line in I . Its slope is $-r$ and its intercept on the V axis ($I = 0$) is ϵ . A positive slope r would mean the voltage rises as more current is drawn.

30. Answer: (C) 5×10^7

An electron gains energy $eE\lambda$ while travelling one mean free path. Setting $eE\lambda = 2$ eV gives $E = 2 \text{ V}/(4 \times 10^{-8} \text{ m}) = 5 \times 10^7 \text{ V/m}$. The very small values (10^{-11}) would come from multiplying by λ instead of dividing.

31. Answer: (C) 1.21 times, same

The volume stays constant, so $R = \rho l/A = \rho l^2/V$ is proportional to l^2 . A 10% stretch gives $R' = (1.1)^2 R = 1.21R$. Specific resistance (resistivity) depends only on the material and temperature, so it stays the same.

32. Answer: (B) 6.3 min

Heat needed $= mc\Delta\theta = 1 \times 4200 \times 80 = 3.36 \times 10^5$ J; power $= VI = 220 \times 4 = 880$ W. $t = 3.36 \times 10^5/880 \approx 382$ s ≈ 6.4 min, closest to 6.3 min. Heating from 0°C to 100°C instead of 20°C would give about 8 min.

33. Answer: (A) 4450 Ω

Full-scale current $= 3/(50 + 2950) = 1$ mA for 30 divisions. For 20 divisions $I = (2/3)$ mA, so total resistance $= 3/(2/3 \times 10^{-3}) = 4500 \Omega$ and the series resistance $= 4500 - 50 = 4450 \Omega$. 4500 Ω would forget to subtract the galvanometer's own resistance.

34. Answer: (A) 3 Ω

Balance requires $P/Q = R/S'$, so the effective arm $S' = 2 \Omega$. S in parallel with 6 Ω : $6S/(S + 6) = 2$ gives $4S = 12$, so $S = 3 \Omega$. Answering 2 Ω forgets that S is in parallel with the 6 Ω .

35. Answer: (A) 2 Ω

The meter still carries 100 A, so the shunt carries 650 A at the same voltage: $S = 13 \times 100/650 = 2 \Omega$. 0.2 Ω would be a power-of-ten slip.

36. Answer: (A) $r_1 - r_2$

The current is $I = 2E/(R + r_1 + r_2)$. The p.d. across the first cell is $E - Ir_1 = 0$, so $I = E/r_1$. Equating: $2r_1 = R + r_1 + r_2$, giving $R = r_1 - r_2$. Setting the second cell's p.d. to zero would give $r_2 - r_1$, which is negative here.

37. Answer: (B) conservation of electric charge and energy respectively

Kirchhoff's junction law (sum of currents at a node is zero) expresses conservation of charge. The loop law (sum of potential changes round a loop is zero) expresses conservation of energy. The reverse pairing swaps the two laws.

38. Answer: (A) $R/4$

Each semicircle has resistance $R/2$ and the two halves are in parallel between diametrically opposite points: $(R/2 \times R/2)/(R/2 + R/2) = R/4$. $R/2$ is the resistance of only one half.

39. Answer: (D) 0.04 Ω

$P = I^2 R$, so $R = P/I^2 = 1/25 = 0.04 \Omega$. Using $P = IR$ gives 0.2 Ω .

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