

NEET 2018 — Physics Question Paper with Solutions

36 Physics questions as set in the paper · answers checked by RankUp

NEET 2018 · Q3

1. At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmosphere? (Given: Mass of oxygen molecule (m) = 2.76×10^{-26} kg, Boltzmann's constant $k_B = 1.38 \times 10^{-23}$ J K⁻¹)

- (A) 5.016×10^4 K
- (B) 8.360×10^4 K
- (C) 2.508×10^4 K
- (D) 1.254×10^4 K

NEET 2018 · Q4

2. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is

- (A) 6.25%
- (B) 20%
- (C) 26.8%
- (D) 12.5%

NEET 2018 · Q5

3. A carbon resistor of (47 ± 4.7) k Ω 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

4. 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 2018 · Q8

5. Unpolarised light is incident from air on a plane surface of a material of refractive index ' μ '. At a particular angle of incidence 'i', it is found that the reflected and refracted rays are perpendicular to each other. Which of the following options is correct for this situation?

- (A) $i = \sin^{-1}(1/\mu)$
- (B) Reflected light is polarised with its electric vector perpendicular to the plane of incidence
- (C) Reflected light is polarised with its electric vector parallel to the plane of incidence
- (D) $i = \tan^{-1}(1/\mu)$

NEET 2018 · Q9

6. In Young's double slit experiment the separation d between the slits is 2 mm, the wavelength λ of the light used is 5896 Å and distance D between the screen and slits is 100 cm. It is found that the angular width of the fringes is 0.20° . To increase the fringe angular width to 0.21° (with same λ and D) the separation between the slits needs to be changed to

- (A) 2.1 mm
- (B) 1.9 mm
- (C) 1.8 mm
- (D) 1.7 mm

NEET 2018 · Q10

7. An astronomical refracting telescope will have large angular magnification and high angular resolution, when it has an objective lens of

- (A) large focal length and large diameter
- (B) large focal length and small diameter
- (C) small focal length and large diameter
- (D) small focal length and small diameter

NEET 2018 · Q11

8. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is

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

NEET 2018 · Q12

9. An electron of mass m with an initial velocity $\vec{V} = V_0\hat{i}$ ($V_0 > 0$) enters an electric field $\vec{E} = -E_0\hat{i}$ ($E_0 = \text{constant} > 0$) at $t = 0$. If λ_0 is its de-Broglie wavelength initially, then its de-Broglie wavelength at time t is

- (A) $\lambda_0 t$
- (B) $\lambda_0(1 + eE_0 t/(mV_0))$
- (C) $\lambda_0/(1 + eE_0 t/(mV_0))$
- (D) λ_0

NEET 2018 · Q13

10. For a radioactive material, half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is

- (A) 30
- (B) 10
- (C) 20
- (D) 15

NEET 2018 · Q14

11. When the light of frequency $2\nu_0$ (where ν_0 is threshold frequency), is incident on a metal plate, the maximum velocity of electrons emitted is v_1 . When the frequency of the incident radiation is increased to $5\nu_0$, the maximum velocity of electrons emitted from the same plate is v_2 . The ratio of v_1 to v_2 is

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

NEET 2018 · Q16

12. In a p-n junction diode, change in temperature due to heating

- (A) does not affect resistance of p-n junction
- (B) affects only forward resistance
- (C) affects only reverse resistance
- (D) affects the overall $V - I$ characteristics of p-n junction

NEET 2018 · Q18

13. An em wave is propagating in a medium with a velocity $\vec{V} = V\hat{i}$. The instantaneous oscillating electric field of this em wave is along $+y$ axis. Then the direction of oscillating magnetic field of the em wave will be along

- (A) $-y$ direction
- (B) $+z$ direction
- (C) $-z$ direction
- (D) $-x$ direction

NEET 2018 · Q19

14. The refractive index of the material of a prism is $\sqrt{2}$ and the angle of the prism is 30° . One of the two refracting surfaces of the prism is made a mirror inwards, by silver coating. A beam of monochromatic light entering the prism from the other face will retrace its path (after reflection from the silvered surface) if its angle of incidence on the prism is

- (A) 30°
- (B) 45°
- (C) 60°
- (D) zero

NEET 2018 · Q20

15. An object is placed at a distance of 40 cm from a concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, the displacement of the image will be

- (A) 30 cm towards the mirror
- (B) 36 cm away from the mirror
- (C) 30 cm away from the mirror
- (D) 36 cm towards the mirror

NEET 2018 · Q21

16. The magnetic potential energy stored in a certain inductor is 25 mJ, when the current in the inductor is 60 mA. This inductor is of inductance

- (A) 1.389 H
- (B) 138.88 H
- (C) 0.138 H
- (D) 13.89 H

NEET 2018 · Q22

17. An electron falls from rest through a vertical distance h in a uniform and vertically upward directed electric field E . The direction of electric field is now reversed, keeping its magnitude the same. A proton is allowed to fall from rest in it through the same vertical distance h . The time of fall of the electron, in comparison to the time of fall of the proton is

- (A) 10 times greater
- (B) 5 times greater
- (C) smaller
- (D) equal

NEET 2018 · Q23

18. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is

- (A) proportional to the square root of the distance between the plates.
- (B) linearly proportional to the distance between the plates.
- (C) independent of the distance between the plates.
- (D) inversely proportional to the distance between the plates.

NEET 2018 · Q24

19. A tuning fork is used to produce resonance in a glass tube. The length of the air column in this tube can be adjusted by a variable piston. At room temperature of 27°C two successive resonances are produced at 20 cm and 73 cm of column length. If the frequency of the tuning fork is 320 Hz, the velocity of sound in air at 27°C is

- (A) 350 m/s
- (B) 339 m/s
- (C) 330 m/s
- (D) 300 m/s

NEET 2018 · Q25

20. A pendulum is hung from the roof of a sufficiently high building and is moving freely to and fro like a simple harmonic oscillator. The acceleration of the bob of the pendulum is 20 m/s² at a distance of 5 m from the mean position. The time period of oscillation is

- (A) 2 s
- (B) π s
- (C) 2π s
- (D) 1 s

NEET 2018 · Q26

21. A metallic rod of mass per unit length 0.5 kg m⁻¹ is lying horizontally on a smooth inclined plane which makes an angle of 30° with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flowing in the rod to keep it stationary is

- (A) 14.76 A
- (B) 5.98 A
- (C) 7.14 A
- (D) 11.32 A

NEET 2018 · Q28

22. An inductor 20 mH, a capacitor 100 μ F and a resistor 50 Ω are connected in series across a source of emf, $V = 10 \sin 314 t$. The power loss in the circuit is

- (A) 2.74 W
- (B) 0.43 W
- (C) 0.79 W
- (D) 1.13 W

NEET 2018 · Q29

23. Current sensitivity of a moving coil galvanometer is 5 div/mA and its voltage sensitivity (angular deflection per unit voltage applied) is 20 div/V. The resistance of the galvanometer is

- (A) 250 Ω
- (B) 25 Ω
- (C) 40 Ω
- (D) 500 Ω

NEET 2018 · Q31

24. Three objects, A : (a solid sphere), B : (a thin circular disk) and C : (a circular ring), each have the same mass M and radius R . They all spin with the same angular speed ω about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation

- (A) $W_B > W_A > W_C$
- (B) $W_A > W_B > W_C$
- (C) $W_C > W_B > W_A$
- (D) $W_A > W_C > W_B$

NEET 2018 · Q32

25. A moving block having mass m , collides with another stationary block having mass $4m$. The lighter block comes to rest after collision. When the initial velocity of the lighter block is v , then the value of coefficient of restitution (e) will be

- (A) 0.8
- (B) 0.25
- (C) 0.5
- (D) 0.4

NEET 2018 · Q33

26. Which one of the following statements is incorrect?

- (A) Frictional force opposes the relative motion.
- (B) Limiting value of static friction is directly proportional to normal reaction.
- (C) Rolling friction is smaller than sliding friction.
- (D) Coefficient of sliding friction has dimensions of length.

NEET 2018 · Q34

27. A toy car with charge q moves on a frictionless horizontal plane surface under the influence of a uniform electric field E . Due to the force qE , its velocity increases from 0 to 6 m/s in one second duration. At that instant the direction of the field is reversed. The car continues to move for two more seconds under the influence of this field. The average velocity and the average speed of the toy car between 0 to 3 seconds are respectively

- (A) 1 m/s, 3.5 m/s
- (B) 1 m/s, 3 m/s
- (C) 2 m/s, 4 m/s
- (D) 1.5 m/s, 3 m/s

NEET 2018 · Q36

28. The moment of the force, $F = 4\hat{i} + 5\hat{j} - 6\hat{k}$ at $(2, 0, -3)$, about the point $(2, -2, -2)$, is given by

- (A) $-7\hat{i} - 8\hat{j} - 4\hat{k}$
- (B) $-4\hat{i} - \hat{j} - 8\hat{k}$
- (C) $-8\hat{i} - 4\hat{j} - 7\hat{k}$
- (D) $-7\hat{i} - 4\hat{j} - 8\hat{k}$

NEET 2018 · Q37

29. A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of -0.004 cm, the correct diameter of the ball is

- (A) 0.053 cm
- (B) 0.525 cm
- (C) 0.521 cm
- (D) 0.529 cm

NEET 2018 · Q38

30. A solid sphere is rotating freely about its symmetry axis in free space. The radius of the sphere is increased keeping its mass same. Which of the following physical quantities would remain constant for the sphere?

- (A) Rotational kinetic energy
- (B) Moment of inertia
- (C) Angular velocity
- (D) Angular momentum

NEET 2018 · Q40

31. If the mass of the Sun were ten times smaller and the universal gravitational constant were ten times larger in magnitude, which of the following is not correct?

- (A) Time period of a simple pendulum on the Earth would decrease.
- (B) Walking on the ground would become more difficult.
- (C) Raindrops will fall faster.
- (D) 'g' on the Earth will not change.

NEET 2018 · Q41

32. A solid sphere is in rolling motion. In rolling motion a body possesses translational kinetic energy (K_t) as well as rotational kinetic energy (K_r) simultaneously. The ratio $K_t : (K_t + K_r)$ for the sphere is

- (A) 10 : 7
- (B) 5 : 7
- (C) 7 : 10
- (D) 2 : 5

NEET 2018 · Q42

33. A small sphere of radius 'r' falls from rest in a viscous liquid. As a result, heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity, is proportional to

- (A) r^5
- (B) r^2
- (C) r^3
- (D) r^4

NEET 2018 · Q43

34. The power radiated by a black body is P and it radiates maximum energy at wavelength, λ_0 . If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $(3/4)\lambda_0$, the power radiated by it becomes nP. The value of n is

- (A) 256/81
- (B) 4/3
- (C) 3/4
- (D) 81/256

NEET 2018 · Q44

35. Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area 3A. If the length of the first wire is increased by Δl on applying a force F, how much force is needed to stretch the second wire by the same amount?

- (A) 4 F
- (B) 6 F
- (C) 9 F
- (D) F

36. A sample of 0.1 g of water at 100°C and normal pressure ($1.013 \times 10^5 \text{ N m}^{-2}$) requires 54 cal of heat energy to convert to steam at 100°C. If the volume of the steam produced is 167.1 cc, the change in internal energy of the sample, is

- (A) 42.2 J
- (B) 208.7 J
- (C) 104.3 J
- (D) 84.5 J

Answer key and explanations

1. Answer: (B) $8.360 \times 10^4 \text{ K}$

Set $v_{\text{rms}} = \sqrt{3k_{\text{B}}T/m}$ equal to the escape speed 11.2 km/s. $T = mv^2/(3k_{\text{B}}) = 2.76 \times 10^{-26} \times (1.12 \times 10^4)^2 / (3 \times 1.38 \times 10^{-23}) \approx 8.36 \times 10^4 \text{ K}$. Using $2k_{\text{B}}T$ or $k_{\text{B}}T$ instead of $3k_{\text{B}}T$ gives the other values.

2. Answer: (C) 26.8%

Carnot efficiency $\eta = 1 - T_2/T_1 = 1 - 273/373 = 100/373 \approx 26.8\%$. Temperatures must be in kelvin; using Celsius would wrongly give 100%.

3. 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%).

4. 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 $n = 10$.

5. Answer: (B) Reflected light is polarised with its electric vector perpendicular to the plane of incidence

This is Brewster's angle, $\tan i = \mu$, at which the reflected light is completely plane polarised with its electric vector perpendicular to the plane of incidence. The expression with $\tan^{-1}(1/\mu)$ inverts Brewster's law, and $\sin^{-1}(1/\mu)$ is the critical angle.

6. Answer: (B) 1.9 mm

Angular fringe width $\theta = \lambda/d$, so $\theta \propto 1/d$. $d' = d \times 0.20/0.21 = 2 \times 0.952 \approx 1.9 \text{ mm}$. Increasing d to 2.1 mm would narrow the fringes instead.

7. Answer: (A) large focal length and large diameter

Magnification $m = f_o/f_e$ grows with the objective's focal length, and resolving power $\propto D/\lambda$ grows with its aperture. So the objective should have both a large focal length and a large diameter; a small aperture would worsen resolution.

8. Answer: (B) 1 : -1

In a Bohr orbit, $K = ke^2/2r$ and the total energy $E = -ke^2/2r$, so $E = -K$ and $K : E = 1 : -1$. The ratio 1 : -2 is kinetic to potential energy, not to total energy.

9. Answer: (C) $\lambda_0/(1 + eE_0t/(mV_0))$

Force on the electron $F = -eE = +eE_0\hat{i}$, along its velocity, so $v = V_0 + eE_0t/m$. Since $\lambda = h/mv$, $\lambda = \lambda_0/(1 + eE_0t/(mV_0))$; the wavelength decreases, so the expression that multiplies λ_0 by the growing factor is wrong.

10. Answer: (C) 20

After 450 decay, 150 of 600 remain, i.e. $1/4 = (1/2)^2$. That is two half-lives = 20 minutes. 30 minutes would leave only 75 nuclei.

11. Answer: (C) 1 : 2

$\frac{1}{2}mv_1^2 = h(2\nu_0 - \nu_0) = h\nu_0$ and $\frac{1}{2}mv_2^2 = h(5\nu_0 - \nu_0) = 4h\nu_0$. So $v_1^2/v_2^2 = 1/4$ and $v_1 : v_2 = 1 : 2$; 1 : 4 is the ratio of kinetic energies, not speeds.

12. Answer: (D) affects the overall V - I characteristics of p-n junction

Heating generates more electron-hole pairs, which changes the reverse saturation current, the barrier potential and the forward current. Hence both forward and reverse behaviour, i.e. the whole V-I characteristic, change; it is not limited to one bias direction.

13. Answer: (B) +z direction

The direction of propagation is along $\mathbf{E} \times \mathbf{B}$. With $\mathbf{E}$ along $\hat{j}$ and propagation along $\hat{i}$, $\mathbf{B}$ must be along $\hat{k}$ because $\hat{j} \times \hat{k} = \hat{i}$. Choosing $-\hat{z}$ would reverse the propagation direction.

14. Answer: (B) 45°

To retrace its path the ray must hit the silvered face normally, so $r_2 = 0$ and $r_1 = A = 30^\circ$. By Snell's law $\sin i = \sqrt{2} \sin 30^\circ = 1/\sqrt{2}$, so $i = 45^\circ$. Zero incidence would make the ray strike the silvered face at 30° , not normally.

15. Answer: (B) 36 cm away from the mirror

With $u = -40$ cm, $f = -15$ cm: $1/v = -1/15 + 1/40$ gives $v = -24$ cm. With $u = -20$ cm: $1/v = -1/15 + 1/20$ gives $v = -60$ cm. The image moves from 24 cm to 60 cm, i.e. 36 cm away from the mirror.

16. Answer: (D) 13.89 H

$U = \frac{1}{2}LI^2$, so $L = 2U/I^2 = 2 \times 25 \times 10^{-3}/(60 \times 10^{-3})^2 = 0.05/0.0036 \approx 13.89$ H. Forgetting to square the current or the factor 2 gives the other values.

17. Answer: (C) smaller

In both cases the electric force is downward with magnitude eE , so each accelerates at $a = eE/m$ (plus g). Since $t = \sqrt{2h/a}$ and the electron's mass is far smaller, its acceleration is much larger and its time of fall is smaller. The times are not equal because the masses differ.

18. Answer: (C) independent of the distance between the plates.

Each plate sits in the uniform field $\sigma/2\epsilon_0$ of the other, so $F = Q^2/(2\epsilon_0 A)$, which contains no separation term. For an isolated capacitor Q is fixed, so the force does not change with distance.

19. Answer: (B) 339 m/s

Successive resonance lengths differ by $\lambda/2$: $73 - 20 = 53$ cm, so $\lambda = 1.06$ m. $v = f\lambda = 320 \times 1.06 \approx 339$ m/s. Using 4×20 cm (ignoring end correction) would give a wrong value.

20. Answer: (B) π s

In SHM $a = \omega^2 x$, so $\omega^2 = 20/5 = 4$ and $\omega = 2$ rad/s. $T = 2\pi/\omega = \pi$ s; 2π s would correspond to $\omega = 1$ rad/s.

21. Answer: (D) 11.32 A

The magnetic force Bil is horizontal; balancing components along the incline: $Bil \cos 30^\circ = mg \sin 30^\circ$. $I = (m/l)g \tan 30^\circ/B = 0.5 \times 9.8 \times 0.577/0.25 \approx 11.32$ A. Taking the force along the incline (without the $\cos 30^\circ$) would give a smaller current.

22. Answer: (C) 0.79 W

$X_L = 314 \times 0.02 = 6.28 \Omega$, $X_C = 1/(314 \times 10^{-4}) = 31.85 \Omega$, $Z = \sqrt{50^2 + 25.57^2} \approx 56.2 \Omega$. $I_{\text{rms}} = (10/\sqrt{2})/56.2 \approx 0.126$ A, so $P = I_{\text{rms}}^2 R \approx 0.79$ W. Using peak instead of rms current doubles the power.

23. Answer: (A) 250 Ω

Voltage sensitivity = current sensitivity / G , so $G = (5 \text{ div/mA})/(20 \text{ div/V}) = (5000 \text{ div/A})/(20 \text{ div/V}) = 250 \Omega$. Forgetting the mA-to-A conversion gives 0.25 Ω -type answers.

24. Answer: (C) $W_C > W_B > W_A$

Work needed equals the rotational KE $\frac{1}{2}I\omega^2$. $I_{\text{ring}} = MR^2 > I_{\text{disc}} = MR^2/2 > I_{\text{sphere}} = 2MR^2/5$, so $W_C > W_B > W_A$. The sphere needs the least because its mass is closest to the axis.

25. Answer: (B) 0.25

Momentum: $mv = 4mv'$, so $v' = v/4$. $e = (\text{relative speed of separation})/(\text{relative speed of approach}) = (v/4 - 0)/v = 0.25$. A value of 0.8 would not conserve momentum with the lighter block stopping.

26. Answer: (D) Coefficient of sliding friction has dimensions of length.

The coefficient of friction is a ratio of two forces (friction/normal reaction), so it is dimensionless; the statement that it has dimensions of length is wrong. The other statements are standard properties of friction.

27. Answer: (B) 1 m/s, 3 m/s

$a = 6 \text{ m/s}^2$. 0–1 s: 3 m forward. 1–2 s: decelerates from 6 to 0, another 3 m forward. 2–3 s: accelerates backward from rest, 3 m back. Net displacement 3 m and distance 9 m in 3 s, so average velocity 1 m/s and average speed 3 m/s.

28. Answer: (D) $-7\hat{i} - 4\hat{j} - 8\hat{k}$

$\vec{r} = (2, 0, -3) - (2, -2, -2) = 2\hat{j} - \hat{k}$. $\vec{\tau} = \vec{r} \times \vec{F} = \hat{i}(2 \cdot (-6) - (-1) \cdot 5) - \hat{j}(0 \cdot (-6) - (-1) \cdot 4) + \hat{k}(0 \cdot 5 - 2 \cdot 4) = -7\hat{i} - 4\hat{j} - 8\hat{k}$. The other vectors have the components permuted.

29. Answer: (D) 0.529 cm

Observed reading = 0.5 cm + 25×0.001 cm = 0.525 cm. Correct reading = observed – zero error = 0.525 – (–0.004) = 0.529 cm. Adding the negative zero error with the wrong sign gives 0.521 cm.

30. Answer: (D) Angular momentum

In free space there is no external torque, so angular momentum $L = I\omega$ is conserved. Increasing the radius raises I , so ω falls and the rotational KE $L^2/2I$ also falls.

31. Answer: (D) 'g' on the Earth will not change.

$g = GM_E/R^2$ depends on G and the Earth's mass, not the Sun's. With G ten times larger, g becomes ten times larger, so the claim that g stays the same is wrong; the larger g also shortens the pendulum period and makes raindrops fall faster.

32. Answer: (B) 5 : 7

$K_t = \frac{1}{2}mv^2$, $K_r = \frac{1}{2}(2/5 mR^2)(v/R)^2 = (1/5)mv^2$. $K_t : (K_t + K_r) = \frac{1}{2} : (7/10) = 5 : 7$. The ratio 2 : 5 is $K_r : K_t$.

33. Answer: (A) r^5

At terminal velocity the heating rate equals $F \cdot v = 6\pi\eta r v \cdot v$. Since $v_t \propto r^2$, power $\propto r \times r^4 = r^5$. Taking only the force ($\propto r^3$ at terminal speed) misses the extra factor of velocity.

34. Answer: (A) 256/81

Wien's law $\lambda_m T = \text{constant}$ gives $T' = (4/3)T$. By Stefan's law $P \propto T^4$, so $n = (4/3)^4 = 256/81$. The inverse 81/256 would correspond to cooling, not heating.

35. Answer: (C) 9 F

$F = YA\Delta l/L$. Equal volume means the second wire has length $L/3$. $F' = Y(3A)\Delta l/(L/3) = 9 \times YA\Delta l/L = 9F$. Considering only the area change would give $3F$.

36. Answer: (B) 208.7 J

$Q = 54 \text{ cal} \approx 54 \times 4.18 \approx 225.7 \text{ J}$. Work by the vapour $W = P\Delta V = 1.013 \times 10^5 \times (167.1 - 0.1) \times 10^{-6} \approx 16.9 \text{ J}$. $\Delta U = Q - W \approx 208.8 \text{ J} \approx 208.7 \text{ J}$.

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