

NEET 2019 — Physics Question Paper with Solutions

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

NEET 2019 · Q1

1. When a block of mass M is suspended by a long wire of length L , the length of the wire becomes $(L + l)$. The elastic potential energy stored in the extended wire is:

- (A) Mgl
- (B) MgL
- (C) $\frac{1}{2} Mgl$
- (D) $\frac{1}{2} MgL$

NEET 2019 · Q2

2. A mass m is attached to a thin wire and whirled in a vertical circle. The wire is most likely to break when:

- (A) the mass is at the highest point
- (B) the wire is horizontal
- (C) the mass is at the lowest point
- (D) inclined at an angle of 60° from vertical

NEET 2019 · Q3

3. Ionized hydrogen atoms and α -particles with same momenta enters perpendicular to a constant magnetic field, B . The ratio of their radii of their paths $r_H : r_\alpha$ will be:

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

NEET 2019 · Q4

4. Body A of mass $4m$ moving with speed u collides with another body B of mass $2m$, at rest. The collision is head on and elastic in nature. After the collision the fraction of energy lost by the colliding body A is:

- (A) $1/9$
- (B) $8/9$
- (C) $4/9$
- (D) $5/9$

NEET 2019 · Q5

5. In a double slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 1 m away, was found to be 0.2° . What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water? ($\mu_{\text{water}} = 4/3$)

- (A) 0.266°
- (B) 0.15°
- (C) 0.05°
- (D) 0.1°

NEET 2019 · Q7

6. A soap bubble, having radius of 1 mm , is blown from a detergent solution having a surface tension of $2.5 \times 10^{-2} \text{ N/m}$. The pressure inside the bubble equals at a point Z_0 below the free surface of water in a container. Taking $g = 10 \text{ m/s}^2$, density of water = 10^3 kg/m^3 , the value of Z_0 is:

- (A) 100 cm
- (B) 10 cm
- (C) 1 cm
- (D) 0.5 cm

NEET 2019 · Q8

7. Which colour of the light has the longest wavelength?

- (A) red
- (B) blue
- (C) green
- (D) violet

NEET 2019 · Q9

8. A disc of radius 2 m and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of 20 cm/s. How much work is needed to stop it?

- (A) 3 J
- (B) 30 kJ
- (C) 2 J
- (D) 1 J

NEET 2019 · Q10

9. The displacement of a particle executing simple harmonic motion is given by $y = A_0 + A \sin \omega t + B \cos \omega t$. Then the amplitude of its oscillation is given by:

- (A) $A_0 + \sqrt{A^2 + B^2}$
- (B) $\sqrt{A^2 + B^2}$
- (C) $\sqrt{A_0^2 + (A + B)^2}$
- (D) $A + B$

NEET 2019 · Q11

10. Two similar thin equi-convex lenses, of focal length f each, are kept coaxially in contact with each other such that the focal length of the combination is F_1 . When the space between the two lenses is filled with glycerin (which has the same refractive index ($\mu = 1.5$) as that of glass) then the equivalent focal length is F_2 . The ratio $F_1 : F_2$ will be:

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

NEET 2019 · Q12

11. Increase in temperature of a gas filled in a container would lead to:

- (A) increase in its mass
- (B) increase in its kinetic energy
- (C) decrease in its pressure
- (D) decrease in intermolecular distance

NEET 2019 · Q13

12. An electron is accelerated through a potential difference of 10,000 V. Its de Broglie wavelength is, (nearly): ($m_e = 9 \times 10^{-31}$ kg)

- (A) 12.2×10^{-13} m
- (B) 12.2×10^{-12} m
- (C) 12.2×10^{-14} m
- (D) 12.2 nm

NEET 2019 · Q14

13. A copper rod of 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is: ($\alpha_{Cu} = 1.7 \times 10^{-5} \text{ K}^{-1}$ and $\alpha_{Al} = 2.2 \times 10^{-5} \text{ K}^{-1}$)

- (A) 6.8 cm
- (B) 113.9 cm
- (C) 88 cm
- (D) 68 cm

NEET 2019 · Q15

14. Pick the wrong answer in the context with rainbow.

- (A) When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed.
- (B) The order of colours is reversed in the secondary rainbow.
- (C) An observer can see a rainbow when his front is towards the sun.
- (D) Rainbow is a combined effect of dispersion, refraction and reflection of sunlight.

NEET 2019 · Q16

15. A body weighs 200 N on the surface of the earth. How much will it weigh half way down to the centre of the earth?

- (A) 150 N
- (B) 200 N
- (C) 250 N
- (D) 100 N

NEET 2019 · Q18

16. For a p-type semiconductor, which of the following statements is true?

- (A) Electrons are the majority carriers and trivalent atoms are the dopants.
- (B) Holes are the majority carriers and trivalent atoms are the dopants.
- (C) Holes are the majority carriers and pentavalent atoms are the dopants.
- (D) Electrons are the majority carriers and pentavalent atoms are the dopants.

NEET 2019 · Q19

17. Average velocity of a particle executing SHM in one complete vibration is:

- (A) $A\omega/2$
- (B) $A\omega$
- (C) $A\omega^2/2$
- (D) zero

NEET 2019 · Q20

18. The unit of thermal conductivity is:

- (A) J m K^{-1}
- (B) $\text{J m}^{-1} \text{K}^{-1}$
- (C) W m K^{-1}
- (D) $\text{W m}^{-1} \text{K}^{-1}$

NEET 2019 · Q21

19. A solid cylinder of mass 2 kg and radius 4 cm is rotating about its axis at the rate of 3 rpm. The torque required to stop after 2π revolutions is:

- (A) $2 \times 10^{-6} \text{ N m}$
- (B) $2 \times 10^{-3} \text{ N m}$
- (C) $12 \times 10^{-4} \text{ N m}$
- (D) $2 \times 10^6 \text{ N m}$

NEET 2019 · Q22

20. A force $F = 20 + 10y$ acts on a particle in y-direction where F is in newton and y in meter. Work done by this force to move the particle from $y = 0$ to $y = 1$ m is:

- (A) 30 J
- (B) 5 J
- (C) 25 J
- (D) 20 J

NEET 2019 · Q23

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

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

NEET 2019 · Q25

22. A hollow metal sphere of radius R is uniformly charged. The electric field due to the sphere at a distance r from the centre:

- (A) increases as r increases for $r < R$ and for $r > R$
- (B) zero as r increases for $r < R$, decreases as r increases for $r > R$
- (C) zero as r increases for $r < R$, increases as r increases for $r > R$
- (D) decreases as r increases for $r < R$ and for $r > R$

NEET 2019 · Q26

23. At a point A on the earth's surface the angle of dip, $\delta = +25^\circ$. At a point B on the earth's surface the angle of dip, $\delta = -25^\circ$. We can interpret that:

- (A) A and B are both located in the northern hemisphere.
- (B) A is located in the southern hemisphere and B is located in the northern hemisphere.
- (C) A is located in the northern hemisphere and B is located in the southern hemisphere.
- (D) A and B are both located in the southern hemisphere.

NEET 2019 · Q27

24. The total energy of an electron in an atom in an orbit is -3.4 eV. Its kinetic and potential energies are, respectively:

- (A) -3.4 eV, -3.4 eV
- (B) -3.4 eV, -6.8 eV
- (C) 3.4 eV, -6.8 eV
- (D) 3.4 eV, 3.4 eV

NEET 2019 · Q28

25. In total internal reflection when the angle of incidence is equal to the critical angle for the pair of media in contact, what will be angle of refraction?

- (A) 180°
- (B) 0°
- (C) equal to angle of incidence
- (D) 90°

NEET 2019 · Q29

26. The work done to raise a mass m from the surface of the earth to a height h , which is equal to the radius of the earth, is:

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

NEET 2019 · Q30

27. When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60° with the horizontal, it can travel a distance x_1 along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can travel x_2 distance. Then $x_1 : x_2$ will be:

- (A) $1 : \sqrt{2}$
- (B) $\sqrt{2} : 1$
- (C) $1 : \sqrt{3}$
- (D) $1 : 2\sqrt{3}$

NEET 2019 · Q31

28. α -particle consists of:

- (A) 2 protons and 2 neutrons only
- (B) 2 electrons, 2 protons and 2 neutrons
- (C) 2 electrons and 4 protons only
- (D) 2 protons only

NEET 2019 · Q32

29. The speed of a swimmer in still water is 20 m/s. The speed of river water is 10 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path, the angle at which he should make his strokes w.r.t. north is given by:

- (A) 30° west
- (B) 0°
- (C) 60° west
- (D) 45° west

NEET 2019 · Q34

30. Two particles A and B are moving in uniform circular motion in concentric circles of radii r_A and r_B with speed v_A and v_B respectively. Their time period of rotation is the same. The ratio of angular speed of A to that of B will be:

- (A) $r_A : r_B$
- (B) $v_A : v_B$
- (C) $r_B : r_A$
- (D) 1 : 1

NEET 2019 · Q35

31. A block of mass 10 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1 m. The coefficient of friction between the block and the inner wall of the cylinder is 0.1. The minimum angular velocity needed for the cylinder to keep the block stationary when the cylinder is vertical and rotating about its axis, will be: ($g = 10 \text{ m/s}^2$)

- (A) $\sqrt{10} \text{ rad/s}$
- (B) $10/(2\pi) \text{ rad/s}$
- (C) 10 rad/s
- (D) $10\pi \text{ rad/s}$

NEET 2019 · Q36

32. Two parallel infinite line charges with linear charge densities $+\lambda \text{ C/m}$ and $-\lambda \text{ C/m}$ are placed at a distance of $2R$ in free space. What is the electric field mid-way between the two line charges?

- (A) zero
- (B) $2\lambda/(\pi\epsilon_0 R) \text{ N/C}$
- (C) $\lambda/(\pi\epsilon_0 R) \text{ N/C}$
- (D) $\lambda/(2\pi\epsilon_0 R) \text{ N/C}$

NEET 2019 · Q37

33. Two point charges A and B, having charges $+Q$ and $-Q$ respectively, are placed at certain distance apart and force acting between them is F . If 25% charge of A is transferred to B, then force between the charges becomes:

- (A) F
- (B) $9F/16$
- (C) $16F/9$
- (D) $4F/3$

NEET 2019 · Q38

34. A small hole of area of cross-section 2 mm^2 is present near the bottom of a fully filled open tank of height 2 m. Taking $g = 10 \text{ m/s}^2$, the rate of flow of water through the open hole would be nearly:

- (A) $12.6 \times 10^{-6} \text{ m}^3/\text{s}$
- (B) $8.9 \times 10^{-6} \text{ m}^3/\text{s}$
- (C) $2.23 \times 10^{-6} \text{ m}^3/\text{s}$
- (D) $6.4 \times 10^{-6} \text{ m}^3/\text{s}$

35. In which of the following processes, heat is neither absorbed nor released by a system?

- (A) isothermal
- (B) adiabatic
- (C) isobaric
- (D) isochoric

36. A 800 turn coil of effective area 0.05 m^2 is kept perpendicular to a magnetic field $5 \times 10^{-5} \text{ T}$. When the plane of the coil is rotated by 90° around any of its coplanar axis in 0.1 s , the emf induced in the coil will be:

- (A) 2 V
- (B) 0.2 V
- (C) $2 \times 10^{-3} \text{ V}$
- (D) 0.02 V

37. A parallel plate capacitor of capacitance $20 \mu\text{F}$ is being charged by a voltage source whose potential is changing at the rate of 3 V/s . The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be, respectively:

- (A) zero, $60 \mu\text{A}$
- (B) $60 \mu\text{A}$, $60 \mu\text{A}$
- (C) $60 \mu\text{A}$, zero
- (D) zero, zero

38. In an experiment, the percentage of error occurred in the measurement of physical quantities A, B, C and D are 1%, 2%, 3% and 4% respectively. Then the maximum percentage of error in the measurement X, where $X = A^2 B^{(1/2)} / (C^{(1/3)} D^3)$, will be:

- (A) $(3/13)\%$
- (B) 16%
- (C) -10%
- (D) 10%

Answer key and explanations

1. Answer: (C) $\frac{1}{2} \text{ Mg l}$

Elastic energy stored = $\frac{1}{2} \times \text{force} \times \text{extension} = \frac{1}{2} \times \text{Mg} \times \text{l}$. Using Mg l confuses the original length with the extension, and Mg l forgets the factor $\frac{1}{2}$ (the average force during stretching is half the final force).

2. Answer: (C) the mass is at the lowest point

At the lowest point the tension must supply the centripetal force and also balance the full weight, $T = \text{mg} + \text{mv}^2/r$, and the speed is also maximum there, so tension is greatest. At the highest point gravity helps provide the centripetal force, so tension is least.

3. Answer: (A) 2 : 1

$r = p/(qB)$; with equal momenta $r \propto 1/q$. The proton has charge e and the α -particle $2e$, so $r_H : r_\alpha = 2 : 1$. Taking 1 : 2 inverts the dependence on charge.

4. Answer: (B) 8/9

For a 1-D elastic collision $v_A = (m_1 - m_2)u/(m_1 + m_2) = (4m - 2m)u/6m = u/3$. A keeps $(1/3)^2 = 1/9$ of its kinetic energy, so it loses 8/9. 1/9 is the fraction retained, not lost.

5. Answer: (B) 0.15°

Angular width $\propto \lambda$, and in water λ becomes λ/μ . New width = $0.2^\circ \times 3/4 = 0.15^\circ$. Multiplying by 4/3 (0.266°) wrongly assumes the wavelength increases in water.

6. Answer: (C) 1 cm

Excess pressure in a soap bubble (two surfaces) = $4T/r = 4 \times 2.5 \times 10^{-2}/10^{-3} = 100$ Pa. Setting $pgZ_0 = 100$ gives $Z_0 = 100/(10^3 \times 10) = 0.01$ m = 1 cm. Using $2T/r$ (single surface) would give 0.5 cm.

7. Answer: (A) red

In the visible spectrum wavelength decreases from red (about 700 nm) to violet (about 400 nm), so red has the longest wavelength. Violet is the shortest-wavelength end.

8. Answer: (A) 3 J

For a rolling disc $KE = \frac{1}{2}mv^2(1 + k^2/R^2) = \frac{3}{4}mv^2 = 0.75 \times 100 \times (0.2)^2 = 3$ J, so 3 J of work must be removed. Counting only translational KE gives 2 J; forgetting to convert cm/s to m/s gives 30 kJ.

9. Answer: (B) $\sqrt{A^2 + B^2}$

A_0 only shifts the mean position; $A \sin \omega t + B \cos \omega t$ combine into a single sinusoid of amplitude $\sqrt{A^2 + B^2}$. Adding A_0 to it gives the maximum displacement from the origin, not the amplitude about the mean position.

10. Answer: (B) 1 : 2

For an equiconvex glass lens ($\mu = 1.5$) $f = R$, so $F_1 = f/2$. The glycerin film is a concave lens with $1/f = 0.5(-2/R) = -1/f$. Then $1/F_2 = 1/f + 1/f - 1/f = 1/f$, so $F_2 = f$ and $F_1 : F_2 = 1 : 2$. The ratio 2 : 1 inverts this.

11. Answer: (B) increase in its kinetic energy

Average molecular kinetic energy is proportional to absolute temperature, so heating raises it. In a closed container the mass is fixed and pressure increases (not decreases) with temperature.

12. Answer: (B) 12.2×10^{-12} m

$\lambda = h/\sqrt{2meV} \approx 1.227/\sqrt{V}$ nm = $1.227/100$ nm = 1.227×10^{-11} m = 12.2×10^{-12} m. 12.2 nm would correspond to an accelerating voltage of only about 0.01 V.

13. Answer: (D) 68 cm

Equal expansions require $L_{Cu} \alpha_{Cu} = L_{Al} \alpha_{Al}$, so $L_{Al} = 88 \times 1.7/2.2 = 68$ cm. 113.9 cm comes from inverting the ratio of expansion coefficients.

14. Answer: (C) An observer can see a rainbow when his front is towards the sun.

A rainbow is seen only with the sun behind the observer, so the statement about facing the sun is wrong. Secondary rainbows do involve two internal reflections with reversed colour order, and rainbows arise from dispersion, refraction and internal reflection.

15. Answer: (D) 100 N

Inside the earth $g(d) = g(1 - d/R)$; at $d = R/2$, g is halved, so the weight becomes 100 N. 150 N wrongly uses a quarter reduction.

16. Answer: (B) Holes are the majority carriers and trivalent atoms are the dopants.

A p-type semiconductor is made by doping with trivalent (acceptor) atoms, which create holes; holes are therefore the majority carriers. Pentavalent dopants produce n-type material with electrons as majority carriers.

17. Answer: (D) zero

After one complete vibration the particle returns to its starting point, so displacement is zero and average velocity is zero. $A\omega$ is the maximum speed, not the average velocity.

18. Answer: (D) $W m^{-1} K^{-1}$

From $H = KA(\Delta T)/L$, $K = HL/(A\Delta T)$, giving $W \cdot m/(m^2 \cdot K) = W m^{-1} K^{-1}$. $J m^{-1} K^{-1}$ misses the per-second (rate) part of heat flow.

19. Answer: (A) 2×10^{-6} N m

$I = \frac{1}{2}MR^2 = \frac{1}{2} \times 2 \times (0.04)^2 = 1.6 \times 10^{-3}$ kg m². $\omega = 3 \times 2\pi/60 = \pi/10$ rad/s; $\theta = 2\pi$ rev $\times 2\pi = 4\pi^2$ rad. $\alpha = \omega^2/2\theta = (\pi^2/100)/(8\pi^2) = 1/800$ rad/s², so $\tau = I\alpha = 2 \times 10^{-6}$ N m. Treating 2π revolutions as 2π radians gives a value 2π times too large.

20. Answer: (C) 25 J

$W = \int_0^1 (20 + 10y) dy = 20 + 5 = 25$ J. Using the final force value 30 N times 1 m gives 30 J, ignoring that the force varies.

21. 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.

22. Answer: (B) zero as r increases for $r < R$, decreases as r increases for $r > R$

By Gauss's law the field inside a charged conducting shell is zero, and outside it falls as kQ/r^2 . A field increasing outside the sphere would contradict the inverse-square dependence.

23. Answer: (C) A is located in the northern hemisphere and B is located in the southern hemisphere.

A positive dip means the north end of the needle dips downward, which happens in the northern (magnetic) hemisphere; negative dip means the needle's north end points up, as in the southern hemisphere. So A is north and B is south.

24. Answer: (C) 3.4 eV, -6.8 eV

In the Bohr model $K = -E$ and $U = 2E$. With $E = -3.4$ eV, $K = +3.4$ eV and $U = -6.8$ eV. Kinetic energy can never be negative, which rules out the choices with negative KE.

25. Answer: (D) 90°

The critical angle is defined as the angle of incidence for which the refracted ray grazes the interface, i.e. the angle of refraction is 90°. Beyond it, total internal reflection occurs.

26. Answer: (C) $\frac{1}{2} mgR$

$W = GMm(1/R - 1/2R) = GMm/2R = \frac{1}{2} mgR$. mgR assumes g stays constant up to height R , which is invalid.

27. Answer: (C) 1 : $\sqrt{3}$

On a smooth incline the deceleration is $g \sin \theta$, so $x = u^2/(2g \sin \theta)$. $x_1/x_2 = \sin 30^\circ/\sin 60^\circ = (1/2)/(\sqrt{3}/2) = 1 : \sqrt{3}$. A steeper incline decelerates the object more, so x_1 must be the smaller distance.

28. Answer: (A) 2 protons and 2 neutrons only

An α -particle is a helium-4 nucleus: 2 protons and 2 neutrons, with no electrons (hence its $+2e$ charge). Including 2 electrons would describe a neutral helium atom.

29. Answer: (A) 30° west

For the shortest path his resultant velocity must point due north, so the westward component of his swimming velocity must cancel the current: $20 \sin \theta = 10$, $\theta = 30^\circ$ west of north. Swimming straight north (0°) gives minimum time, not the shortest path.

30. Answer: (D) 1 : 1

Angular speed $\omega = 2\pi/T$; equal time periods mean equal angular speeds, ratio 1 : 1. The ratio $v_A : v_B$ equals $r_A : r_B$ here, which is the ratio of linear, not angular, speeds.

31. Answer: (C) 10 rad/s

The normal force supplies the centripetal force, $N = m\omega^2 r$, and friction must balance weight: $\mu m\omega^2 r \geq mg$. $\omega^2 = g/(\mu r) = 10/(0.1 \times 1) = 100$, so $\omega = 10$ rad/s. $\sqrt{10}$ rad/s forgets to divide by μ .

32. Answer: (C) $\lambda/(\pi\epsilon_0 R)$ N/C

Each line gives $E = \lambda/(2\pi\epsilon_0 R)$ at distance R . At the midpoint the field of $+\lambda$ points away from it and that of $-\lambda$ points toward it, i.e. in the same direction, so they add: $\lambda/(\pi\epsilon_0 R)$. Zero would hold only for like charges.

33. Answer: (B) 9F/16

Transferring $Q/4$ from A to B leaves A with $+3Q/4$ and B with $-Q + Q/4 = -3Q/4$. Force $\propto$ product of charges, so $F' = (9/16)F$. $16F/9$ inverts the ratio.

34. Answer: (A) $12.6 \times 10^{-6} \text{ m}^3/\text{s}$

Torricelli: $v = \sqrt{2gh} = \sqrt{40} \approx 6.32$ m/s. Flow rate = $Av = 2 \times 10^{-6} \times 6.32 \approx 12.6 \times 10^{-6} \text{ m}^3/\text{s}$. $6.4 \times 10^{-6} \text{ m}^3/\text{s}$ is roughly the speed alone without multiplying by the 2 mm^2 area.

35. Answer: (B) adiabatic

An adiabatic process is by definition one with no heat exchange ($Q = 0$). In an isothermal process heat does flow, exactly balancing the work done, so that temperature remains constant.

36. Answer: (D) 0.02 V

Flux changes from NBA to zero: $\Delta\phi = 800 \times 5 \times 10^{-5} \times 0.05 = 2 \times 10^{-3} \text{ Wb}$. $\text{emf} = \Delta\phi/\Delta t = 2 \times 10^{-3}/0.1 = 0.02 \text{ V}$. $2 \times 10^{-3} \text{ V}$ is the flux change, not divided by the time.

37. Answer: (B) 60 μA , 60 μA

Conduction current $I = C dV/dt = 20 \times 10^{-6} \times 3 = 60 \mu\text{A}$. Displacement current between the plates equals the conduction current in the wires, so both are $60 \mu\text{A}$. Saying the displacement current is zero ignores Maxwell's correction.

38. Answer: (B) 16%

Maximum relative errors add regardless of whether the quantity is in the numerator or denominator: $2 \times 1\% + \frac{1}{2} \times 2\% + \frac{1}{3} \times 3\% + 3 \times 4\% = 2 + 1 + 1 + 12 = 16\%$. Subtracting the denominator errors gives the wrong -10% .

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