

JEE MAIN DUAL NATURE OF RADIATION AND MATTER — PYQS
Max. Marks: 104
Questions: 26
Section A (MCQ) — 22 questions

- Q.1** A monochromatic source of light operating at 15 kW emits 2.5×10^{22} photons/s. The region of an electromagnetic spectrum to which the emitted electromagnetic radiation belongs to _____.
(Take $h = 6.6 \times 10^{-34}$ J.s and $c = 3 \times 10^8$ m/s).

[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) Microwave (2) Infrared
(3) Visible (4) Ultraviolet

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- Q.2** K_1 and K_2 be the maximum kinetic energies of photoelectrons emitted from a surface of a given material for the light of wavelength λ_1 and λ_2 , respectively. If $\lambda_1 = 2\lambda_2$ then the work function of material is given by :

[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) $K_2 + 2K_1$ (2) $2K_2 - K_1$
(3) $K_1 - 2K_2$ (4) $K_2 - 2K_1$

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- Q.3** An electron of mass m is moving in an electric field $\vec{E} = -2E_0\hat{i}$ ($E_0 = \text{constant} > 0$), with an initial velocity $\vec{V} = v_0\hat{i}$ ($v_0 = \text{constant} > 0$). If $\lambda_0 = \frac{h}{4mv_0}$, its de Broglie wavelength at time t is _____.
($e = \text{charge of electron}$)

[JEE Main 2026 (Online) 5th April Morning Shift]

- (1) $\frac{4\lambda_0}{\left[1 - \frac{E_0 e t}{2m v_0}\right]}$ (2) $\frac{4\lambda_0}{\left[1 + \frac{E_0 e t}{2m v_0}\right]}$
(3) $\frac{4\lambda_0}{\left[1 + \frac{2E_0 e t}{m v_0}\right]}$ (4) $\frac{4\lambda_0}{\left[1 - \frac{2E_0 e t}{m v_0}\right]}$

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- Q.4** Light source having wavelength 331 nm is used to generate photo-electrons whose stopping potential is 0.2 V. The work function of the used metal in the experiment is $\alpha \times 10^{-19}$ J. The value of α is _____.
($h = 6.62 \times 10^{-34}$ J s, $e = 1.6 \times 10^{-19}$ C and $c = 3 \times 10^8$ m/s)

[JEE Main 2026 (Online) 5th April Morning Shift]

- (1) 3.68 (2) 4.68 (3) 5.68 (4) 2.68

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- Q.5** An electron is travelling with a velocity v in free space and when it enters a medium, its velocity is reduced by 20%. The de Broglie wavelength of electron in the medium is $\alpha\lambda_0$, where λ_0 is its de Broglie wavelength in free space. The value of α is _____.
(1) 1.20 (2) 1.0 (3) 1.25 (4) 0.75

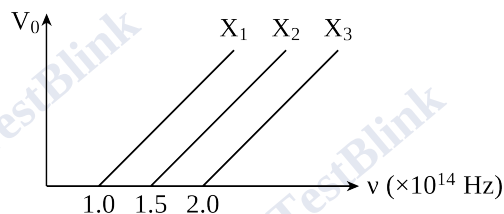
[JEE Main 2026 (Online) 5th April Evening Shift]

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- Q.6** The graph shows variation of stopping potential V_0 with the frequency ν of the incident radiation for three photosensitive metals X_1 , X_2 and X_3 . Which metal will give out electrons with greater kinetic energy, for the same wavelength of incident radiation?

[JEE Main 2026 (Online) 4th April Morning Shift]



- (1) X_1
(2) X_2
(3) X_3
(4) All the metals will give out photoelectrons with same kinetic energies.

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- Q.7** Match the **List-I** with **List-II**

List-I		List-II	
A.	Planck's constant	I.	$M L^2 T^{-2}$
B.	Stopping potential	II.	T^{-1}
C.	Work function	III.	$M L^2 T^{-1}$
D.	Threshold frequency	IV.	$M L^2 T^{-3} A^{-1}$

Choose the correct answer from the options given below : [JEE Main 2026 (Online) 4th April Evening Shift]

- (1) A-III, B-IV, C-I, D-II (2) A-I, B-II, C-III, D-IV
(3) A-IV, B-III, C-I, D-II (4) A-I, B-IV, C-III, D-II

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Q.8 The de Broglie wavelength associated with an electron accelerated through a potential difference V is λ_e and the de Broglie wavelength associated with a proton accelerated through the same potential difference is λ_p . If their corresponding masses are m_e and m_p , respectively, then the ratio of their de Broglie wavelengths $\left(\frac{\lambda_e}{\lambda_p}\right)$ is _____.

[JEE Main 2026 (Online) 4th April Evening Shift]

- (1) $\sqrt{\frac{m_p}{m_e}}$ (2) $\sqrt{\frac{m_e}{m_p}}$ (3) $\frac{m_p}{m_e}$ (4) $\left(\frac{m_p}{m_e}\right)^2$

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Q.9 For a certain metal, when monochromatic light of wavelength λ is incident, the stopping potential for photoelectrons is $3V_0$. When the same metal is illuminated by light of wavelength 2λ , then the stopping potential becomes V_0 . The threshold wavelength for photoelectric emission for the given metal is $\alpha\lambda$. The value of α is _____.

[JEE Main 2026 (Online) 2nd April Morning Shift]

- (1) 1 (2) 4 (3) 2 (4) 3

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Q.10 Number of photons of equal energy emitted per second by a 6 mW laser source operating at 663 nm is _____.

(Given : $h = 6.63 \times 10^{-34}$ J s and $c = 3 \times 10^8$ m/s)

[JEE Main 2026 (Online) 28th January Evening Shift]

- (1) 10×10^{15} (2) 5×10^{16}
(3) 5×10^{15} (4) 2×10^{16}

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Q.11 When a light of a given wavelength falls on a metallic surface the stopping potential for photoelectrons is 3.2 V. If a second light having wavelength twice of first light is used, the stopping potential drops to 0.7 V. The wavelength of first light is _____ m.

($h = 6.63 \times 10^{-34}$ J s, $e = 1.6 \times 10^{-19}$ C, $c = 3 \times 10^8$ m/s)

[JEE Main 2026 (Online) 24th January Evening Shift]

- (1) 2.9×10^{-8} (2) 2.5×10^{-7}
(3) 3.1×10^{-7} (4) 2.2×10^{-8}

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Q.12 The de Broglie wavelength of an oxygen molecule at 27°C is $x \times 10^{-12}$ m. The value of x is (take Planck's constant = 6.63×10^{-34} J s, Boltzmann constant = 1.38×10^{-23} J/K, mass of oxygen molecule = 5.31×10^{-26} kg)

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) 24 (2) 30 (3) 20 (4) 26

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Q.13 Light is incident on a metallic plate having work function 110×10^{-20} J. If the produced photoelectrons have zero kinetic energy then the angular frequency of the incident light is _____ rad/s. ($h = 6.63 \times 10^{-34}$ J s)

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1) 1.04×10^{13} (2) 1.66×10^{16}
(3) 1.66×10^{15} (4) 1.04×10^{16}

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Q.14 A light wave described by $E = 60[\sin(3 \times 10^{15}t) + \sin(12 \times 10^{15}t)]$ (in SI units) falls on a metal surface of work function 2.8 eV. The maximum kinetic energy of ejected photoelectron is (approximately) _____ eV. ($h = 6.6 \times 10^{-34}$ J s and $e = 1.6 \times 10^{-19}$ C)

[JEE Main 2026 (Online) 21st January Morning Shift]

- (1) 3.8 (2) 7.8 (3) 6.0 (4) 5.1

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Q.15 A photoemissive substance is illuminated with a radiation of wavelength λ_i so that it releases electrons with de-Broglie wavelength λ_e . The longest wavelength of radiation that can emit photoelectron is λ_o . Expression for de-Broglie wavelength is given by: (m : mass of the electron, h : Planck's constant and c : speed of light)

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1) $\lambda_e = \frac{\sqrt{h\lambda_i}}{\sqrt{2mc}}$
(2) $\lambda_e = \frac{h}{\sqrt{2mc\left(\frac{1}{\lambda_i} - \frac{1}{\lambda_o}\right)}}$
(3) $\lambda_e = \sqrt{\frac{h}{2mc\left(\frac{1}{\lambda_i} - \frac{1}{\lambda_o}\right)}}$
(4) $\lambda_e = \sqrt{\frac{h\lambda_o}{2mc}}$

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Q.16 A small mirror of mass m is suspended by a massless thread of length l . Then the small angle through which the thread will be deflected when a short pulse of laser of energy E falls normal on the mirror

(c = speed of light in vacuum and g = acceleration due to gravity)

[JEE Main 2025 (Online) 4th April Morning Shift]

$$(1) \theta = \frac{E}{mc\sqrt{gl}} \quad (2) \theta = \frac{E}{2mc\sqrt{gl}}$$

$$(3) \theta = \frac{3E}{4mc\sqrt{gl}} \quad (4) \theta = \frac{2E}{mc\sqrt{gl}}$$

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Q.17 Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**
Assertion (A): In photoelectric effect, on increasing the intensity of incident light the stopping potential increases.

Reason (R): Increase in intensity of light increases the rate of photoelectrons emitted, provided the frequency of incident light is greater than threshold frequency.

In the light of the above statements, choose the correct answer from the options given below

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) Both A and R are true and R is the correct explanation of A
- (2) A is false but R is true
- (3) Both A and R are true but R is NOT the correct explanation of A
- (4) A is true but R is false

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Q.18 The work function of a metal is 3 eV. The color of the visible light that is required to cause emission of photoelectrons is

[JEE Main 2025 (Online) 3rd April Morning Shift]

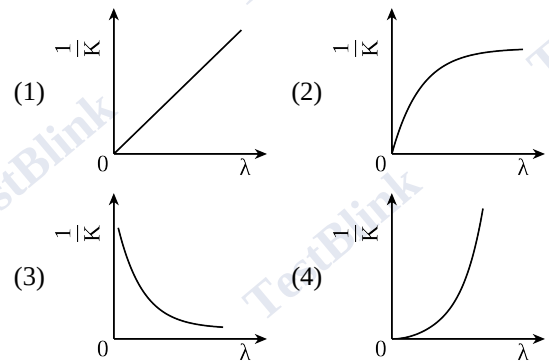
- (1) Red
- (2) Green
- (3) Blue
- (4) Yellow

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Q.19 If λ and K are de Broglie wavelength and kinetic energy, respectively, of a particle with constant mass, the correct graphical representation for the particle will be :

[JEE Main 2025 (Online) 29th January Morning Shift]



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Q.20 Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): Emission of electrons in photoelectric effect can be suppressed by applying a sufficiently negative electric potential to the photoemissive substance.

Reason (R): A negative electric potential, which stops the emission of electrons from the surface of a photoemissive substance, varies linearly with frequency of incident radiation.

In the light of the above statements, choose the most appropriate answer from the options given below :

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (2) Both (A) and (R) are true but (R) is not the correct explanation of (A).
- (3) (A) is false but (R) is true
- (4) (A) is true but (R) is false

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Q.21 A proton of mass ' m_p ' has same energy ' E ' as that of a photon of wavelength ' λ '. If the proton is moving at non-relativistic speed, then ratio of its de Broglie wavelength to the wavelength of photon is

[JEE Main 2025 (Online) 28th January Morning Shift]

$$(1) \frac{1}{c} \sqrt{\frac{E}{m_p}} \quad (2) \frac{1}{c} \sqrt{\frac{2E}{m_p}}$$

$$(3) \frac{1}{2c} \sqrt{\frac{E}{m_p}} \quad (4) \frac{1}{c} \sqrt{\frac{E}{2m_p}}$$

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Q.22 Which of the following phenomena cannot be explained by wave theory of light?

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) Refraction of light
- (2) Reflection of light
- (3) Diffraction of light
- (4) Compton effect

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Section B (Numerical) — 4 questions

- Q.23** The de Broglie wavelength for an electron accelerated through the potential difference of V_1 volt is λ_1 . When the potential difference is changed to V_2 volt, the associated de Broglie wavelength is increased by 50%. If $(V_1/V_2) = (9/\alpha)$, then the value of α is _____.

[JEE Main 2026 (Online) 6th April Evening Shift]

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- Q.24** The ratio of de Broglie wavelength of a deuteron with kinetic energy E to that of an alpha particle with kinetic energy $2E$, is $n:1$. The value of n is _____.
(Assume mass of proton = mass of neutron)

[JEE Main 2026 (Online) 28th January Morning Shift]

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- Q.25** A particle having electric charge 3×10^{-19} C and mass 6×10^{-27} kg is accelerated by applying an electric potential of 1.21 V. Wavelength of the matter wave associated with the particle is $\alpha \times 10^{-12}$ m. The value of α is _____.
(Take Planck's constant = 6.6×10^{-34} J s)

[JEE Main 2026 (Online) 21st January Evening Shift]

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- Q.26** An electron is released from rest near an infinite non-conducting sheet of uniform charge density ' $-\sigma$ '. The rate of change of de-Broglie wave length associated with the electron varies inversely as n^{th} power of time. The numerical value of n is _____.

[JEE Main 2025 (Online) 8th April Evening Shift]

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ANSWER KEY

Section A (MCQ) — 22 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	4	4	3	3	3	1	1	1	2	4	2
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	4	4	4	3	4	2	3	4	2	4	4

Section B (Numerical) — 4 questions

Ques.	23	24	25	26							
Ans.	4	2	10	2							