



# PHYSICS

## BOOKS - PUNJAB BOARD PREVIOUS YEAR PAPERS

### Wave Nature of Matter

#### Exercise

1. Find de-Broglie wavelength of wave associated with a particle of rest mass

$9 \times 10^{-31}$  kg and moving with a speed  $1.5 \times 10^8 \text{ ms}^{-1}$  ( $h = 6.6 \times 10^{-34}$  Js).



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2. Find de-Broglie wave length of wave associated with a particle of rest mass  $5 \times 10^{-30}$  kg and moving with a speed  $1.8 \times 10^8 \text{ ms}^{-1}$  ( $h = 6.6 \times 10^{-34}$  Js).



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3. Calculate the momentum of electrons if their wavelength is  $2\text{\AA}$ . Given that Planck's constant,  $h = 6.629 \times 10^{-34}$  Js, mass of electrons,  $m = 9.1 \times 10^{-31}$  kg.



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4. Calculate the de-Broglie wavelength for electron moving with speed of  $6 \times 10^5 \text{ m s}^{-1}$ ?



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5. What voltage must be applied to an electron microscope to produce electrons of wavelength  $0.4\overset{\circ}{\text{A}}$ ?



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6. A photon and an electron have got same De Broglie wavelength ( $\approx 10^{-10}m$ ). Which has greater kinetic energy? Explain.



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7. What is the momentum and De Broglie wavelength of an electron with kinetic energy of 120 eV.



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8. Calculate the momentum and De Broglie wavelength of the electrons accelerated through a potential difference of 56V. Mass of electron is  $9.1 \times 10^{-31}$  kg.



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9. Calculate the momentum of electrons, if their wavelength is  $1\text{\AA}$ . Given that Planck's constant,  $h = 6.626 \times 10^{-34}$  Js, mass of electron,  $m = 9.1 \times 10^{-31}$  kg.



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10. Calculate the momentum of electrons, if their wavelength is  $3\text{\AA}$ . Given that Planck's constant,  $h = 6.626 \times 10^{-34}$  Js, mass of electron,  $m = 9.1 \times 10^{-31}$  kg.



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**11.** Calculate the De-Brogile wavelength of an electron and proton if their  $10^5 m/s$  given mass of electron is  $9.1 \times 10^{-31}$  kg (kilogram).

Mass of proton  $1.67 \times 10^{-27} kg$ .

Plank.s constant

$h = 6.625 \times 10^{-34}$  JS (Joule Second).



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12. Calculate the de-Broglie wavelength for electron moving with speed of  $6 \times 10^5 \text{ m s}^{-1}$ ?



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13. Calculate the de Broglie wavelength for electron moving with a speed of  $9 \times 10^5 \text{ m s}^{-1}$

Given  $h = 6.6 \times 10^{-34} \text{ J s}$  and mass of electron =  $9.1 \times 10^{-31} \text{ kg}$ .



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14. Calculate the momentum of electrons if their wavelength is  $2\overset{\circ}{\text{A}}$ . Given that Planck's constant,  $h = 6.629 \times 10^{-34}$  Js, mass of electrons,  $m = 9.1 \times 10^{-31}$  kg.



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15. What is the de-Broglie wavelength of an electron beam accelerated through a potential difference of 25 V?



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16. What is de -Broglie wavelength of an electron beam accelerated through a potential difference of 36 V?



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17. An electron of mass  $m$  and charge  $e$  is accelerated from rest through a potential difference  $V$  in vacuum. Its final velocity will be

A.  $\frac{eV}{2m}$

B.  $\frac{eV}{m}$

C.  $\sqrt{\frac{2eV}{m}}$

D.  $\sqrt{\frac{eV}{m}}$

**Answer:**



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**18.** The minimum wavelength of the X-rays produced by electrons accelerated through a potential of  $V$ . (in volt) is directly proportional to

to

A.  $\sqrt{V}$

B.  $V^2$

C.  $\frac{1}{\sqrt{V}}$

D.  $\frac{1}{V}$

**Answer:**



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**19.** The de Brogile wave corresponding to a particle of mass  $.m.$  and velocity  $.v.$  has a wavelength associated with it.

A.  $\frac{h}{mv}$

B.  $hmv$

C.  $\frac{mh}{v}$

D.  $\frac{h}{\sqrt{mv}}$

**Answer:**



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**20. Select the correct option:**

If an electron and a photon have same de Broglie wavelength, then they will have same:

A. Energy

B. velocity

C. Linear momentum

D. Angular momentum

**Answer:**



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**21.** Wavelength of electromagnetic radiation is doubled, what will happen to energy of photon?



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**22.** Prove that a photon at rest has no mass.



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**23.** Write de-Broglie hypothesis for matter wave and find an expression for de- Broglie wavelength.



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**24.** An electron and a proton are possessing same amount, of kinetic energy. Which of two has a greater De Broglie wavelength? Justify your answer.



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**25.** Electron and proton are moving with the same speed, which will have more wavelength?



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26. An electron and  $\alpha$  particle have same de Broglie wavelength associated with them. How are their kinetic energy related to each other?



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27. Write de-Broglie hypothesis for matter wave and find an expression for de- Broglie wavelength.



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**28.** Calculate the de\_Brogile.s wavelngth of an electron of energy 400 eV.



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**29.** Write de-Brogile hypothesis for matter wave and find an expression for de- Brogile wavelength.



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**30.** Why are de-Broglie waves with a moving football not visible?



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**31.** Explain why wave nature of matter is not apparent in our daily observations.



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**32.** Derive an expression for de-Broglie's wavelength associated with an accelerated electron.



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