

Worksheet: De Broglie Waves



Q1: What is the de Broglie wavelength of a proton whose kinetic energy is 2.0 MeV?



Question Video

A 17 fm

B 30 fm

C 20 fm

D 27 fm

E 24 fm

Q2: What is the de Broglie wavelength of an electron travelling at a speed of 5.000×10^6 m/s?

A 139.1 pm

B 149.3 pm

C 145.5 pm

D 134.2 pm

E 129.2 pm

Q3: What is the wavelength of an electron that is moving at a 3.00% of the speed of light?

- A 82.9 pm
- B 83.7 pm
- C 80.9 pm
- D 84.5 pm
- E 81.8 pm



Question Video

Q4: What is the de Broglie wavelength of a proton whose kinetic energy is 10 MeV?

- A 3.3 fm
- B 13 fm
- C 18 fm
- D 6.3 fm
- E 9.0 fm

Q5: A proton in an accelerator has an energy of 1.00-TeV.

► Find the Lorentz factor γ for the proton.

A 1 004

B 1 102

C 1 032

D 1 011

E 1 060

► Find the DeBroglie wavelength for the proton.

A 112 am

B 136 am

C 130 am

D 119 am

E 124 am

Q6: What is the velocity of a 0.400-kg billiard ball if its wavelength is 7.50 fm?

A 2.06×10^{-20} m/s

B 2.38×10^{-20} m/s

C 2.55×10^{-20} m/s

D 2.70×10^{-20} m/s

E 2.21×10^{-20} m/s

Q7: At what velocity will an electron have a wavelength of 2.11 m?

A 4.35×10^{-4} m/s

B 3.45×10^{-4} m/s

C 4.22×10^{-4} m/s

D 1.06×10^{-4} m/s

E 2.11×10^{-4} m/s

Q8: What is the kinetic energy of a 0.0300 nm wavelength electron in a tunneling electron microscope?

A 3.00 keV

B 6.17 keV

C 1.50 keV

D 1.67 keV

E 4.50 keV

Q9: What is the wavelength of an electron accelerated from rest by a 36.7 keV potential difference?

A 5 820 fm

B 6 410 fm

C 3 250 fm

D 4 870 fm

E 3 670 fm

Q10: What is the de Broglie wavelength of a 70 kg football player running at a speed of 6.5 m/s?

A 11×10^{-36} m

B 1.5×10^{-36} m

C 4.6×10^{-36} m

D 23×10^{-36} m

E 7.7×10^{-36} m

Q11: At what velocity does a proton with a 5.80 fm wavelength move? Give your answer in units of c .

A 0.290 c

B 0.145 c

C 0.524 c

D 0.228 c

E 0.313 c

Q12: Find the wavelength of a proton that is moving at 3.40% of the speed of light.

A 34.0 fm

B 6.80 fm

C 38.9 fm

D 23.7 fm

E 17.0 fm

Q13: What is the de Broglie wavelength of an electron that is accelerated from rest through a potential difference of 16 keV?

A 4.2 pm

B 9.7 pm

C 8.0 pm

D 7.9 pm

E 8.6 pm

Q14: The de Broglie wavelength of a neutron is 0.0500 nm.

► What is the speed of this neutron?

A 5.50 km/s

B 8.78 km/s

C 0.256 km/s

D 0.100 km/s

E 7.94 km/s

► What is the energy of this neutron?

A $4.87 \times 10^{-20} \text{ J}$

B $5.71 \times 10^{-20} \text{ J}$

C $3.33 \times 10^{-20} \text{ J}$

D $2.37 \times 10^{-20} \text{ J}$

E $5.26 \times 10^{-20} \text{ J}$

Q15: An X-ray photon has an energy of 125 keV, and a neutron has the same momentum as the photon.

► Find the momentum of the photon.

A $5.00 \times 10^{-23} \text{ kg} \cdot \text{m/s}$

B $1.18 \times 10^{-23} \text{ kg} \cdot \text{m/s}$

C $6.25 \times 10^{-23} \text{ kg} \cdot \text{m/s}$

D $1.25 \times 10^{-23} \text{ kg} \cdot \text{m/s}$

E $6.67 \times 10^{-23} \text{ kg} \cdot \text{m/s}$

► Find the velocity of the neutron with the same momentum.

A 12.7 km/s

B 6.34 km/s

C 8.10 km/s

D 20.4 km/s

E 39.9 km/s

► What is the neutron's kinetic energy?

A 4.84×10^{-18} J

B 2.25×10^{-18} J

C 1.27×10^{-18} J

D 3.14×10^{-18} J

E 1.33×10^{-18} J

Q16: A neutron has a wavelength of 5.60 fm.

► What is the neutron's velocity?

A 34.5×10^6 m/s

B 69.0×10^6 m/s

C 70.6×10^6 m/s

D 19.0×10^6 m/s

E 96.0×10^6 m/s

► What is the neutron's kinetic energy?

A 85.2 MeV

B 65.0 MeV

C 26.2 MeV

D 42.0 MeV

E 97.0 MeV

Q17: A 45 GeV electron is produced in a linear accelerator. What is the wavelength of the electron?

A 0.045 fm

B 0.060 fm

C 0.028 fm

D 0.014 fm

E 0.056 fm

Q18: At what velocity will an electron have a wavelength of 2.11 m?

A 3.45×10^{-4} m/s

B 5.49×10^{-5} m/s

C 7.27×10^{-4} m/s

D 1.53×10^{-3} m/s

E 2.16×10^{-3} m/s

Q19: The detail that you can observe using a probe is limited by its wavelength. Calculate the energy, in joules, of a particle that has a wavelength of 2×10^{-16} m, small enough to detect details about one-tenth the size of a nucleon.

A 9×10^{-10} J

B 10×10^{-9} J

C 9×10^{-9} J

D 10×10^{-10} J

E 5×10^{-9} J