

Practice Worksheet — Grade 12 Physics

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Conservation of momentum collisions

1. A 2.0 kg cart moving at 3.0 m/s collides with a stationary 4.0 kg cart and they stick together. What is their common speed afterwards?

Answer: _____ (m/s)

2. Why do cars have crumple zones?
- a) they increase the momentum change during the collision
 - b) they make the collision perfectly elastic
 - c) they reduce the total impulse acting on the car
 - d) they extend the collision time, reducing the force on the occupants
3. What distinguishes an elastic collision from an inelastic one?
- a) the two objects always stick together in an elastic collision
 - b) no energy of any kind at all is lost in an inelastic collision
 - c) kinetic energy is conserved in an elastic collision only
 - d) momentum is conserved only in elastic collisions
4. A rifle recoils when it is fired. Which principle best explains this?
- a) the total momentum of rifle and bullet stays zero, so they move in opposite directions
 - b) the rifle gains more kinetic energy than the bullet, and energy pushes it back
 - c) the bullet is heavier than the rifle at the instant the charge goes off
 - d) momentum is created by the explosion and has to go somewhere afterwards

Coulomb's law and electric fields

5. According to Coulomb's law, if the distance between two charges is doubled, the force between them becomes
- a) half of its original value
 - b) one quarter of its original value
 - c) four times its original value
 - d) twice its original value
6. Two charges of 2.0 μC and 3.0 μC sit 0.10 m apart. What is the force between them? Use $k = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.

Answer: _____ (N)

7. In which direction does an electric field point?
- a) towards a positive charge and away from a negative charge
 - b) always from left to right
 - c) away from a positive charge and towards a negative charge
 - d) in the direction a negative test charge would move
8. A charge of $4.0\ \mu\text{C}$ sitting in an electric field experiences a force of $0.60\ \text{N}$. What is the electric field strength at that point, in newtons per coulomb?

Answer: _____ (N/C)

Momentum impulse

9. A $0.145\ \text{kg}$ baseball reaches the bat travelling at $38.0\ \text{m/s}$ and leaves in the opposite direction at $42.0\ \text{m/s}$. The bat and ball stay in contact for $0.850\ \text{ms}$. What is the magnitude of the average force the bat exerts on the ball?

Answer: _____ (N)

10. What is the momentum of a $1500\ \text{kg}$ car travelling at $20.0\ \text{m/s}$?

Answer: _____ ($\text{kg}\cdot\text{m/s}$)

11. A force of $250\ \text{N}$ acts on an object for $0.20\ \text{s}$. What is the impulse delivered?

Answer: _____ ($\text{N}\cdot\text{s}$)

12. Which statements about conservation of momentum are correct? Select all that apply.
- a) it holds when no external net force acts on the system
 - b) it applies to explosions as well as collisions
 - c) momentum is a vector, so direction matters
 - d) it only applies when kinetic energy is also conserved

Nuclear decay and half life

13. What did Rutherford's gold foil experiment reveal about the atom?
- a) the atom has a small, dense, positively charged nucleus
 - b) the atom is a uniform sphere of positive charge with embedded electrons
 - c) the nucleus contains neutrons as well as protons
 - d) electrons occupy fixed circular orbits

14. In the Bohr model, what happens when an electron drops from a higher to a lower energy level?
- a) a photon is absorbed with energy equal to the gap between levels
 - b) the nucleus loses a proton in the process
 - c) a photon is emitted with energy equal to the gap between levels
 - d) the electron gains kinetic energy but emits nothing
15. A radioactive isotope has a half-life of 5.0 days. What percentage of the original sample remains after 15.0 days?

Answer: _____ (%)

16. What happens to an atom's atomic number during beta-negative decay?
- a) it decreases by one, because a proton becomes a neutron
 - b) it decreases by two, as in alpha decay
 - c) it stays the same, since only energy is released
 - d) it increases by one, because a neutron becomes a proton

Photon energy and photoelectric effect

17. A photocell inside a camera's exposure sensor uses a metal with a work function of 2.30 eV. Violet light of wavelength 400 nm falls on the metal. What is the maximum kinetic energy of the electrons it emits, in electron volts? Use $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$, $c = 3.00 \times 10^8 \text{ m/s}$ and $1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$.

Answer: _____ (eV)

18. What is the wavelength of light with a frequency of $6.0 \times 10^{14} \text{ Hz}$? Use $c = 3.00 \times 10^8 \text{ m/s}$. Give your answer in nanometres.

Answer: _____ (nm)

19. Which list places electromagnetic waves in order of increasing frequency?
- a) visible, radio, infrared, X-ray, ultraviolet
 - b) infrared, radio, visible, X-ray, ultraviolet
 - c) radio, infrared, visible, ultraviolet, X-ray
 - d) X-ray, ultraviolet, visible, infrared, radio
20. The double-slit experiment produces an interference pattern. What does this demonstrate about light?
- a) light behaves purely as a particle
 - b) light behaves as a wave
 - c) light travels faster through slits
 - d) light has mass