

Brett Robbins Academic Consulting

Physics 30 Practice Test

Unit B: Forces & Fields

25 Questions

Original practice questions written to the Alberta curriculum, in the style of past diploma examinations. Work through each question, then check your answers with the key at the end.

This practice test was made by AI and there may be mistakes. If a question or answer looks wrong, contact Brett for clarification.

Question 1

A point charge of $+2.0 \times 10^{-6} \text{ C}$ and a point charge of $+5.0 \times 10^{-6} \text{ C}$ are separated by a distance of 0.30 m. The magnitude of the electric force that each charge exerts on the other is

- | | |
|-----------|----------|
| A) 0.30 N | B) 1.0 N |
| C) 3.0 N | D) 9.0 N |

Question 2

A test charge of $+2.0 \times 10^{-8} \text{ C}$ experiences an electric force of $3.6 \times 10^{-5} \text{ N}$ at a point in an electric field. The magnitude of the electric field strength at that point is

- | | |
|--------------------------------------|-------------------------------------|
| A) $7.2 \times 10^{-13} \text{ N/C}$ | B) $5.6 \times 10^{-4} \text{ N/C}$ |
| C) $1.8 \times 10^2 \text{ N/C}$ | D) $1.8 \times 10^3 \text{ N/C}$ |

Question 3

Two parallel plates are separated by a distance of 2.0 cm and are connected to a 24 V battery. The magnitude of the electric field between the plates is

- | | |
|----------------------------------|----------------------------------|
| A) 0.48 N/C | B) 12 N/C |
| C) $1.2 \times 10^3 \text{ N/C}$ | D) $2.4 \times 10^3 \text{ N/C}$ |

Question 4

An electron is accelerated from rest through an electric potential difference of 150 V.

The kinetic energy gained by the electron, expressed in units of 10^{-17} J and to three significant digits, is

Question 5

A proton moves at a speed of 4.0×10^5 m/s in a direction perpendicular to a magnetic field of strength 0.25 T. The magnitude of the magnetic force on the proton is

- A) 1.6×10^{-14} N B) 1.6×10^{-13} N
C) 6.4×10^{-14} N D) 4.0×10^{-19} N

Question 6

One point charge exerts an electric force of magnitude F on a second point charge.

The distance between the charges is then tripled, and the charge on one of the charges is doubled. The magnitude of the new force is

- A) $\frac{2}{3}F$ B) $\frac{9}{2}F$
C) $\frac{1}{9}F$ D) $\frac{2}{9}F$

Question 7

Two identical conducting spheres are mounted on insulating stands. One sphere carries a charge of $+6.0 \times 10^{-6}$ C and the other carries a charge of -2.0×10^{-6} C.

The spheres are touched together and then separated. The charge on each sphere is now

- A) $+2.0 \times 10^{-6}$ C B) $+4.0 \times 10^{-6}$ C
C) -2.0×10^{-6} C D) $+8.0 \times 10^{-6}$ C

Question 8

The magnitude of the electric field strength at a distance of 0.25 m from a point charge of $+3.2 \times 10^{-6}$ C, expressed in scientific notation, is $a.bc \times 10^d$ N/C.

Record the values of a , b , c , and d , in order, as a four – digit answer.

Question 9

An external agent moves a charge of $+2.50 \times 10^{-6} \text{ C}$ from the negative plate of a parallel plate apparatus to the positive plate. The electric potential difference between the plates is 320 V. The work done by the external agent, expressed in scientific notation, is $a.bc \times 10^{-d} \text{ J}$. Record the values of a , b , c , and d , in order, as a four – digit answer.

Question 10

A proton moves horizontally toward the right side of the page through a magnetic field that is directed toward the top of the page. Both the velocity of the proton and the magnetic field lie in the plane of the page. The direction of the magnetic force on the proton is

- | | |
|-------------------------------|----------------------------------|
| A) into the page | B) out of the page |
| C) toward the top of the page | D) toward the bottom of the page |

Question 11

In a Millikan – type apparatus, a charged oil drop that has a mass of $4.9 \times 10^{-15} \text{ kg}$ is suspended motionless in an electric field that has a strength of $3.0 \times 10^4 \text{ N/C}$. The magnitude of the charge on the oil drop is

- | | |
|------------------------------------|------------------------------------|
| A) $3.0 \times 10^{-19} \text{ C}$ | B) $1.6 \times 10^{-19} \text{ C}$ |
| C) $1.6 \times 10^{-18} \text{ C}$ | D) $4.8 \times 10^{-14} \text{ C}$ |

Question 12

An alpha particle ($q = 3.20 \times 10^{-19}$ C, $m = 6.64 \times 10^{-27}$ kg) travels in a circular path that has a radius of 0.150 m in a magnetic field that has a strength of 0.0200 T.

The speed of the alpha particle is

- A) 1.4×10^5 m/s
- B) 7.2×10^4 m/s
- C) 2.9×10^5 m/s
- D) 1.4×10^6 m/s

Question 13

Three charged spheres are fixed in a straight horizontal line. A charge of $+8.0 \times 10^{-6}$ C is 0.30 m to the left of a charge of $+2.0 \times 10^{-6}$ C, and a charge of -4.0×10^{-6} C is 0.30 m to the right of the $+2.0 \times 10^{-6}$ C charge. The net electric force on the $+2.0 \times 10^{-6}$ C charge is

- A) 0.80 N, to the left
- B) 2.4 N, to the right
- C) 2.4 N, to the left
- D) 0.80 N, to the right

Question 14

An electron is released from rest beside the negative plate of a parallel plate apparatus and moves toward the positive plate. As the electron moves, its electric potential energy i and its kinetic energy ii .

The statement above is completed by the information in row

A) i : increases

ii : increases

B) i : increases

ii : decreases

C) i : decreases

ii : decreases

D) i : decreases

ii : increases

Question 15

A straight wire that is 0.50 m long carries a current of 2.4 A. The wire is oriented perpendicular to a magnetic field that has a strength of 0.18 T. The magnitude of the magnetic force on the wire, to three significant digits, is ____ N.

Question 16

An electron is accelerated from rest through an electric potential difference of 250 V.

The final speed of the electron is

A) 4.7×10^6 m/s

B) 1.9×10^7 m/s

C) 9.4×10^6 m/s

D) 8.8×10^{13} m/s

Question 17

In a Millikan – type apparatus, an oil drop that has a mass of 9.8×10^{-15} kg is suspended motionless in an electric field that has a strength of 3.0×10^4 N/C.

The number of excess electrons on the oil drop is

Question 18

Electric field strength is classified as a *i* quantity, and electric potential difference is classified as a *ii* quantity.

The statement above is completed by the information in row

A) i: vector

ii: vector

B) i: vector

ii: scalar

C) i: scalar

ii: vector

D) i: scalar

ii: scalar

Question 19

A charge of $+4.0 \times 10^{-6} \text{ C}$ and a charge of $-4.0 \times 10^{-6} \text{ C}$ are separated by a distance of 0.40 m, with the positive charge on the left and the negative charge on the right. The net electric field at the point midway between the charges is

- A) 0 N/C
- B) $9.0 \times 10^5 \text{ N/C}$, toward the negative
- C) $1.8 \times 10^6 \text{ N/C}$, toward the negative
- D) $1.8 \times 10^6 \text{ N/C}$, toward the positive

Question 20

A long straight wire carries a conventional current vertically upward. At a point located immediately to the right of the wire, the magnetic field produced by the current in the wire is directed

- A) out of the page
- B) toward the top of the page
- C) toward the bottom of the page
- D) into the page

Question 21

A proton moves a distance of 4.0 cm in the direction of a uniform electric field that has a strength of $5.0 \times 10^3 \text{ N/C}$. The work done by the electric field on the proton is

- A) $3.2 \times 10^{-17} \text{ J}$
- B) $3.2 \times 10^{-19} \text{ J}$
- C) $8.0 \times 10^{-19} \text{ J}$
- D) $2.0 \times 10^{-16} \text{ J}$

Question 22

An electron is placed between two parallel plates where the electric field strength is $1.5 \times 10^3 \text{ N/C}$. The magnitude of the acceleration of the electron, expressed in units of 10^{14} m/s^2 and to three significant digits, is

Question 23

A straight wire lies in the plane of the page and carries a conventional current toward the bottom of the page. The wire is in an external magnetic field that is directed into the page. The direction of the magnetic force on the wire is

- | | |
|--------------------------------------|-------------------------------|
| A) toward the left side of the page | B) toward the top of the page |
| C) toward the right side of the page | D) out of the page |

Question 24

An electron travels in a circular path that has a radius of 2.0 cm in a magnetic field. The speed of the electron is $3.5 \times 10^6 \text{ m/s}$. The magnitude of the magnetic field, expressed in scientific notation, is $a.bc \times 10^{-d} \text{ T}$. Record the values of a , b , c , and d , in order, as a four – digit answer.

Question 25

A positively charged rod is brought into contact with the knob of a neutral electroscope and is then removed. After the rod is removed, the electroscope is *i* charged, and during the contact, electrons moved *ii*.

The statement above is completed by the information in row

A) i: positively

ii: from the rod onto the electroscope

B) i: negatively

ii: from the electroscope onto the rod

C) i: negatively

ii: from the rod onto the electroscope

D) i: positively

ii: from the electroscope onto the rod

Answer Key

- | | | |
|---------|-----------|----------|
| 1. B | 10. B | 19. C |
| 2. D | 11. C | 20. D |
| 3. C | 12. A | 21. A |
| 4. 2.40 | 13. B | 22. 2.63 |
| 5. A | 14. D | 23. C |
| 6. D | 15. 0.216 | 24. 9964 |
| 7. A | 16. C | 25. D |
| 8. 4605 | 17. 20 | |
| 9. 8004 | 18. B | |

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