B1-B4 · Cumulative A

Original diploma-style practice | Items 1-2

Scope: B1-B4 only; not the whole unit or a full diploma examination. Printed matching, ordering, ranking and selection tasks are analogues of digital response tasks.

Use $k = 8.99 \times 10^9$ N·m²/C² and $g = 9.81$ m/s² where needed (Alberta Physics 30 data sheets, Constants). For numerical responses, use the stated unit or coefficient and precision. Work in degrees.

B1-B4-A-01 · Multiple choice

A negative rod is brought near a neutral metal sphere. Ground is connected, then disconnected while the rod stays nearby. The rod is removed last. What is the sphere’s final charge sign?

A. positive
B. negative
C. neutral
D. cannot ever be charged

Response: _____

B1-B4-A-02 · Multiple choice

A target has calculated electric forces of 0.240 N east and 0.320 N north. What is its net force magnitude?

A. 0.560 N
B. 0.400 N
C. 0.080 N
D. 0.0768 N

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 3-4

B1-B4-A-03 · Multiple choice

A field points east at P. What happens to field and force when a positive small test charge is replaced with an equal negative test charge?

A. Both field and force reverse.
B. Field reverses; force does not.
C. Neither reverses.
D. Field stays the same; force reverses.

Response: _____

B1-B4-A-04 · Multiple choice

A pair force has magnitude F. One charge magnitude is multiplied by 3 and distance by 2; the other charge and signs remain fixed. What is the new force magnitude?

A. 3F/4
B. 3F/2
C. F/12
D. 12F

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 5-6

B1-B4-A-05 · Multiple choice

A negative rod approaches a neutral metal sphere on an insulating stand from the left. Which description is correct?

A. Charge redistributes but total charge remains zero.
B. Total charge must become the same sign as the rod.
C. Positive metal cores flow across the sphere.
D. The sphere cannot feel a net force.

Response: _____

B1-B4-A-06 · Multiple choice

For fixed point charges, which pair of axes straightens the force-distance graph?

A. F against r^2
B. F against $1/r$
C. F against $1/r^2$
D. F against r

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 7-8

B1-B4-A-07 · Multiple choice

Two equal-magnitude sources lie equally far left and right of P. The left source is positive; the right source is positive. What is the net field at P?

A. Nonzero left.
B. Zero.
C. Nonzero right.
D. Nonzero upward.

Response: _____

B1-B4-A-08 · Multiple choice

A suspended sphere is at rest with a horizontal electric force left. Which tension direction is possible?

A. Vertical downward.
B. Vertical upward only.
C. Downward and toward the electric force.
D. Upward and opposite the horizontal electric force.

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 9-10

B1-B4-A-09 · Multiple choice

A charge diagram shows field arrows pointing straight in toward a point. What source sign and positive-test charge force direction does it represent?

A. Negative source; inward force.
B. Positive source; inward force.
C. Negative source; outward force.
D. Positive source; outward force.

Response: _____

B1-B4-A-10 · Multiple choice

Which change demonstrates charge conservation when two metal objects on insulating stands touch?

A. Each final charge is zero.
B. The signed total final charge equals the signed initial total.
C. Each object keeps its original charge.
D. All objects must have equal final charges.

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 11-12

B1-B4-A-11 · Numerical response

Two identical metal spheres on insulating supports start at +8.0 μC and −2.0 μC. They touch then separate far apart, with no charge loss. What is each final charge in μC? Record the positive result to one decimal place.

Response: _____

B1-B4-A-12 · Numerical response

Point charges of magnitudes 2.00 μC and 4.00 μC are 0.300 m apart in air. Use $k = 8.99 \times 10^9$ N·m²/C². What is their force magnitude in N? Record three significant figures.

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 13-14

B1-B4-A-13 · Numerical response

A charged sphere of mass 3.00×10^{-4} kg hangs at rest with its string 30.0° from vertical. The electric force is horizontal. Use g = 9.81 m/s². What is the electric-force magnitude, expressed as a $\times 10^{-3}$ N? Record a to three significant figures.

Response: _____

B1-B4-A-14 · Numerical response

A fixed point source has magnitude 3.00 μC. A point is 0.300 m away in air. Use $k = 8.99 \times 10^{9}$ N·m²/C². What is the field strength there, expressed as a $\times 10^{5}$ N/C? Record a to three significant figures.

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 15-16

B1-B4-A-15 · Numerical response

A negative test charge has charge magnitude 3.00 nC in a field of 2.00×10^{4} N/C north. What is the force magnitude, expressed as a $\times 10^{-5}$ N? Record a to three significant figures.

Response: _____

B1-B4-A-16 · Numerical response

At P, two sources have equal magnitude 2.00 µC. The positive source is 0.300 m left of P; the negative source is 0.300 m right of P. Use $k = 8.99 \times 10^{9}$ N·m²/C². What is net field strength, expressed as a $\times 10^{5}$ N/C? Record a to three significant figures.

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 17-18

B1-B4-A-17 · Select all that apply

Choose every true statement: A. Field exists without a test charge. B. A negative test charge’s force opposes E. C. Ground cannot exchange electrons. D. Net zero force means no individual force.

Response: _____

B1-B4-A-18 · Matching

Methods: 1 = $E = k|Q|/r^2$; 2 = $F = qE$; 3 = balanced forces. Match a-b-c to method codes: (a) find field from one source Q and distance r; (b) find force from known field E and test charge q; (c) find horizontal electric force from the mass of a sphere at rest and string angle.

Response: _____

B1-B4 · Cumulative A

Original diploma-style practice | Items 19-20

B1-B4-A-19 · Ranking

With a fixed point source, points have distances A: r, B: 2r, C: r/2. Rank field strengths largest to smallest; state ties if any.

Response: _____

B1-B4-A-20 · Ordering

Starting with a neutral conductor, order these actions to retain induction charge without rod contact: 1 remove positive rod; 2 disconnect ground; 3 bring positive rod near; 4 connect ground. Record the four-digit order.

Response: _____