Exam 1--PHYS 102--S17

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. The up-quark, u, has an elementary charge of \(+\frac{2}{3}e\) and the down-quark, d, of \(-\frac{1}{3}e\). What combination of three of these quarks makes up a proton?
   a. udd
   b. uud
   c. ddd
   d. uuu

2. The diagram shows three heavily charged plastic cubes. The net force on cube B is shown. If cube B is negatively charged, what are the charges on cubes A and C, respectively?
   a. cube A is negative; cube C is negative
   b. cube A is positive; cube C is positive
   c. cube A is negative; cube C is positive
   d. cube A is positive; cube C is negative

3. When you rub your feet on the carpet, your body has become electrically charged. What has happened?
   a. you gain electrons from the carpet
   b. you deposit electrons on the carpet
   c. you gain protons from the carpet
   d. you deposit protons on the carpet

4. Which of these is a property of charge?
   I. It is quantized.
   II. It is conserved.
   III. It is directional.
   IV. It is immovable.
   a. I & II
   b. I & III
   c. I, II, and III
   d. II & III
   e. all of these

5. Is this statement true or false: The electrostatic force helps to hold together heavy nuclei.
   a. True
   b. False

6. To start a car engine, the car battery moves \(5.0\times10^{20}\) electrons through the starter motor. How many coulombs of charge were moved?
   a. \(+2.0\times10^{-21}\) C
   b. \(-3.1\times10^{39}\) C
   c. \(-0.2\) C
   d. \(3.2\times10^{-40}\) C
   e. \(-80\) C

7. The force between two charges, which are separated by 4 m, is 18 N. If the two charges are moved further to a distance of 12 m, what is the force?
   a. 2 N
   b. 9 N
   c. 18 N
   d. 27 N
   e. 6 N

8. Two identical charges, 2.0 m apart, exert forces of magnitude 4.0 N on each other. The value of either charge is:
   a. \(1.9\times10^5\) C
   b. \(2.1\times10^{-5}\) C
   c. \(1.8\times10^{-9}\) C
   d. \(4.2\times10^{-5}\) C
   e. \(3.8\times10^6\) C
9. Two electrons and a proton are spaced equally far apart in a line, as shown. What is the direction of the net force on the second electron, $e_2$?

a. left  

b. right  

c. it has a zero net force  

10. What is the magnitude of the force acting on the charge $q_2$, which is in the middle of this configuration?

![Diagram of charges](image)

a. 0.009 N  

b. 0 N  

c. 3.2 N  

d. 0.018  

11. A 6.0 $\mu$C charge is placed at the origin and a second charge is placed on the x-axis at $x = 0.30$ m. If the resulting force on the second charge is 5.4 N in the positive x-direction, what is the value of its charge?

![Diagram of forces](image)

a. 9.0 $\mu$C  

b. 9.0 nC  

c. -9.0 $\mu$C  

d. -9.0 nC  

12. For this figure, what is the magnitude of the electric field at point $P$?

![Diagram of electric field](image)

a. 73 N/C  

b. 28 N/C  

c. 81 N/C  

d. 63 N/C  

e. 36 N/C  

13. For the figure in the previous question, what is the direction of the electric field at point $A$?

a. 83º below the -x axis  

b. in the -y direction  

c. in the +x direction  

d. 8º from the +x axis  

e. 17º above the -x axis  

14. This figure shows 2 spheres that each have a charge. If $q_2$ has a charge with a magnitude of 4 C, what is the charge on $q_1$?

![Diagram of charges](image)

a. -12 C  

b. +2.7 C  

c. +6 C  

d. +2 C
15. Consider this configuration of charges. At what point is the electric field equal to zero? (Point C is equidistant between the 2 charges. Notice that one of these charges is negative.)

a. a
b. b
c. c
d. d
e. e

16. You direct a beam of electrons between two charged plates as in this figure. In what direction will the beam move?

a. towards the top
b. towards the bottom
c. away from you
d. towards you

17. Consider this configuration of charges. At the origin, towards which quadrant does the net electric field vector point?

a. I
b. II
c. III
d. IV

18. Two uniform electric fields are superimposed. The first electric field is \( E = 12 \text{ N/C} \) in the positive \( x \) (+x) direction. The second electric field is \( E = 8 \text{ N/C} \) in the negative \( y \) (-y) direction. With respect to the positive \( x \) axis, at what angle will a positive test charge accelerate in this combined field?

a. \( 48^\circ \) below the +x axis
b. \( 34^\circ \) below the +x axis
c. \( 42^\circ \) above the +x axis
d. \( 56^\circ \) below the +x axis

19. If the distance between two negative point charges is increased by a factor of three, the resultant potential energy is what factor times the initial potential energy?

a. \( 9.0 \)
b. \( 1/3 \)
c. \( 3.0 \)
d. \( 1/9 \)

20. This diagram shows a collection of charges. At which point is the potential equal to zero?

a. a
b. b
c. c
d. d
e. None of these points
21. This figure shows two charges. What is the potential at point P?

![Diagram of two charges]

a. -18 V  
b. 12 V  
c. 162 V  
d. -126 V  
e. -63 V

22. What potential energy is contained in the configuration of charges in the previous problem?

![Diagram of two charges]

a. $4.1 \times 10^{-7}$ J  
b. $1.5 \times 10^{-7}$ J  
c. $3.0 \times 10^{-7}$ J  
d. $5.4 \times 10^{-7}$ J

23. How is electric potential related to electric potential energy?

a. Electric potential is the electric potential energy per unit length at in space. This relation is not dimensionally correct.  
b. Electric potential is the electric potential energy per unit charge at a given position in space.  
c. Electric potential is the electric potential energy per unit area in space. 

d. Electric potential is the electric potential energy per unit mass at a given position in space.

24. Membrane walls of living cells have surprisingly large electric fields across them due to separation of ions. What is the voltage across an 6.00 nm–thick membrane if the electric field strength across it is $6.0 \times 10^6$ V/m? You may assume a uniform electric field.

a. 12 V  
b. 0.036 V  
c. 1.0 V  
d. $1.0 \times 10^{15}$ V

25. Positive charges move from...

a. high potential to low potential  
b. low potential to high potential  
c. remain in place  
d. it depends on the magnitude of the charge and potential

26. How are equipotential lines related to electric field lines?

a. equipotential lines always encircle field lines  
b. equipotential lines are always parallel to field lines  
c. equipotential lines are independent of field lines  
d. equipotential lines are always perpendicular to field lines  
e. equipotential lines are always stronger field lines
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Answer Section

MULTIPLE CHOICE

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