Name: ______________________

Exam 2--PHYS 102--Spring 2017

Multiple Choice (30 pts)
Identify the choice that best completes the statement or answers the question.

1. Consider this collection of charges. Which of these statements describe the net electric flux for the Gaussian surface?

   a. positive
   b. negative
   c. zero
   d. it depends on the magnitude of Q

2. The amount of electric field passing through a surface is called
   a. electricity
   b. Gauss’ law
   c. electric flux
   d. charge surface density
   e. none of the above

3. Which of these is a conservative force?
   I. Electric force
   II. Frictional force
   III. Gravitational force
   IV. Electric potential
   a. II
   b. I & III
   c. I, III, & IV
   d. all of these

4. The vectors in this diagram represent the electric field; the 4 arrows are all the same length. What type of charge does the box contain?

   a. a positive charge
   b. a net negative charge
   c. no net charge
   d. a negative charge
   e. a net positive charge

5. Electric potential is ________________.
   a. always quantized.
   b. a measure of force per unit charge.
   c. equal to the force on a charged particle.
   d. a measure of energy per unit charge.
   e. a conservative force.

6. A charged particle sits in an electric field as shown here. If the particle follows the path shown by the dashed line (ie, upwards), how much work is done to move the particle?

   a. zero work
   b. positive work
   c. negative work
   d. unable to tell without knowing the charge of the particle
7. The following is a plot of potential (V) versus position (x). You release a proton at the point x=A. What will the particle do?

[Diagram showing a graph with a potential V versus position x.]

a. go to the left
b. remain stationary
c. go to the right
d. oscillate back and forth

8. Where on this line is the potential equal to zero?

[Diagram showing a line with charges marked at different points.]

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

9. A parallel-plate capacitor is connected to a battery and has a charge of 10 C. If the area of the plates is now doubled, what is the new value of the charge?

a. 10 C
b. 20 C
c. 40 C
d. 2.5 C
e. 0.2 C

10. What must be done to a capacitor in order to increase the amount of charge it can hold (assuming it has a constant voltage)?

I. Increase the area of the plates
II. Decrease separation between the plates
III. Insert a dielectric between the plates
IV. Increase the separation between the plates

a. II & III
b. III
c. III & IV
d. I, II, & III
e. I & III

11. Consider this circuit. All three capacitors are identical. What is the voltage across C₁?

[Diagram showing a circuit with capacitors and a battery marked 12 V.]

a. 6 V
b. 8 V
c. 3 V
d. 4 V
e. 9 V

12. What is the primary purpose of a capacitor?

a. to create a current
b. to store electrical energy
c. to create a potential difference
d. to complete a circuit

13. What are you to Dr. Young?

a. just a student.
b. a paycheck.
c. an obstacle.
d. the BEST EVER!!!
Problem

14. (18 pts) Consider this circuit. What is the charge and voltage for each capacitor?

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15. (5 pts) Draw 5 equipotential lines for this collection of charges. The lines here represent the electric field.

16. (12 pts) You have a potential described by this function:

\[ V = 2y + 3xyz^2 \]

What is the electric field, in vector notation, at the following coordinates:

\( (x=0, y=1, z=2) \)

17. (10 pts) Consider this configuration of 2 charges and answer the following questions.

a) What is the potential at point A?

b) What work must you do to bring a 2 C charge from very far away to point A?
18. (10 pts) You build a capacitor out of two metal plates. It has plates with area $21 \times 10^{-12} \text{ m}^2$ and has a capacitance of $60 \times 10^{-15} \text{ F}$.

a) What is the separation between the plates?

b) You insert a material in between the plates; the dielectric constant of the materials equals 2. What is the new capacitance?

c) You connect the capacitor (without the dielectric) to a 12 V battery. When fully charged, how much energy is stored in the capacitor?

19. (15 pts) An electric field is given by:
\[ \vec{E} = -2\hat{i} + 4\hat{j} \]
This field is present in and around this gaussian surface, a rectangular prism 3m x 3m x 5m.

a) What is the electric flux through the gaussian surface?

b) What is the charge enclosed inside the surface?
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Answer Section

MULTIPLE CHOICE

1. ANS: B    PTS: 1
2. ANS: C    PTS: 1
3. ANS: B    PTS: 1
4. ANS: C    PTS: 1    REF: S17
5. ANS: D    PTS: 1    REF: S17
6. ANS: A    PTS: 1
7. ANS: A    PTS: 1
8. ANS: B    PTS: 1
9. ANS: B    PTS: 1    REF: S17
10. ANS: D   PTS: 1    REF: S17
11. ANS: E   PTS: 1    REF: S17
12. ANS: B   PTS: 1
13. ANS: D   PTS: 1

PROBLEM

14. ANS:    
  PTS: 1
15. ANS:    
  PTS: 1
16. ANS:    
  PTS: 1    REF: S17
17. ANS:    
  PTS: 1
18. ANS:    
  PTS: 1
19. ANS:    
  PTS: 1    REF: S17