GREAT! 90 + no drill set = 90% A-   Now 186/200 = 93% A avg.
J6

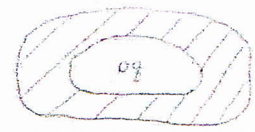
PHYSICS 242 EXAM 2dS12 PAGE 1 OF 2 NAME Mr. Haynes

1. (20 points) This problem is the one that I promised you about a conductor that contains a cavity. The conductor's free charges are at rest overall. There is a charge q (insulated from the conductor) in the cavity. The excess charge on the cavity wall = +9 pC. The cavity wall can also be called the *inner* surface of the conductor. The excess charge on the *outer* surface of the conductor is –5 pC.

Your answers must be consistent. $q_{cw} = 9\,pC$ $q_{outer} = -5\,pC$

The net electric flux is zero through all Gaussian surfaces completely in the material of the conductor because E = 0 there. Thus, the insulated charge q = –9 pC and there is 0 pC distributed through the bulk of the material. Therefore, the total excess charge on the conductor is 4 pC pC.

20



AT THE RIGHT OF THE PAGE, FILL IN THE "o" OF THE BEST ANSWER, FOR EXAMPLE, d●.
>>IF YOU DON'T KNOW IT, RULE OUT THE OBVIOUSLY WRONG ANSWERS AND THEN *GUESS*.<<
4 points each to a maximum of 70 points

Perfect 70!

2. There are only two charges in a certain region of space. Charge 1 is +3 nC and is *outside* of a Gaussian surface. Charge 2 is –5 nC and is *inside* that Gaussian surface. For that Gaussian surface, Q_{encl} = ______ nC.

a) –5 b) +3 c) –3 d) 5 – 3 = 2 a● bo co do 2.

3. The symbol $\oint$ refers to an integral over a(n) ____________ surface.

a) circular b) flat c) open d) closed ao bo co d● 3.

4. Consider a very long straight line of negative charge, that is, with a $-\lambda$. The Gaussian surface surrounding it is that of a coaxial cylinder of radius r and length l. The side of the cylinder has an area $2\pi rl$ and its ends each have an area πr^2. The cylinder's volume is $\pi r^2 l$. The charge enclosed within this Gaussian surface is __________.

a) $-\lambda l$ b) $-2\lambda\pi r^2$ c) $-\lambda 2\pi rl$ d) $-\lambda\pi r^2 l$ a● bo co do 4.

5. Continuing Question 4, in the integral over either *end* of the Gaussian surface, $E\cos\phi\, dA$ equals __________ because the vectors $\vec{E}$ and $d\vec{A}$ are _______________. ($\cos 0 = 1$, $\cos 90^\circ = 0$, $\cos 180^\circ = -1$)

a) $-E\,dA$, antiparallel
b) zero, perpendicular
c) $E\,dA$, parallel
d) $E\pi r^2$, integrated

ao b● co do 5.

6. Continuing Question 4, $\int dA$ over the *side* of the Gaussian surface equals

a) πr^2 b) $2\pi rl$ c) $\frac{Q_{encl}}{\varepsilon_0}$ d) $\pi r^2 l$ ao b● co do 6.

7. Which one of these four equations is NOT a version of Gauss's law?

a) $\Phi_E = \frac{Q_{encl}}{\varepsilon_0}$
b) $\oint E_\perp\, dA = \frac{Q_{encl}}{\varepsilon_0}$
c) $\Phi_E = \oint E\cos\phi\, dA$
d) $\oint \vec{E}\cdot d\vec{A} = \frac{Q_{encl}}{\varepsilon_0}$

ao bo c● do 7.

8. A uniform electric field makes an angle of 60° with a flat surface. Thus it makes an angle of 90° – 60° = 30° with the normal to the surface. The area of the surface is 0.004 m^2. The resulting electric flux through the surface is 800 N·m^2/C. Therefore, the magnitude of the electric field is _______________ N/C.

a) (800)(0.004)cos 30°
b) $\frac{800}{0.004\cos 60^\circ}$
c) (800)(0.004)cos 60°
d) $\frac{800}{0.004\cos 30^\circ}$

$\frac{\Phi_E}{\cos\theta A} = E$

ao bo co d● 8.

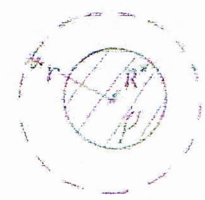
Perfect Page

9. The constant ε_0 equals ______________ $\frac{C^2}{N \cdot m^2}$.

a) 1.602×10^{-19} b) 8.854×10^{-12} c) 8.8×10^{12} d) 9.0×10^{9} ao b● co do 9.

10. A spherical charge distribution has a uniform *positive* charge density ρ and a radius R. We use Gauss's law to find E *outside* of this distribution. We use a concentric spherical Gaussian surface of radius r, where $r > R$.

Recall that a sphere of general radius a has diameter $2a$, surface area $4\pi a^2$, and volume $\frac{4}{3}\pi a^3$.



At all points on the Gaussian surface, the direction of $\vec{E}$ is

a) tangent to the surface c) undetermined
b) radially inward d) radially outward ao bo co d● 10.

11. Continuing Question 10 above: at all points on the Gaussian surface, the direction of $d\vec{A}$ is

a) tangent to the surface c) undetermined
b) radially inward d) radially outward ao bo co d● 11.

12. Continuing Question 10 above: $\oint E\,dA = E \oint dA$ over the Gaussian surface because E is ______________ by ______________.

a) Gauss's, law c) constant, symmetry
b) Gaussian, surface d) electrifying, golly ao bo c● do 12.

13. Continuing Question 10 above: $\oint dA$ over the Gaussian surface equals

a) $4\pi R^2$ b) $\frac{4}{3}\pi A^3$ c) $4\pi r^2$ d) $2aA$ ao bo c● do 13.

14. Continuing Question 10 above: Q_{encl} equals ρ times

a) $\frac{4}{3}\pi r^3$ b) $4\pi a^2$ c) $\frac{4}{3}\pi R^3$ d) ε_0 ao bo c● do 14.

15. A charge of 120 nC is uniformly distributed over an insulating curve of length 2.4 m. A Gaussian surface encloses 72 nC of the 120 nC (leaving 48 nC outside the Gaussian surface). For this curve, λ = __________ nC/m.

a) $\frac{72}{2.4} = 30$ b) $\frac{120}{2.4} = 50$ c) zero d) $\frac{48}{2.4} = 20$ ao b● co do 15.

16. The net electric flux through the Gaussian surface of Problem 15 above is ____________ $\times 10^{-9}$ C/ε_0.

a) 72 b) 120 c) zero d) 48 a● bo co do 16.

17. In using Gauss's law to find the electric field caused by a highly symmetric negative charge distribution, we must recall that its $\vec{E}$ is directed ________________ a negative charge.

a) away from b) around c) toward d) tangent to ao bo c● do 17.

18. We find that $\vec{E}$ and $d\vec{A}$ are antiparallel (opposite) over part of a Gaussian surface. Therefore, in evaluating $\int \vec{E} \cdot d\vec{A}$ over that part, we must use

a) $\theta = 0$ b) $\phi = 180°$ c) $\phi = 90°$ d) $Q_{encl} = \varepsilon_0$ ao b● co do 18.

19. Suppose that we want to use Gauss's law to find the electric field due to a very large flat surface with a uniformly distributed positive charge. To take advantage of symmetry, the Gaussian surface we should use is a

a) cylinder with axis perpendicular to the surface c) concentric sphere
b) cylinder with axis parallel to the surface d) regular pyramid a● bo co do 19.

Perfect Page —