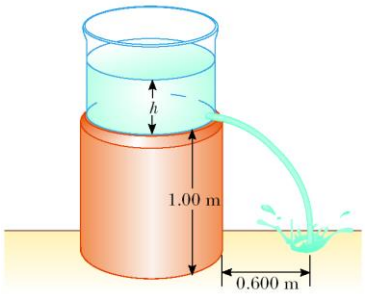
AP Physics 2 Fall Semester Review

Questions 1 – 10 are due Thursday, 11 – 15 on Friday, the exam is on Monday

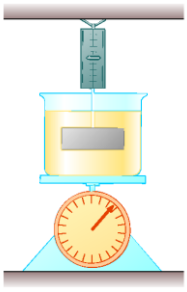
Unit 1 – Fluids

1) An air filled ball is pushed to 2 meters below the water level in a pool. (a) What is the absolute pressure on the ball while held 2 m below the surface? (b) What is the gauge pressure on ball?

2) An iron ball that has a radius of 3 cm is 5 m below the surface in a salt water pool that has a density of 1050 kg/m^3. (a) If a string is attached to the ball and the ball is lifted at a constant speed, what would the tension be in that string? (b) How would the tension change if the ball was in a fresh water pool? Justify your answer. (c) How would the tension change if the ball was at a depth of 10 m instead of 5 m? Justify your answer



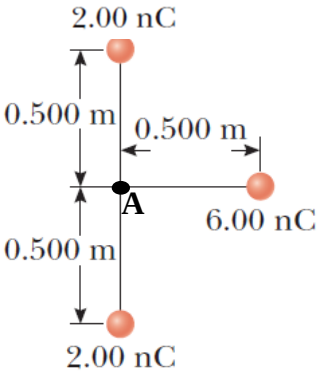
3) A 1 m high water jug is filled to a height of *h*. A small hole that has a diameter of 2 mm is at the bottom as shown to the right. (a) Calculate the initial speed of the water as it exits the valve. (b) What is the height *h* that the water is filled to in the jug? State any assumptions or approximations made that were used in your work. (c) How would the location that the water hits the table change if the level of water in the jug was initially increased? Justify your answer. (d) How would the location that the water hits the table change if the overall atmospheric pressure in the room was decreased? Justify your answer.

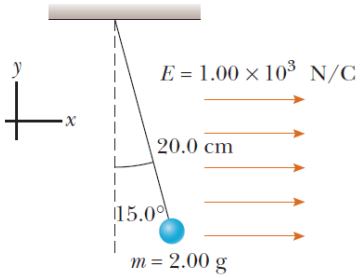
4) 

A 2.0 kg beaker containing 3.0 kg of oil (density = 916 kg/m^3) rests on a scale. A 5.0 kg block of iron is suspended from a spring scale and is completely submerged in the oil. Find the readings of both scales.

Unit 2 – Electrostatics

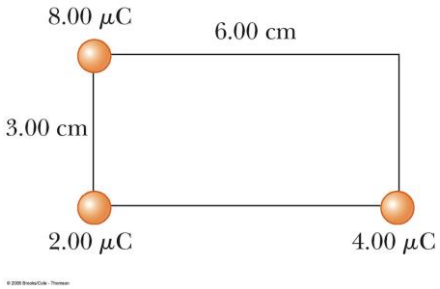
5) The figure to the right shows 3 charged objects. (a) Determine the magnitude of the net electric field at the point marked A due to all three charges, and state (in words) its direction. (b) If each charge is reduced to half of its original charge, how would the strength of the electric field change? Justify your answer and be specific in the value of the field. (c) How does the magnitude of electric field change if all three charges are moved to 1/3 the distance away from point A? Justify your answer.





6) A small plastic ball of mass 2.0 g, carrying a charge of *q* and is suspended by an uncharged, non-conducting thread 20.0 cm long. The thread is attached to the ceiling and the ball hangs in equilibrium, as shown to the right, in the electric and gravitational fields. (a) What is the charge on the ball? Justify your answer. (b) What is the charge on the ball? (c) As the small plastic ball moved from hanging completely vertical to its location shown in the diagram, did the ball gain or lose electric potential energy? Justify your answer. (d) How does the electric force change as it moved from hanging vertically to the location shown. Justify your answer.

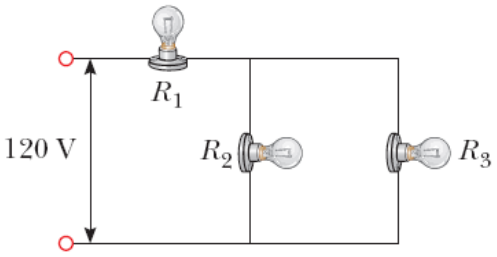
7) The potential difference between the accelerating plates of a TV set is about 1500 V. If the distance between the plates is 2.5 cm, (a) find the magnitude of the uniform electric field in the region between the plates. (b) If a proton is placed midway between the plates, calculate the force acting on the proton from the electric field. (c) If the proton is allowed to move, how fast will it be moving the instant before it makes contact with one of the plates?



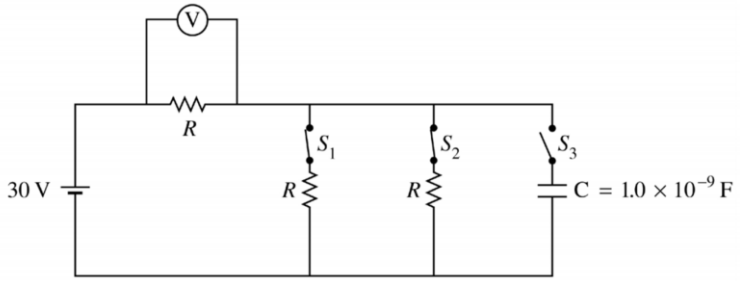
8) (a) What is the net force acting on the charge in the lower left hand corner? (b) What is the magnitude of the electric field at the upper right hand corner? (c) What is the electric potential at the upper right hand corner? (d) Draw on the diagram to show where a negatively charged object would need to be placed to cancel the charge found in part (a).

Unit 3 – Electric Circuits with Resistors & Capacitors

9) Three 100.0 W, 120 V light bulbs are connected across a 120-V power source, as shown to the right. Find (a) What is the resistance or each bulb? (b) What is the potential difference on bulb 2? (c) Find the total power delivered to the three bulbs. (d) Draw where a voltmeter and ammeter would need to be placed to find the current and potential difference on bulb 3.



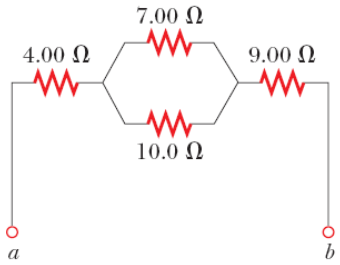
10)



Three identical resistors, each with a resistance of 2 Ω, and a capacitor of 1.0×10^{-9} F are connected to a 30 V battery with negligible internal resistance as shown to the left. Switches S_1 and S_2 are initially closed and switch S_3 is initially open. A voltmeter is connected as shown.

(a) Determine the reading on the voltmeter. (b) Switches S_1 and S_2 are not opened and S_3 is now closed. Determine the charge Q on the capacitor after it is fully charged. (d) If the capacitor plates are separated by 1 mm, what is the area of the plates? (d) If the battery is now removed, what resistors, if any, have current passing through them? Justify your answer and describe how this changes over time.

11) (a) Find the current in the 4.0 Ω resistor connected if a battery is connected between points a and b that has an internal resistance of 2.0 Ω. The terminal voltage of the battery is 9.0 V. (b) What is the emf of the battery? (c) How much power is dissipated by the 9.0 Ω resistor? (d) What is the potential difference across the 7.0 Ω resistor?



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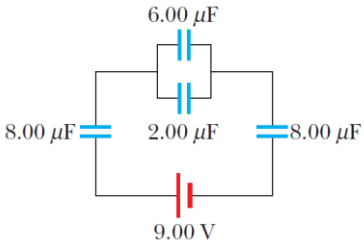
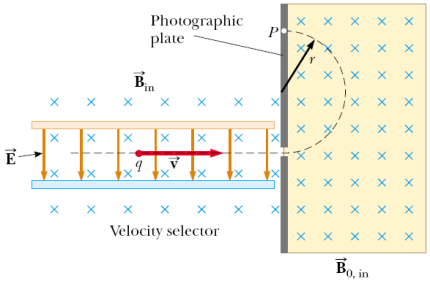


(a) Determine the equivalent capacitance. (b) What is the electric potential stored on either 8.0 μF capacitor? (c) What is the charge on the 6.0 μF capacitor? (d) How much energy is stored on the 6.0 μF capacitor?

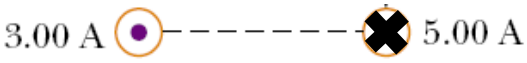
Unit 4 – Magnetism

13)



A charged object enters the region to the left and moves at a constant velocity between the two charged plates that are 10.0 mm apart and have an electric potential of 12 V. There is also a magnetic field in this region that has a magnitude of 0.35 T. When the object enters the region after the charged plates a magnetic field causes the particle to follow the path of the dashed line. This path has a radius of 10 cm. (a) What is the strength of the electric field? (b) Does the object have a negative or positive charge? Justify your answer. (c) What is the speed of the object if it moves between the plates at a constant speed and in a straight line? (d) How much time does it take for the object to hit the wall after it leaves the charged plates? (e) How much work is done by the magnetic field in the region after the charged plates?

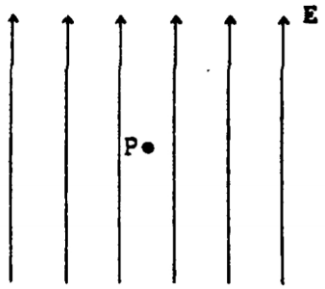
14)



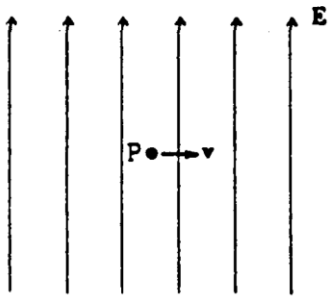
(a) The above picture shows two wires entering and leaving the plane of the page. If each is carrying the current shown, draw the magnetic lines of flux for each wire. (b) What is the strength of the magnetic field 5.0 cm to the right of the right wire if the distance between the wires are 2.0 cm? (c) What force does the wire on the right exert on the wire on the left, make sure you state the direction.

15) Determine the magnitude and direction of the force acting on electron in each of the following situations. Describe qualitatively the path followed by the negatively charged particle and sketch the path of each diagram.

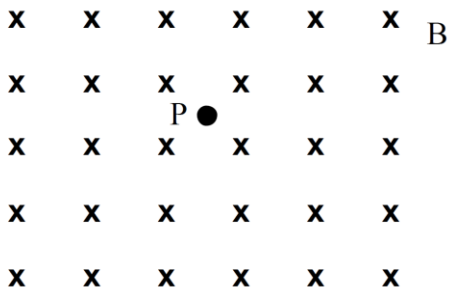
(a) The electron is at rest at point P in the electric E having an intensity of 1000 N/C and directed up in the plane of the page as shown below.



(b) In the same electric field as in part (a), the electron at point P has a velocity of 10,000 m/s directed to the right as shown below.



(c) The electron is released from rest at point P in a magnetic field B having and intensity of 0.1 T and directed as shown in the diagram below.



(d) In the same magnetic field as in part (c), the electron at point P has a velocity of 10,000 m/s directed as shown in the diagram below.