(a) Calculate the total capacitance between points A and B.

(b) Calculate the current in the 2 $\Omega$ resistor.

(c) Calculate the potential difference between points A and B.

(d) Calculate the charge stored on the 8 $\mu$F capacitor.

(e) If the value of 12 $\Omega$ resistor is INCREASED, what will happen to the following quantities after we allow the capacitors to fully recharge again?

i) The total current in the circuit. $\text{____increases}$ $\text{____decrease}$ $\text{____stays the same}$

ii) The voltage drop across the 2 $\Omega$ resistor. $\text{____increases}$ $\text{____decrease}$ $\text{____stays the same}$

iii) The charge stored on the 4 $\mu$F capacitor. $\text{____increases}$ $\text{____decrease}$ $\text{____stays the same}$

iv) Power dissipated by the now increased 12 $\Omega$ resistor. $\text{____increases}$ $\text{____decrease}$ $\text{____stays the same}$
A 5kg potter’s wheel of radius 0.3m is connected to a 300W electric motor of internal resistance of 3Ω. \( I_{\text{disk}} = \frac{1}{2} m r^2 \)

a) How much current is drawn from the power source if we assume maximum motor efficiency?

b) How much time would it take the disk to reach 600 rev/min if we assume maximum efficiency?

c) If a clay pot is added to the disk, what will happen to the time it takes to reach 600 rev/min? Explain.

d) A variable resistor (a resistor that can change resistance) is needed to control the speed of the disk. Draw the circuit diagram for the potter wheel. Label the power source, motor, variable resistor, and anything you might need in the circuit.

e) Explain how the variable resistor controls the rate of rotation.
The following data is listed for the Swagatron T3 hoverboard on swagatron.com.

Dual 300W motors  
Voltage: 32V  
Maximum Weight Limit: 220 lbs (100kg)  
Product Weight: 22 lbs (9.9kg)  
Max Speed: 8 mph (3.58m/s)  
Range: 7 miles (11300m)  
Charger: 90 W  
Charging Time: 1 Hours  
Climbing Capability: 30°

1) Draw the circuit diagram for the hoverboard, assuming each motor is hooked up in parallel.

2) Using the data from above, what is internal resistance of a motor operating at max efficiency?

3) According to the specifications, how much energy is given to the battery during a full charging session? Assume the battery starts with no energy.

4) How much time would it take a 100kg rider to reach maximum speed if we assume 100% efficient motors?

5) Describe the effects to the above numbers if we were to take into account the internal resistance of the battery?

   Battery voltage: ____increases  ____decrease  ____stays the same

   Motor Voltage Drop: ____increases  ____decrease  ____stays the same

   Range: ____increases  ____decrease  ____stays the same