

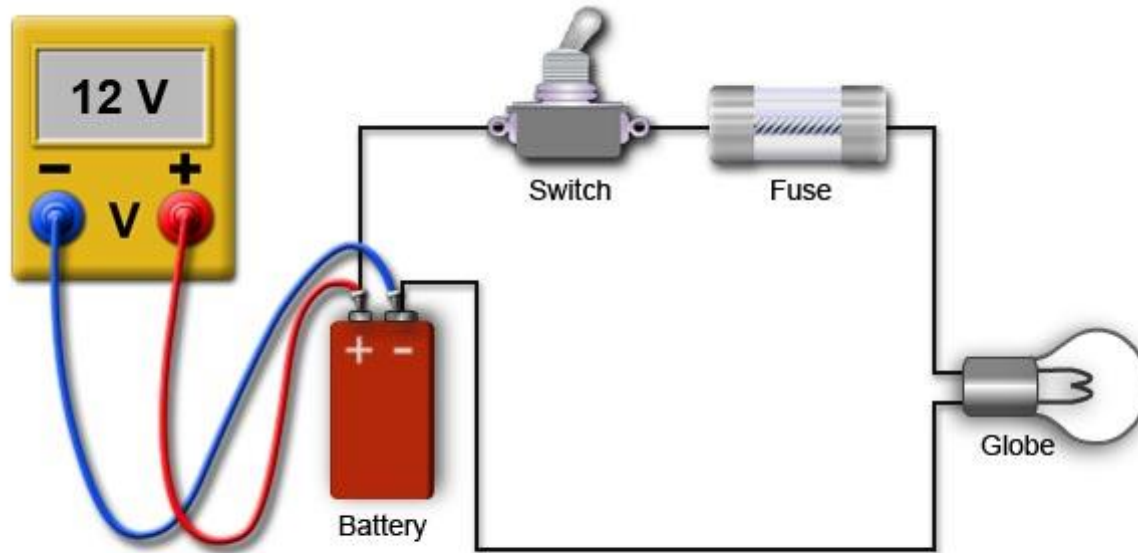
Electricity

2015 EdExcel A-Level Physics
Topic 3

Potential Difference



Voltage

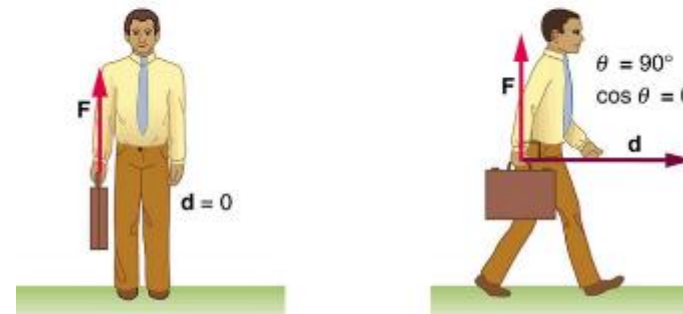
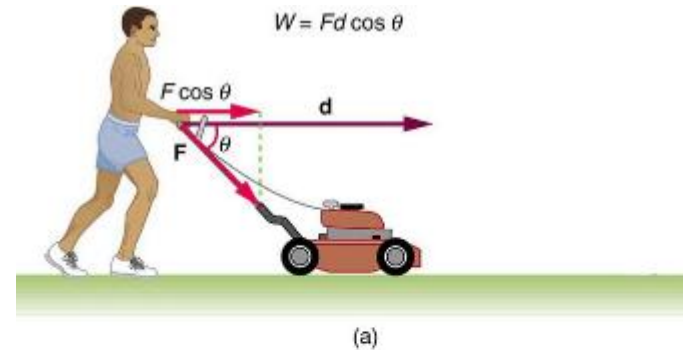
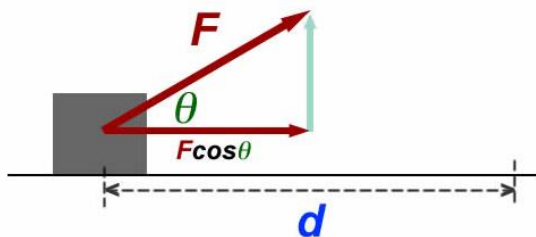


“Voltage” is the electrical pressure that pushes the electrons. Electrons move due to “voltage difference”, sometimes called a “potential difference” (p.d.). A higher p.d. means a stronger push, which often causes an increase in current.

Work done in real life

- Work is done on an object when a force causes a displacement of the object.

$$W = Fd \cos \theta$$



Work done in electricity

The voltage between two points is the work done per coulomb travelling between the two points

$$\text{Voltage} = \frac{\text{work done}}{\text{charge}} \qquad V = \frac{W}{Q}$$

Voltage” is the force that pushes the electrons. For electrons to move there must be a “voltage difference”, sometimes called a “potential difference” (p.d.). A higher p.d. means a stronger push, which causes an increase in current.

We can see that $1V = 1JC^{-1}$

Example

A battery does 12J of work. If it transfers 3C of charge, what is the battery's voltage?

Given data:

Work = $W = 12\text{J}$
Charge = $Q = 3\text{C}$
Voltage $V = ?$

Formula

$$W = QV$$

$$V = W/Q$$

$$V = 12\text{J}/3\text{C}$$
$$= 4\text{V}$$

Practice Questions

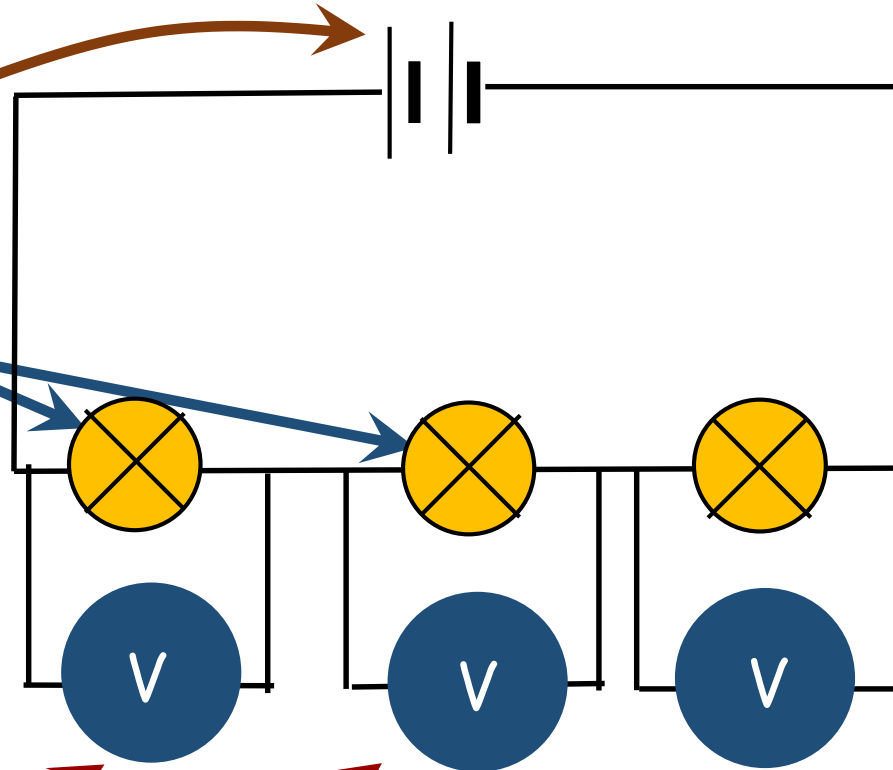
- 1) A motor does 200J of work in transferring 10C of charge. What is the voltage?
- 2) A 3V battery transfers 60C of charge. How much work did it do?
- 3) If the current of the battery is 0.4A and 50C charge is transferring how long was it used for?
- 4) if a battery takes 1600 joules of energy to move 1×10^{20} electrons . What is the voltage?

Voltage in a series circuit

If the voltage across the battery is 9V...

...and these bulbs are all identical...

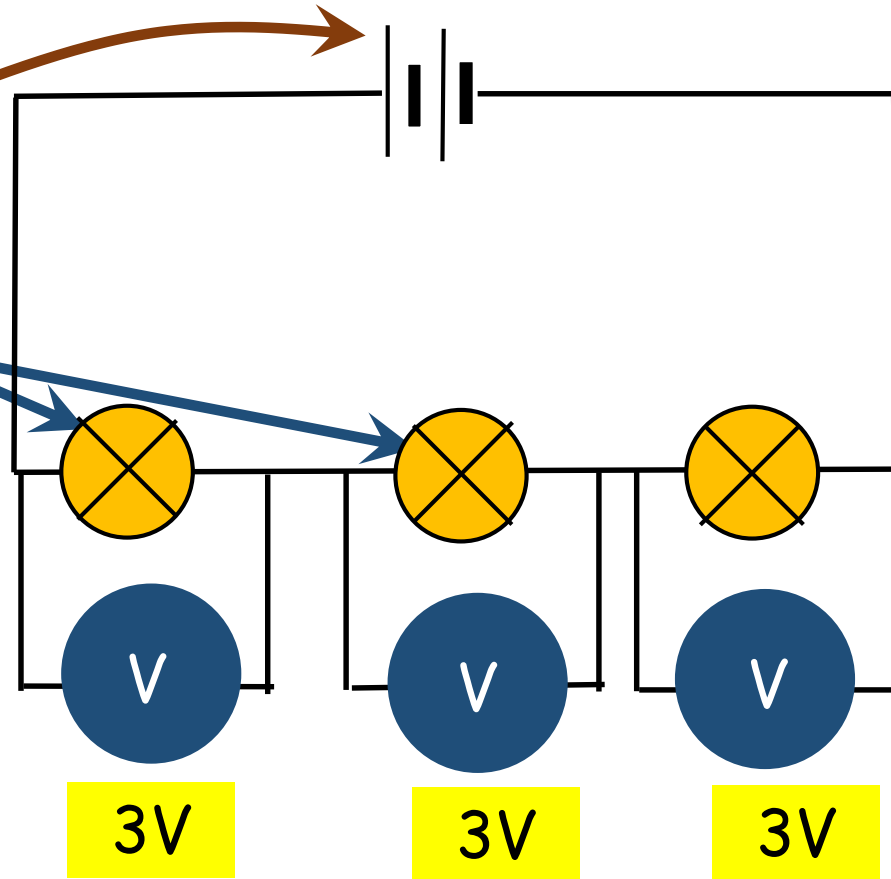
...what will the voltage across each bulb be?



Voltage in a series circuit

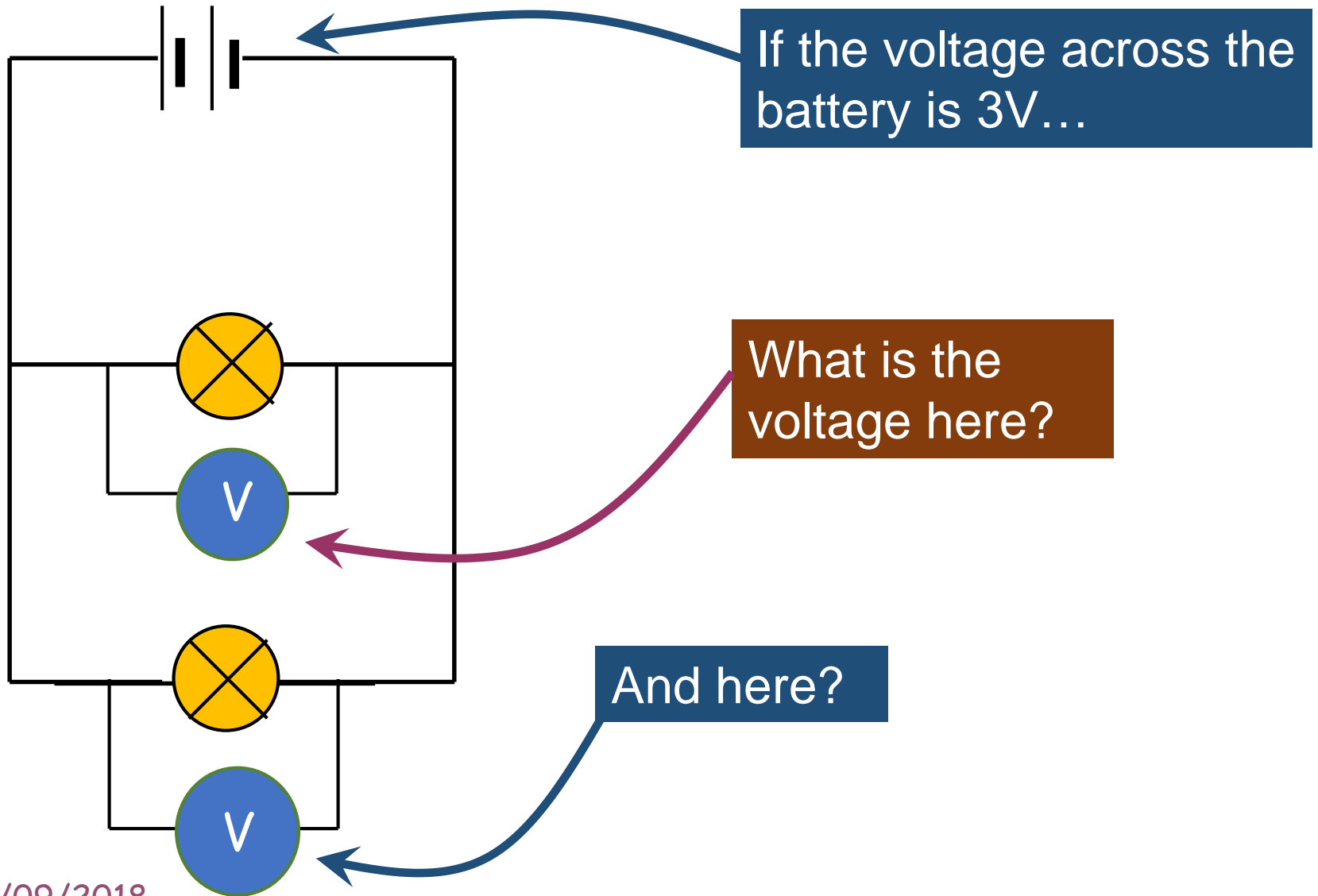
If the voltage across the battery is 9V...

...and these bulbs are all identical...

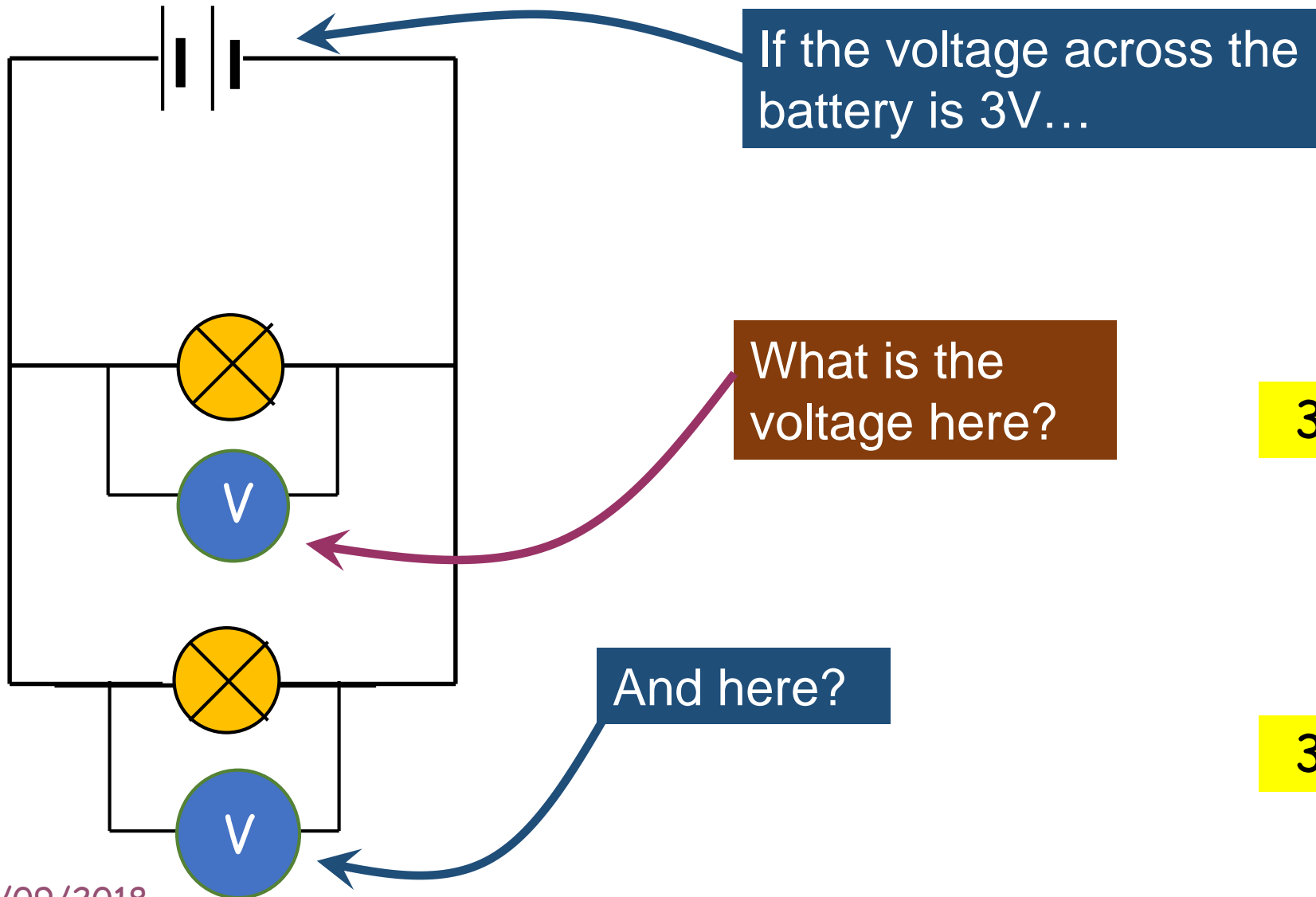


Energy is conserved, so the voltage splits up in a series circuit. The total Voltage across the components = power supply Voltage.

Voltage in a parallel circuit



Voltage in a parallel circuit



Series Vs Parallel

In a SERIES circuit:

Current is the **SAME** through all series components

Voltages **SPLITS** and adds to the total circuit voltage

Resistance: Adding resistance increases total R

In a PARALLEL circuit:

Current "**SPLITS UP**" through parallel branches

Voltage is **THE SAME** across all parallel branches

Adding resistance reduces total R