1. The potential difference across the 10 Ω resistor is 7.1 V.

7.1 V
10 Ω

12 Ω
25 Ω

ε = 15.0 V   r

a) What is the power dissipated by the 25 Ω resistor?   **(4 marks)**
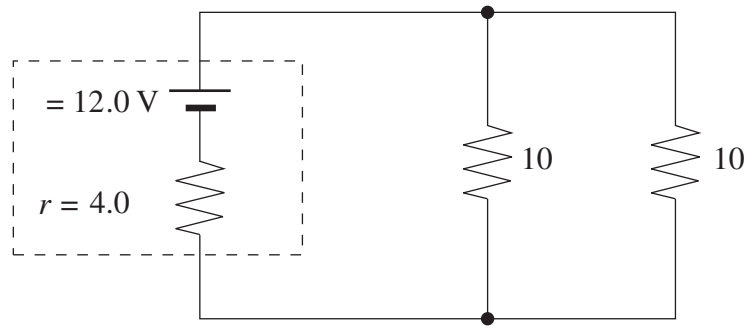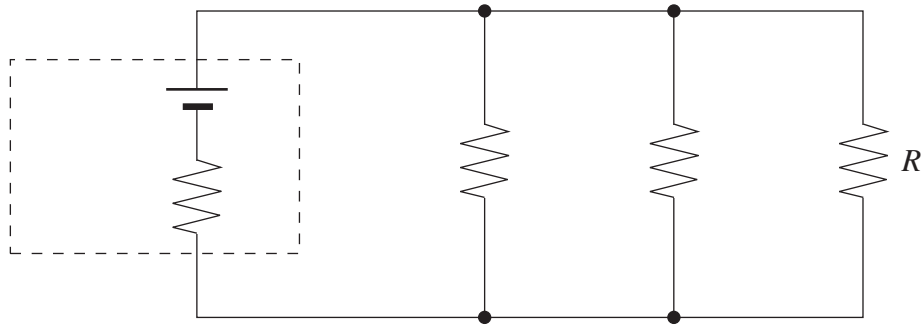
b) What is the internal resistance of the battery?   **(3 marks)**

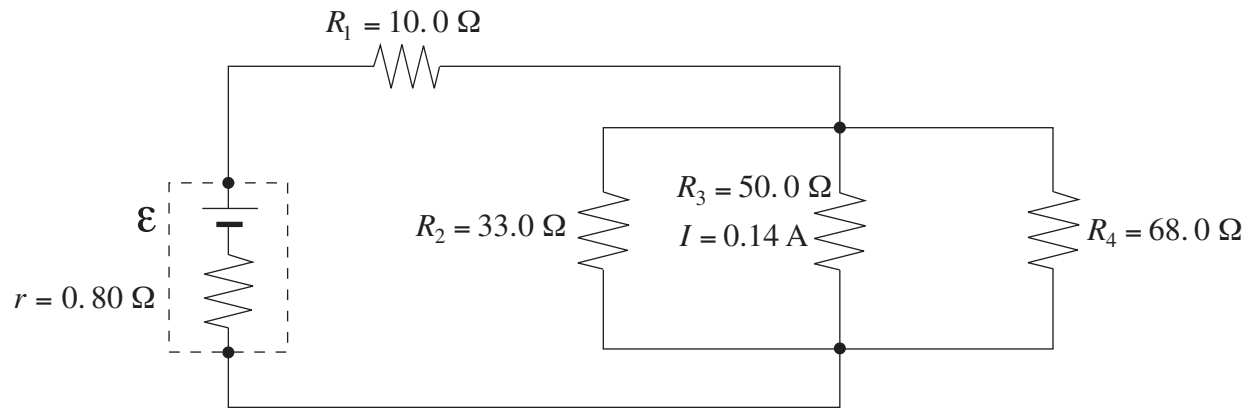2. a) For the circuit below, what is the terminal voltage of the battery? **(4 marks)**

= 12.0 V

$r = 4.0$

10   10

b) If resistor R is added in parallel to the circuit as shown, what is the effect on the terminal voltage? **(1 mark)**

❏ increase

❏ no change

❏ decrease

c) Using principles of physics, explain your choice for b). **(4 marks)**

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3. The current through the 50.0 Ω resistor in the circuit below is 0.14 A.

$R_1 = 10.0\ \Omega$

$\mathcal{E}$

$r = 0.80\ \Omega$

$R_2 = 33.0\ \Omega$

$R_3 = 50.0\ \Omega$
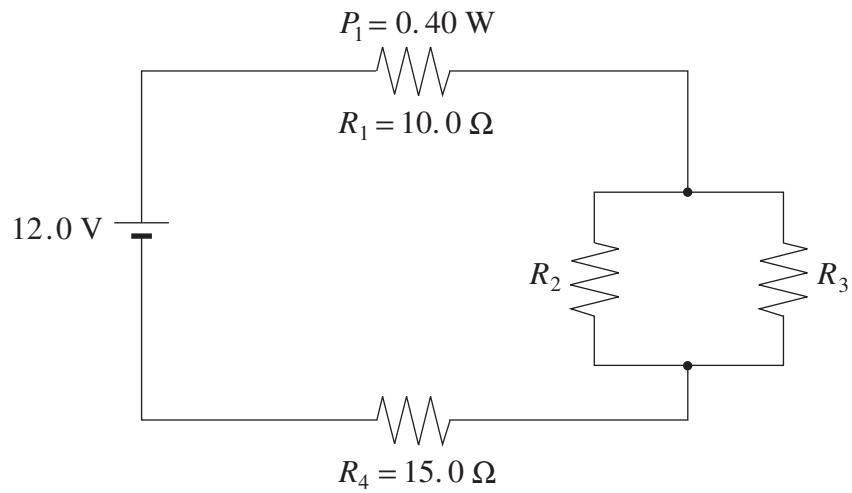$I = 0.14\ \text{A}$

$R_4 = 68.0\ \Omega$

a) Determine the emf of the battery. **(5 marks)**

b) Determine the power dissipated in the battery's internal resistance. **(2 marks)**

4. In the circuit below, resistor R_1 dissipates 0.40 W. Resistors R_2 and R_3 are identical.

$P_1 = 0.40$ W

$R_1 = 10.0\ \Omega$

12.0 V

R_2 R_3

$R_4 = 15.0\ \Omega$

What is the resistance of R_2? **(7 marks)**

5. A 12 V battery from a car is used to operate a 65 W headlight.

a) How much energy does the headlight use in 1.5 hours? **(2 marks)**

b) What total charge passes through the headlight during this time? **(3 marks)**

c) What is the total number of electrons that pass through the headlight during this time period? **(2 marks)**

6. A 12 V battery transfers 33 C of charge to an external circuit in 7.5 s.

    a) What current flows through the circuit? **(2 marks)**

    b) What is the resistance of the circuit? **(2 marks)**

    c) What is the power output of the battery? **(2 marks)**
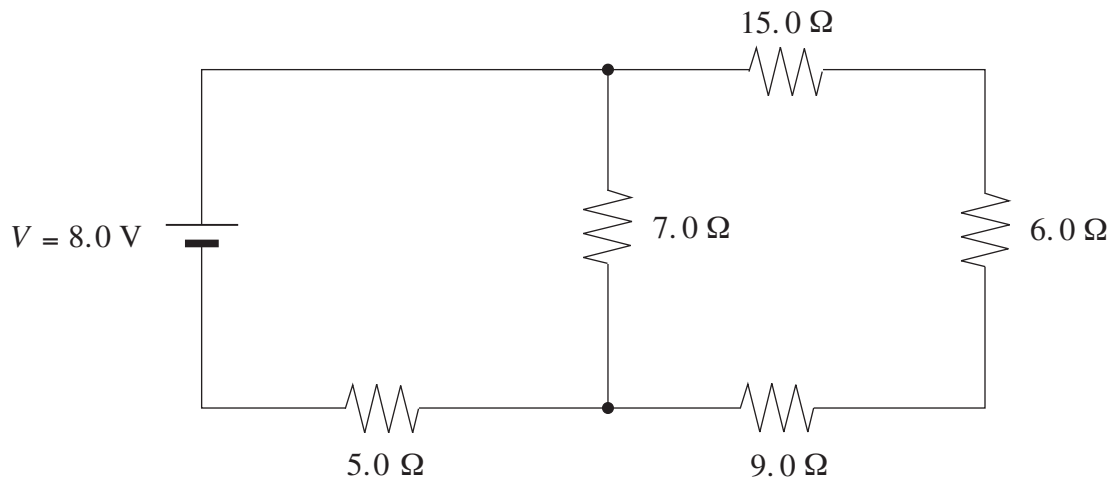
    d) The external circuit is most likely to consist of

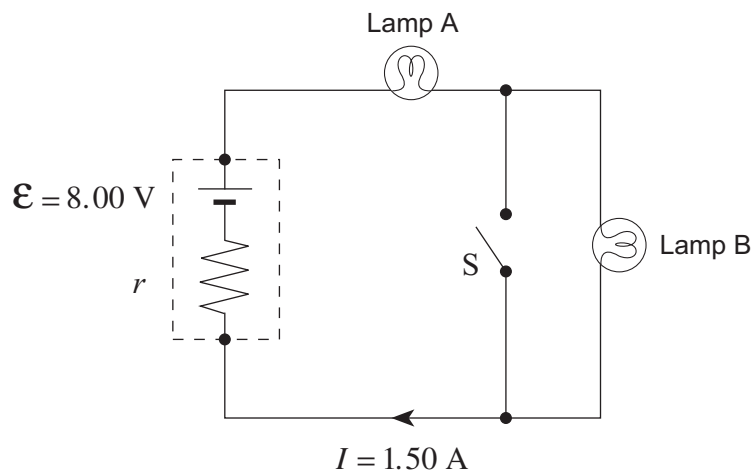   ☐ a bulb.
        ☐ a kettle.
        ☐ a calculator.

    (Check one response.) **(1 mark)**

7. What is the potential difference across the $6.0\ \Omega$ resistor in the circuit shown?   **(7 marks)**

$$15.0\ \Omega$$

$$V = 8.0\ \text{V}$$

$$7.0\ \Omega \qquad 6.0\ \Omega$$
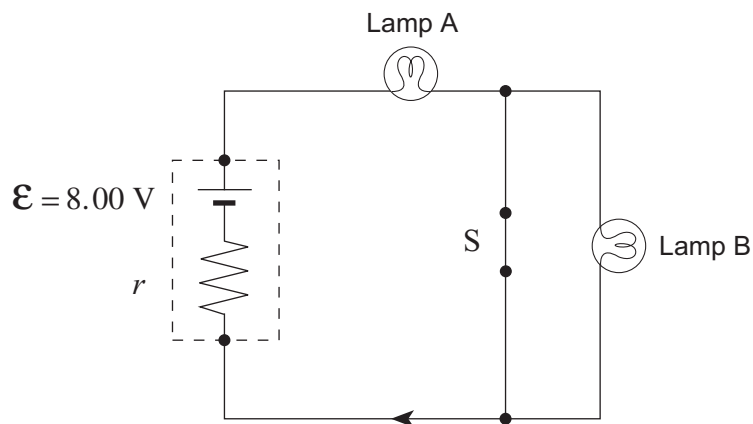
$$5.0\ \Omega \qquad 9.0\ \Omega$$

8. The circuit shown consists of an 8.00 V battery and two light bulbs. Each light bulb dissipates 5.0 W. Assume that the light bulbs have a constant resistance. Switch S is open.

Lamp A

$\mathcal{E} = 8.00$ V

r

S

Lamp B

$I = 1.50$ A

a) If a current of 1.50 A flows in the circuit, what is the internal resistance r of the battery?

(4 marks)

b) The switch S is now closed.

Lamp A will now be

i) ☐ brighter.
  ☐ the same brightness as before.
  ☐ dimmer.

(Check one response.) **(1 mark)**

The battery's terminal voltage will now be

ii) ☐ greater than before.
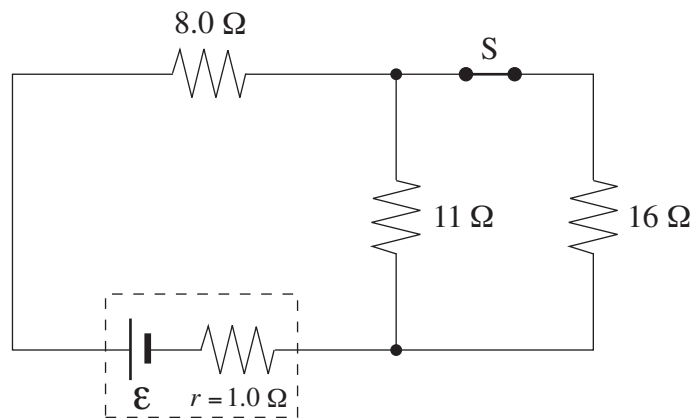   ☐ the same as before.
   ☐ less than before.

(Check one response.) **(1 mark)**

c) Using principles of physics, explain your answers to b). **(3 marks)**

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9. The terminal voltage of the battery is 5.8 V.

8.0 Ω

S

11 Ω   16 Ω

ε $r = 1.0\ \Omega$

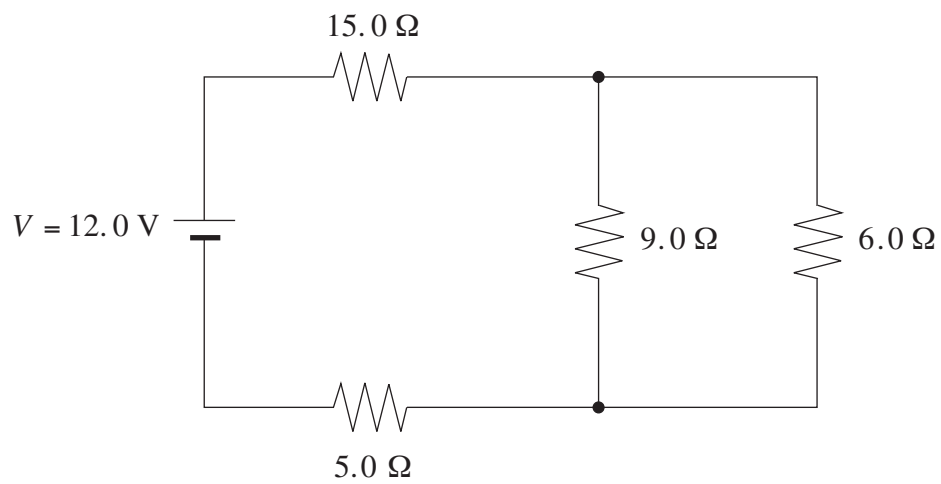a) What is the emf of this battery?   **(6 marks)**

b) What is the effect on the emf of the battery when switch S is opened?   **(1 mark)**
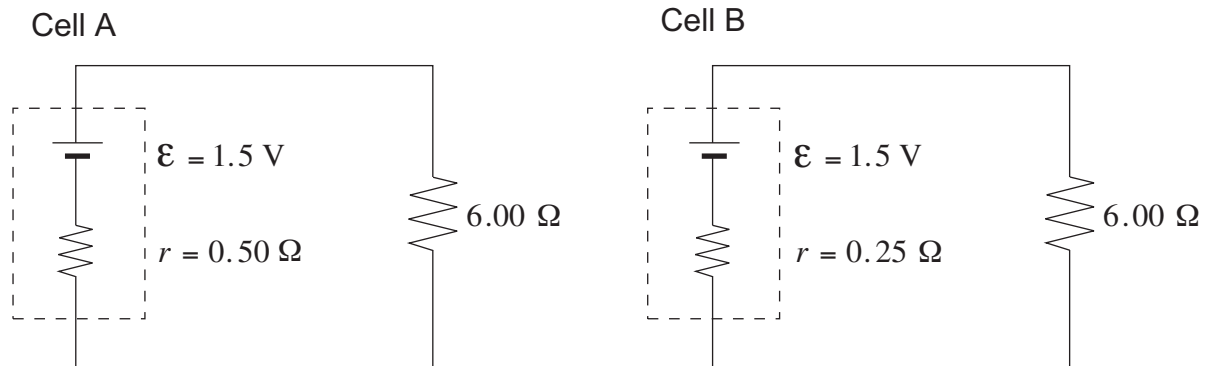
_____

10. How much energy does the 6.0 Ω resistor dissipate in 15 seconds in the circuit shown?

(7 marks)

15. 0 Ω

$V = 12.0$ V

9.0 Ω   6.0 Ω

5.0 Ω

11. Each of the two cells shown is connected to an external 6.00 Ω resistor.

Cell A

$\mathcal{E} = 1.5$ V

6.00 Ω

$r = 0.50$ Ω

Cell B

$\mathcal{E} = 1.5$ V

6.00 Ω

$r = 0.25$ Ω

With supporting calculations, state which cell delivers the greater power to the 6.00 Ω resistor.

(7 marks)