Topic Skills Practice Cover Sheet

Unit Name:	UEECD0046 Solve problems in single path circuits
Topic Title:	Effects of Electrical Current

Skill Practice Number:	5.2
Skill Practice Name:	Effects of Electrical Current

Electrical Trades College Student ID:	**Campus:** Revesby
Student Name:	
Student Signature:	**Date:**

Results	
Planning:	
Carryout:	
Completion:	
Overall Results:	
Comments:	

Topic Skills Practice 5.2

UEECD0046 Solve problems in single path circuits

KE-UEECD0046 Knowledge Evidence

Topic 5. Effects of Electrical Current

Skills Practice 5.2: Effects of Electrical Current

Task:

To initiate and observe the chemical, magnetic and heating effects of an electric current.

Objectives:

At the completion of this skills practice, you should be able to:

- measure the resistance of an electrolytic cell with two different types of electrolytes.
- connect an electrolytic cell to a d.c. supply and measure the current at various voltage levels.
- observe the reaction to the cells electrodes and electrolyte.
- measure the resistance of an electrical coil.
- demonstrate that a coil produces a magnetic field when conducting electric current.
- demonstrate that current flow through a resistor will cause the temperature of the resistor to rise.

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1. Planning the Skills Practice

1.1 Equipment

- d.c. power supply
- d.c. voltmeter
- d.c. ammeter
- digital mult-meter
- fuse and control switch
- wire wound resistor
- coil with removable steel core

1.2 Suggested Materials

- scourer or emery paper
- sachet of salt
- 500 mℓ glass beaker
- copper electrodes
- electrode holder

1.3 Miscellaneous Items

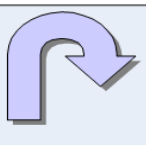
- ppe
- connection leads
- pens/pencils

1.4 Risk Assessment

Risk assessment procedure:

- identify any hazards that may exist with this skills practice below
- list the supervision level you will be working under - Direct (D), General (G) or Broad (B)
- list the risk classification – High Risk (H), Medium Risk (M) or Low Risk (L)
- list the control measures required for each identified hazard that you need to implement.

hazard/s identified	supervision level (D, G or B)	risk classification (H, M or L)	control measure/s
Exposed terminal	D	H	Ensure voltage/ current is tested
Hot resistors	D	H	PPE gloves
Spills	D	M/L	Observation of positioning of beaker
Splashing of water	D	M/L	PPE Safety glasses



Feedback

Have your teacher/trainer check your risk assessment

Teacher/Trainer Initials and Date	✓

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2. Carrying Out the Skills Practice

2.1 Observe the Chemical Effect

2.1.1 Using a scouring pad or emery paper, clean the copper electrodes, and then attach the electrodes to the electrode holder.

2.1.2 Fill the beaker with 450 mℓ of clean tap water and place the electrode holder on top of the beaker so that the electrodes are immersed in the water (electrolyte).

2.1.3 Measure the resistance of the electrolytic cell by using the digital multi-meter set on the *ohms range* and record in table 5.1.

note: use the diagram of figure 5.1 to assist you when connecting the ohmmeter (digital multi-meter).

table 5.1

electrolytic cell	cell resistance
with tap-water electrolyte	2.1 to 2.7 K ohms
with salt-water electrolyte	1 KΩ to 1.25 KΩ ohms

2.1.4 Add the sachet of salt to the beaker of water and stir until the salt has dissolved. Measure the resistance of the electrolytic cell and record in table 5.1.

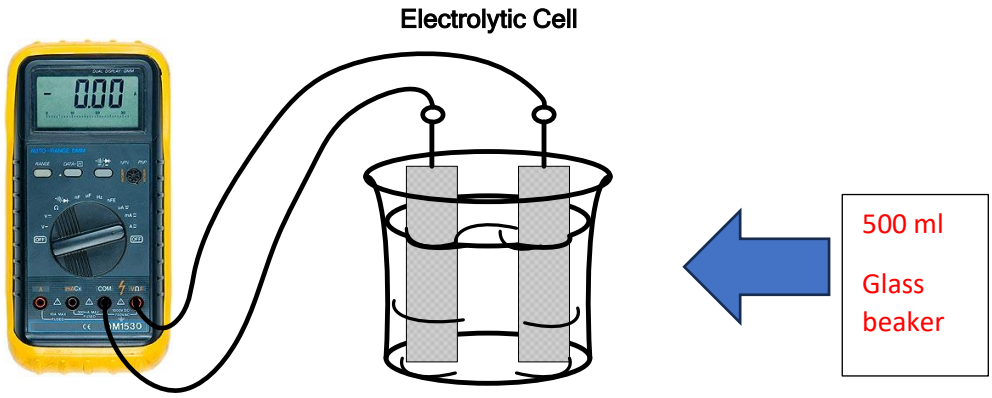

Figure 5.1

1 Tea spoon

2.1.5 Connect the circuit using figure 5.2 as a guide (on the next page).
Use the ammeter and the voltmeter to measure your current and voltage values.

2.1.6 Turn on the d.c. power supply and adjust the output voltage to the values shown in table 5.2.

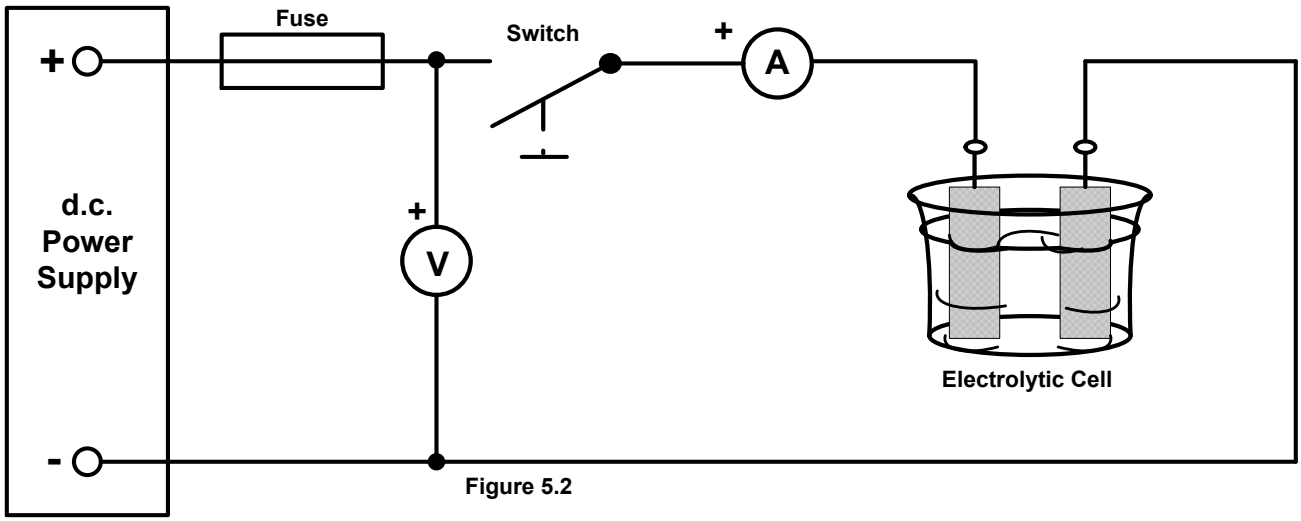

Figure 5.2

2.1.7 Measure the circuit current and note your observations of the electrolyte (i.e. is the electrolyte bubbling, is there a slight or large amount of bubbling, is the electrolyte bubbling at one electrode or both?).

table 5.2

applied voltage (volts)	circuit current (amperes)	electrolyte observations
10	500 mA	slight
20	780 ma	More than slight
30	1A	Medium

Feedback

Have your teacher/trainer check your work

Teacher/Trainer Initials and Date

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2.1.8 Turn off and disconnect the power supply.

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2.2 Observe the Magnetic Effect

2.2.1 Measure the resistance of the coil using the digital mult-meter set on the *ohms range* and enter the resistance value in table 5.3.

table 5.3

coil resistance	
2.5 to 2.6 Ω	ohms

Use small coil

2.2.2 Connect the circuit using figure 5.3 as a guide.
Use the analogue ammeter and the analogue voltmeter to measure your current and voltage values.

2.2.3 Turn on the d.c. power supply and adjust the output voltage to the values shown in table 5.4. Measure the circuit current, move the steel core in and out of the coil and note your observations of the coil (i.e. is there no magnetic effect, a slight magnetic effect or is there a strong magnetic effect?).

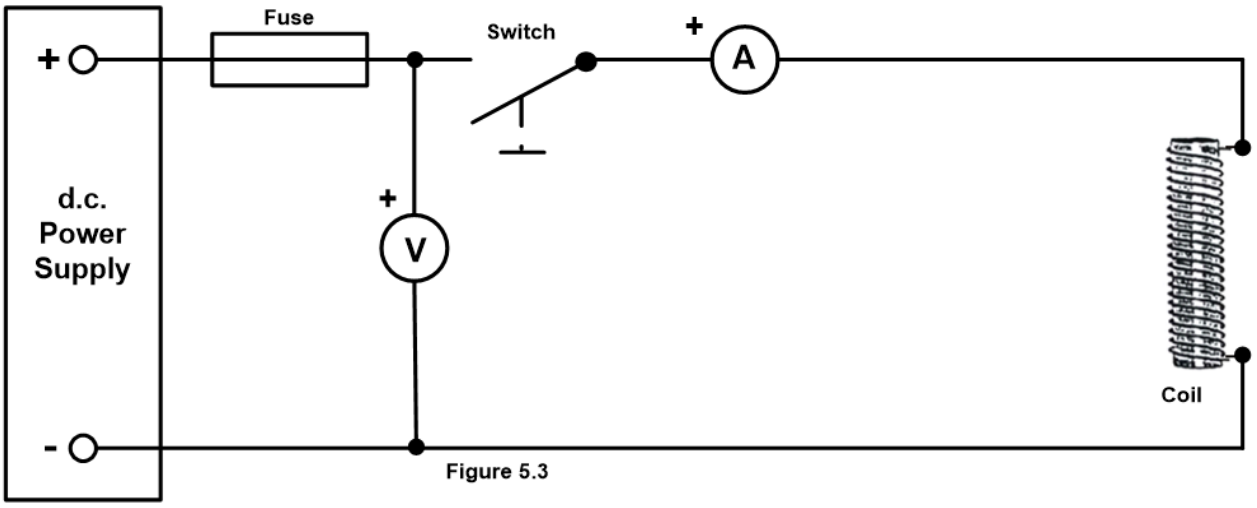


Figure 5.3

table 5.4 3 A scale

applied voltage (volts)	circuit current (amperes) (move the steel core)	coil observations
3	0.72 A	slight
6	1.42 A	Slight to strong
9	2 a	Strong

A little heat is sensed in coil

Topic Skills Practice 5.2

	Feedback	Have your teacher/trainer check your work	Teacher/Trainer Initials and Date	✓

2.2.4 Turn off the d.c. supply and disconnect the circuit.

2.3 Observe the Heating Effect

2.3.1 Due to the tolerance of the resistor, the actual value of resistance may not be the same as the value marked on the resistor. Measure the actual resistance of the resistor using the digital multi-meter set on the *ohms range* and enter the resistance value in table 5.5.

table 5.5

actual resistance of resistor
15 ohms

2.3.2 Connect the circuit using figure 5.4 as a guide. Use the analogue ammeter and the analogue voltmeter to measure the current and voltage values.

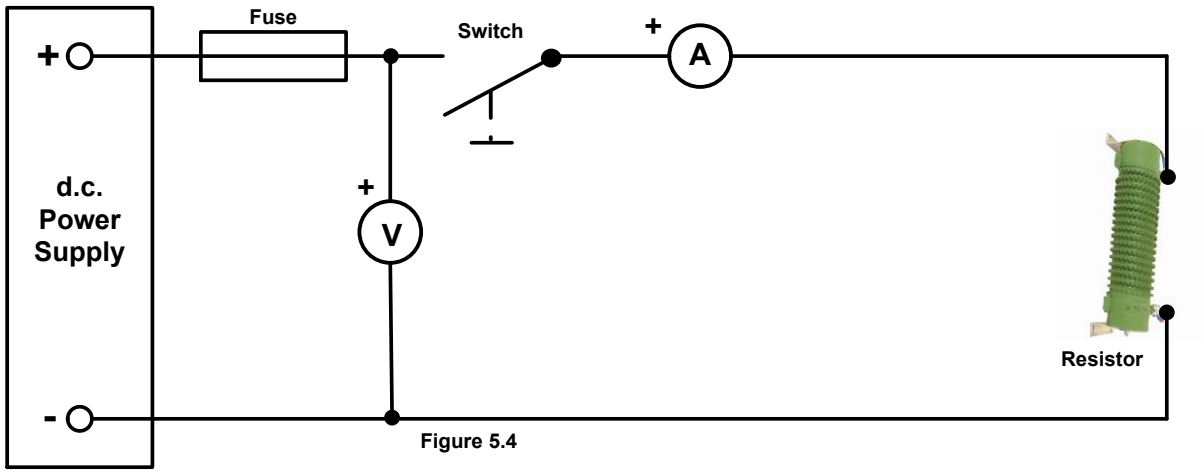


Figure 5.4

2.3.3 Turn on the d.c. power supply and adjust the output voltage to the values shown in table 5.6 (on the next page). Measure the circuit current, touch the resistor with the back of your hand and note your observations of the resistor (i.e. is the resistor cool, warm or hot?).

table 5.6

applied voltage (volts)	circuit current (mA)	resistor observations
3	300 mA	Cold
6	390 mA	Warm
9	520 mA	Hot

Feedback

Have your teacher/trainer check your work

Teacher/Trainer Initials and Date

✓

2.3.4 Turn off the d.c. power supply, disconnect the circuit and return all equipment to its proper place, safely and carefully.

3. Completing the Skills Practice

3.1 Skills Practice Review Questions

3.1.1 Clean your work area, return all equipment to the correct storage areas as directed by your teacher/trainer, and then complete the following review questions using the results and observations from your skills practice.

1. What effect did the addition of salt have on the resistance of the water?

Resistance decreased

2. Which electrolyte, the tap-water or salt-water electrolyte, would be the better conductor of an electric current?

Salt water

3. What effects did increasing the voltage have on the circuit current and the cell's electrodes and electrolyte?

As voltage increases

- Circuit current increases proportionately
- Cell's electrodes & electrolyte reduce resistance and increase temperature

4. Give one practical example where the electrolytic effect of a current could be used.

Battery charging

Electroplating

Refining metals

5. What effects did increasing the voltage have on the circuit current and the strength of the magnetic field produced by the coil?

As the supply voltage increases , the magnetic field produced by the coil increases.

6. Give **two** practical examples where the magnetic effect of a current could be used.

   - Alternators and generators
   - Electric motors
   - Transformers
   - Relays and contactors

7. Compare the marked and measured values of resistance for the resistor.

   If the values are different, give a brief explanation why.

The marked (or nominal) value is intended, but not normally accurate due to manufacturing

Imperfections and therefore sold within a given tolerance (<1%,1%,2%,5% & 10%)

Measure values vary slightly because of meter tolerances when measuring resistors.

8. What effects did increasing the voltage have on the circuit current and the heat produced by the resistor?

Increasing the supply voltage proportionately increased the current $I = \frac{V}{R} = I^2 R$

This then caused the more power consumption in the resistor , expressed as heat $P = \frac{V^2}{R} = I^2 R$

Ie, the more voltage , causing more current, causing more heat.

9. Give **four** practical examples where the heating effect of a current could be used.

   - Heating elements
   - Spot welding
   - Arc welding
   - Soldering iron

10. Using the results obtained from each of the three parts of the practical, complete the table below.

electrical load	actual resistance (ohms)	voltage (volts)	circuit current (amperes)
electrolytic cell with salt-water electrolyte	400 Ω	5	0.042 A
		10	0.11 A
		15	0.18 A
coil	18.2 Ω	5	0.25 A
		10	0.55 A
		15	0.88 A
resistor	15 Ω	5	0.3 A
		10	0.66 A
		15	1 A

11. What effect did increasing the supply voltage have on the circuit current in each case?

The circuit current increase proportionally with the supply voltage.

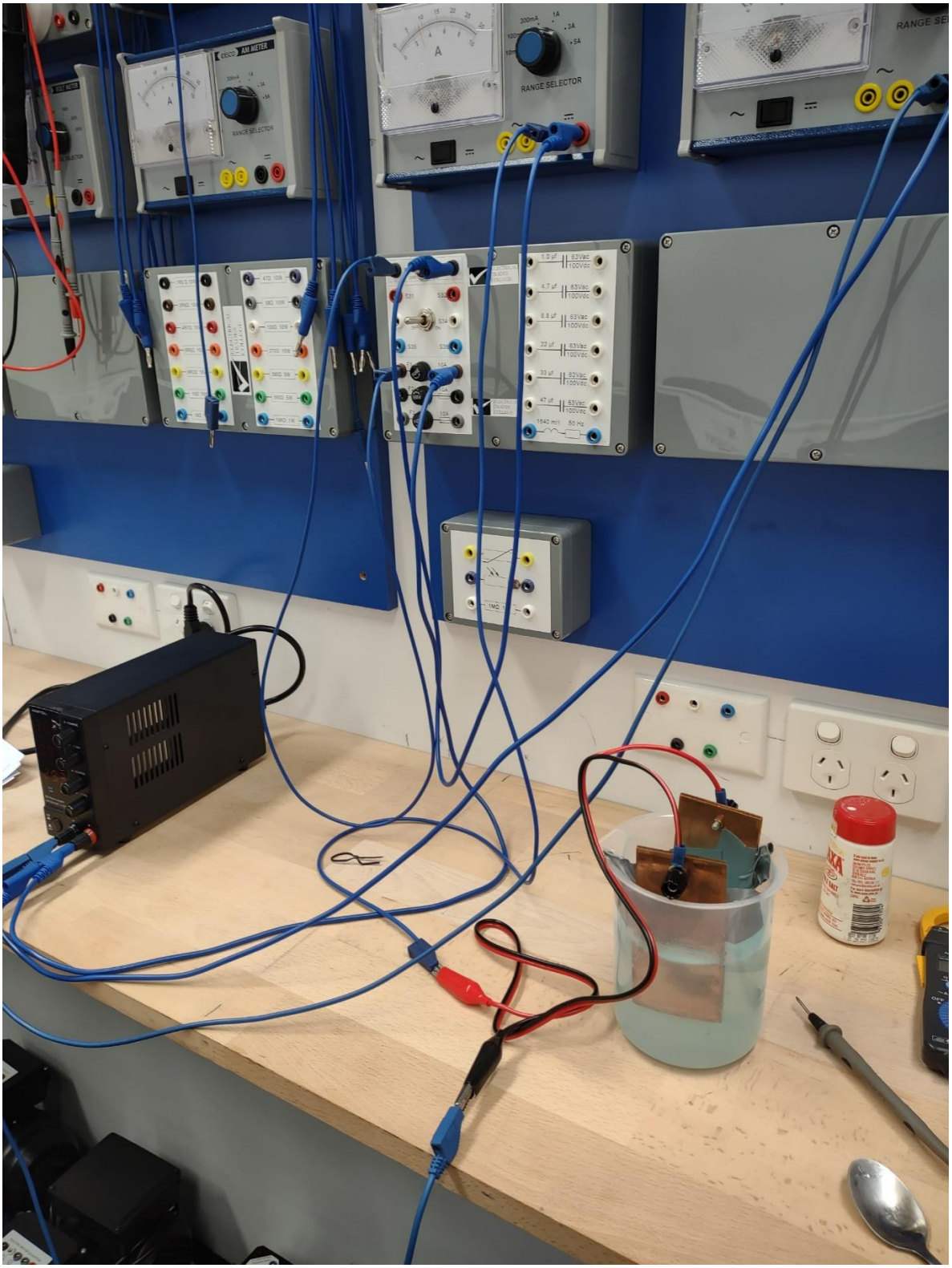
This supports Ohm's law $I = \frac{V}{R}$

12. What conclusions could be drawn about the amount of current that will flow in a circuit when compared with the resistance in the circuit?

The amount of current is inversely proportional to the resistance in the circuit.

Ie. The current will decrease when the resistance is increased and vice-versa

the current will increase when the resistance is decreased.



	Feedback **Have your teacher/trainer check your answers**	**Teacher/Trainer Initials and Date**	✓