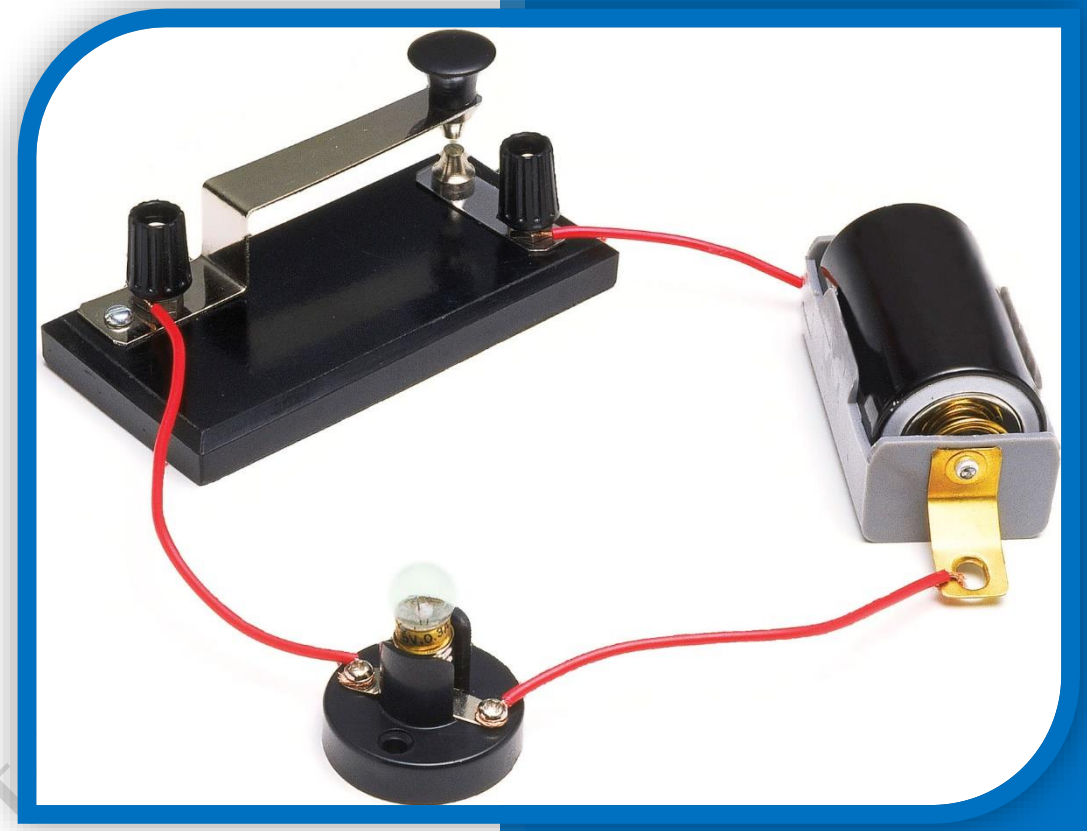
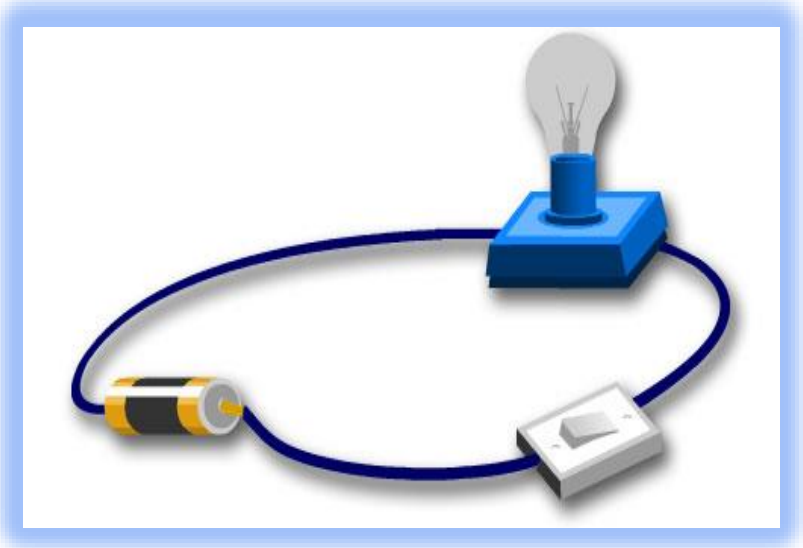
KNOWLEDGEBASE

2020

CELLS AND SIMPLE CIRCUITS





TEACHERS OF PHYSICS

www.teachersofphysics.com

10/15/2020

1. Distinguish between a primary cell and a secondary cell.

Primary cells

- ✓ These are cells which cannot be recharged for use again e.g. simple cell.

Secondary Cells:

- ✓ These are rechargeable cells e.g the Lead-acid accumulator and the Nickel-alkaline accumulator.

2. Define the term "e.m.f" of a cell. (1mk)

- ✓ ***Electromotive force (E.m.f)*** *refers to* voltage across the terminals of a battery in an open circuit (when no current flows in the circuit).

3. Distinguish between electromotive force and potential difference (2mks)

- ✓ ***Electromotive force (E.m.f)*** *refers to* voltage across the terminals of a battery in an open circuit (when no current flows in the circuit).
- ✓ ***Potential difference (Pd)*** refers to the voltage across the terminals of a battery in a closed circuit (when current is flowing in the circuit).

4. State one major difference between a primary cell and a secondary cell(1mk)

- ✓ ***Primary cells*** cannot be recharged for use again while ***Secondary Cells*** are rechargeable.

5. State the major difference between a dry cell and a wet cell (1mk)

- ✓ Dry cells uses solid electrolyte while wet cells uses solution of an electrolyte.
- ✓ *Dry cell* has *no liquid while wet cell have liqiud.*

6. State two advantages and one disadvantage of alkaline cells over lead acid accumulator. (3mk)

Advantages

a. Large currents can be drawn from them over a short period of time.
b. They require very little attention to maintain.
c. They are lighter (more portable) than the Lead – acid accumulators.
d. They can be kept in a discharged condition for a very long time before the cells are ruined.

Disadvantage

a. They are very expensive.
b. They have a lower e.m.f per cell.

7. Name two advantages which a lead accumulator has over a dry cell (2mk)

a. lead accumulator is rechargeable
b. Large currents can be drawn from them over a short period of time.

8. Give a reason why it is necessary to leave the caps of the cells open when charging an accumulator. (1mk)

- ✓ To allow gases to escape(0_2 and H_2)

9. State the reason for topping up a lead acid accumulator with distilled water. (1mk)

- ✓ *The addition of distilled water into a lead acid accumulator to improve on the ion concentration.*
- ✓ *Distilled water has been filtered to remove metals and minerals that may interfere with the process of the accumulator.*

10. Give a reason why it is not advisable to smoke a cigarette near a charging battery. (1mk)

- ✓ Batteries produces explosive gases i.e hydrogen gas, therefore sparks and flame from burning cigarettes can ignite fire.

11. It is common practice that once an accumulator is recharged the terminals are connected using a wire so as to assess its state of charge. How is this dangerous to the life of the accumulator?

- ✓ Can cause fire or explosion.

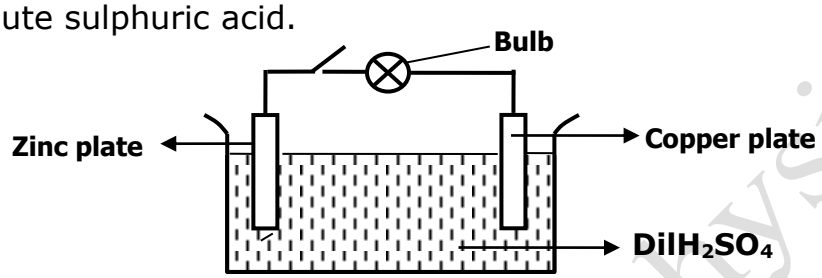
12. Recharging is one of the practices of maintenance of accumulators. State two measurements, which need to be taken to help you decide when an accumulator is due for charging.

- ✓ Density of the acid.
- ✓ E.M.F of the cell.
- ✓ Level of the acid.

13. State **two** qualities that are used to determine whether accumulator require charging or not. (2mks)

- ✓ E.m.f of the cell drops below 1.8V
- ✓ Relative density of the acid falls below 1.12 (using a hydrometer)

14. The figure below shows a simple cell made of copper and zinc electrodes dipped in dilute sulphuric acid.



a) Identify the cathode and the anode. (2 mks)

Cathode .....*Zinc*.....

Anode .....*Copper*.....

b) State the two common defects in a simple cell. (2 mks)

- ✓ ***Polarization***
- ✓ ***Local action***

c) Explain how the defects in b) are minimized. (2 mks)

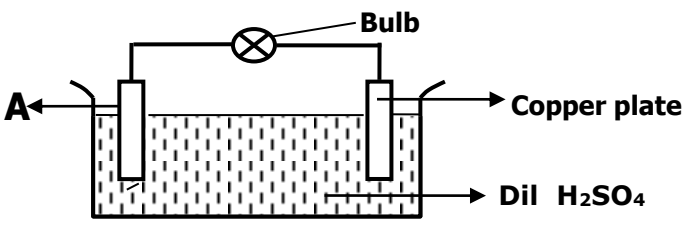
Ways of correcting Polarization defect:

- Addition of potassium dichromate (depolarizer). Oxygen from the depolarizer combines with the hydrogen atoms to produce water.
- Removing copper plate and brushing off the gas bubbles.

Ways of correcting Local action defect:

- Use of pure zinc.
- Coating zinc with mercury (amalgamation).

15. The figure below shows the set – up for a simple cell.



(i) Name the electrode **A**. (1 mk)

- ✓ *Zinc plate*

(ii) Explain why the bulb goes off after only a short time.

✓ *The bulbs went off due to polarization effect, in which hydrogen bubbles were formed on the copper electrode which formed insulation around the copper electrode therefore blocking the easy flow of current*

16. Differentiate between local action and polarization as defects in a simple chemical cell (1mk)

Polarization – accumulation of bubbles around the copper plate (positive plate).

Local action– the zinc plate is depleted (eaten away) as it reacts with dilute sulphuric acid.

17. **State** how polarization is reduced in a dry cell (1mk)

- ✓ Addition of potassium dichromate (depolarizer). Oxygen from the depolarizer combines with the hydrogen atoms to produce water.
- ✓ Removing copper plate and brushing off the gas bubbles.

18. Explain how polarization affects the working of a simple cell. (1mk)

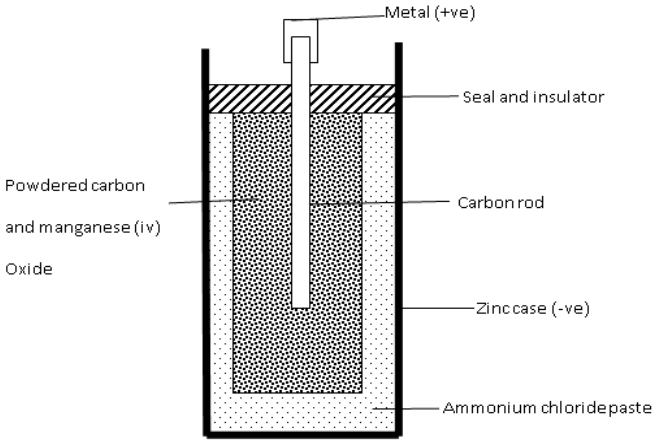
- ✓ This defect provides insulation to the flow of current and also sets up some "local" cells with copper whose electron flow tends to oppose the flow of electrons from the zinc plate.
- ✓ The overall effect is increase in the internal resistance of the cell, which reduces the flow of current.

19. Distinguish between open and closed circuit. (2mk)

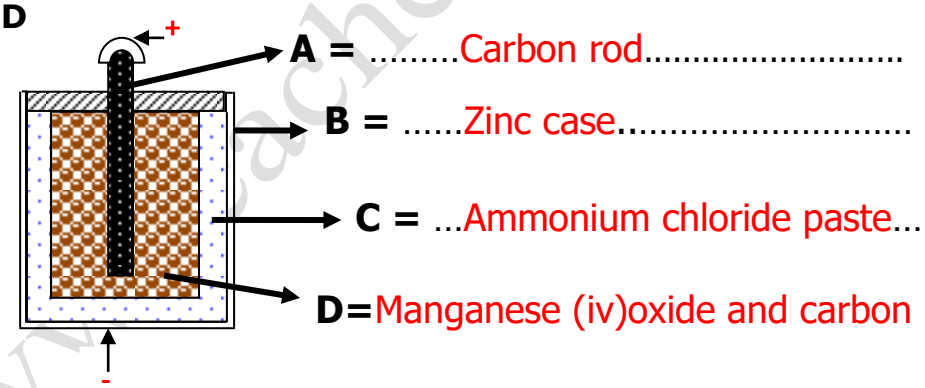
A closed circuit is a circuit that allows charges to move in a complete path when the switch is closed.

An ***open*** is a circuit that does not allow charges to move in a complete path such a circuit.

20. Draw a well labeled diagram of a dry cell



21. The figure below shows the features of a dry Leclanche cell. Name parts **A, B, C** and **D**



(4mk)

(ii)Indicate on the same diagram the positive **(+)** and the negative **(-)** terminals. (1mk)

22. State the use of manganese (IV) oxide in a dry cell (1mk)

- ✓ *Manganese (IV) oxide* and act as the depolarizer.
- ✓ Oxidises the hydrogen gas to water Or Reduce polarization.

23. State two precautionary measures you would take to maintain the efficiency of an accumulator.

a. The level of the electrolyte should be checked regularly and maintained above the plates. Topping should be done by distilled water; NOT ACID!

b. Large currents should not be drawn from the battery for a long time.

c. Shorting/ overcharging of the accumulator should be avoided.

d. The terminals should always be kept clean and greased.

e. The accumulator should not be directly placed on the ground during storage. It should be rested on some insulator like a wooden block.

24. State the advantage of Nickel-cadmium battery over the lead -acid type.

- ✓ *They have a much longer life than the lead-acid ones.*
- ✓ *They supply larger amounts of current and for a longer period.*
- ✓ *Can be left unused for months without any damage.*

25. Give a reason why it is not advisable to arrange cells in parallel unless they have identical e.m.f .

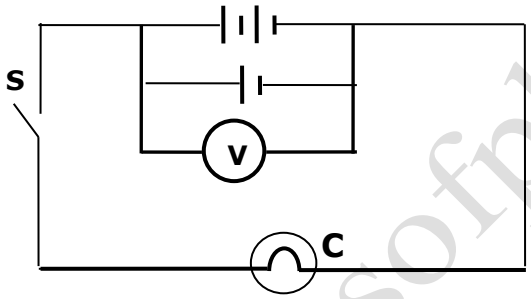
- ❖ When cells are in parallel arrangement their e.m.f. is the same as the e.m.f. of one cell.
- ❖ Current is supplied for a longer time in parallel connection of cells.

Note: *Cells should be arranged in parallel only when they have the same e.m.f otherwise one will drain the other.*

26. A form two student found his dry cells leaking on removing them from his torch. He asked his friend what could be the cause of this. What answer did his friend provide?

- ✓ The depolarizer manganese (IV) oxide has oxidized hydrogen gas produced during polarization to water.

27. Figure below represents a simple circuit diagram containing cells of e.m.f 1.5V each.



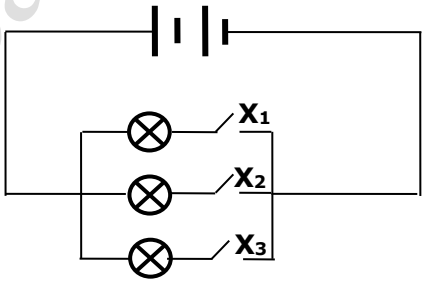
(i) What does component **C** represent. (1mk)

- ✓ Bulb/filament lamp

(ii) Determine the reading of **V** when the switch is open. (1mk)

=3.0V *

28. **State** the changes in brightness of the bulbs in the circuit diagram as the switches X_1, X_2 and X_3 are switched on one after the other.



(i) ***X_1 is closed.***

Only upper will light;

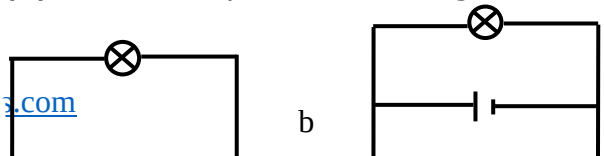
(ii) ***X_2 is closed.***

The upper and second upper bulb lights but with more brightness compared to a (i)because of decrease in resistance.

(iii) ***X_3 is closed.***

All Bulb will light with same brightness more brightness compared to a (ii).

29. Fig (a) and (b) show two possible arrangements of a bulb to a source of power.



a b

In which of the arrangement above would the cells drain faster. Explain your answer. (2mk)

(a)

- ✓ ***Connecting cells in series increases the e.m.f and current in the circuit is higher.***
- ✓ When cells are in parallel arrangement their e.m.f. is the same as the e.m.f. of one cell.
- ✓ Current is supplied for a longer time in parallel connection of cells.
- ✓ *Cells should be arranged in parallel only when they have the same e.m.f otherwise one will drain the other.*

30. A battery is rated **120AH**. How long will it work if it steadily supplies a current of **4A**. (2mk)

$$capacity = current\ in\ amperes \times time\ in\ hours$$
$$120\ AH = 4\ A \times time$$
$$time = \frac{120\ AH}{4\ A} = 30\ hours$$

31. Calculate the amount of current flowing through a bulb if **720C** of charges flow through it in **200** seconds.

$$Current, I = \frac{\text{Charge , Q}}{\text{Time , t}}$$
$$\text{I} = \frac{720}{200}$$
$$= 3.6\ \text{A}$$

32. Calculate the amount of current flowing through a bulb if **300C** of charges flow through it in **2.5** minutes.

$$Current, I = \frac{\text{Charge , Q}}{\text{Time , t}}$$
$$\text{I} = \frac{300}{2.5 \times 60}$$
$$= 2\ \text{A}$$

33. Find the time takes for a charge of **960C** to pass through a conductor where a current of **4A** is flowing.

$$\text{Time , t} = \frac{\text{Charge , Q}}{Current, I}$$
$$\text{I} = \frac{960}{4}$$
$$= 240\ \text{Secs}$$

34. If **180C** of charge flows through a circuit in one minute. Find the current through the circuit.

$$Current, I = \frac{\text{Charge , Q}}{\text{Time , t}}$$

$$\text{I} = \frac{180}{1 \times 60}$$

$$= 3 \text{ A}$$

35. Calculate the amount of charge passing through a point in a circuit if a current of **5A** flows for **1.5** minutes.

$$\text{Charge , } Q = Current, I \times \text{Time , } t$$
$$= 5 \times (1.5 \times 60)$$
$$= 450 \text{ C}$$

36. A current of **4.8A** was passed through an electrolyte for **½** hours. **Calculate** the quantity of electricity used.

$$\text{Charge , } Q = Current, I \times \text{Time , } t$$
$$= 4.8 \times (0.5 \times 60)$$
$$= 144 \text{ C}$$

37. A charge of magnitude **1200C** flows through a point in **15** minutes. Calculate the current. (2mks)

$$Current, I = \frac{\text{Charge , Q}}{\text{Time , t}}$$

$$\text{I} = \frac{1200}{15 \times 60}$$

$$= 1.3333 \text{ A}$$

38. A current of **0.5A** flows in a circuit. Determine the quantity of charge that crosses a point in **4** minutes.

$$\text{Charge , } Q = Current, I \times \text{Time , } t$$
$$= 0.5 \times (4 \times 60)$$
$$= 120 \text{ C}$$

39. A current of **2 A** passes through bulb **Q** for **2** minutes **30** seconds. Determine the quantity of charge through Q (2mk)

$$\text{Charge , } Q = Current, I \times \text{Time , } t$$
$$= 2 \times (2.5 \times 60)$$
$$= 300 \text{ C}$$

40. A charge of magnitude $12 \times 10^3 C$ flows through a point in 15 minutes. Calculate the current. (2mks)

$$Current, I = \frac{\text{Charge , Q}}{\text{Time , t}}$$

$$\text{I} = \frac{12 \times 10^3}{15 \times 60}$$

$$= 13.3333 \text{ A}$$

41. A charge of 360 coulombs flows through a lamp every minute. Calculate the number of electrons involved (electron charge is 1.6×10^{-19}C). (3 mk)

$1C = 6.25 \times 10^{18}$ electrons

$360 / 1.6 \times 10^{-19} = X$

$$X = \frac{360}{1.6 \times 10^{-19}} \times 6.25 \times 10^{18}$$

$= 2.25 \times 10^{21} \times 6.25 \times 10^{18}$ electrons

$= 14.0625 \times 10^{39}$ electrons