CHAPTER 7: ELECTRICITY

• All matters are made of small particles called atoms.
• Protons have positive electric charged and electrons have negative electric charged.
• static electricity – phenomena where charges that are not moving. PMR 09
• Objects can lose or gain electrons by rubbing with different types of objects
• If a neutral object loses electrons, it becomes positively charged.
• If a neutral object gains electrons, it becomes negatively charged

<table>
<thead>
<tr>
<th>Type of strip</th>
<th>Observations</th>
<th>Type of force exists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polythene-polythene</td>
<td>repel each other</td>
<td>Repulsive</td>
</tr>
<tr>
<td>Polythene-cellulose acetate</td>
<td>attract each other</td>
<td>Attractive</td>
</tr>
</tbody>
</table>
Electrostatic charge

Electroscope is a device that is used to detect and identify the presence of static electric charges.

Using an electroscope to identify static electric charges in an object:

i. The presence of charge in an object can be determined by observing any deflection on the gold leaves. When the electroscope is not charged, the gold leaves hang straight down. When the electroscope is charged, the gold leaves deflect from its normal.
### Observation

<table>
<thead>
<tr>
<th>Material</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bits of paper</td>
<td>______________ the plastic ruler</td>
</tr>
<tr>
<td>Water stream</td>
<td>______________ the plastic ruler</td>
</tr>
<tr>
<td>Electroscope</td>
<td>The gold leaf ____________</td>
</tr>
</tbody>
</table>
### Observation

<table>
<thead>
<tr>
<th>Material</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bits of paper</td>
<td>Attracted towards the plastic ruler</td>
</tr>
<tr>
<td>Water stream</td>
<td>Attracted towards the plastic ruler</td>
</tr>
<tr>
<td>Electroscope</td>
<td>The gold leaf diverged</td>
</tr>
</tbody>
</table>
Diagram 6.1 shows what happen when Jessica brought a plastic comb that she used to comb her hair several times near the small stream of water. Rajah 6.1 menunjukkan apa yang berlaku apabila Jessica membawa sikat plastik yang telah digunakan untuk menyikat rambutnya beberapa kali berdekatan dengan aliran air yang halus.

Before Jessica comb her hair
Sebelum Jessica menyikat rambutnya

After Jessica comb her hair
Selepas Jessica menyikat rambutnya

Diagram 6.1
Rajah 6.1

i) What happen to the comb when she combs her hair with it?
Apakah yang terjadi kpd sikit apabila Jessica menyikat rambut dengannya?

[1 mark]
[1 markah]

ii) What will happen if she combs her hair again with the same comb twice as much this time and brings the comb to the stream of water again.
Apakah yang akan terjadi jika Jessica menyikat rambutnya dengan sikit yang sama dua kali lebih banyak dan membaw sikit tersebut ke aliran air lagi.

[1 mark]
[1 markah]

iii) Explain your answer In 6(a)(ii).
Terangkan jawapan anda di 6(a)(ii).

[1 mark]
Static electrical charges
Observation

- Polythene-polythene
- Strips _repel_ each other
- Repulsive___ force

- Polythene-cellulose acetate
- Strips _attract_ each other
- Attractive___ force
2 Detecting electrostatic charges

- Charged material: 
  - Metal plate
  - Gold leaf diverges

- Uncharged material: 
  - Metal plate
  - Gold leaf does not diverge

Similar charges, different charges
Diagram 6.2 shows an experiment to study the flow of electrical charges.

Positive charge

*The pointer of Galvanometer deflects*

- Electric current is produced
- Electron flow

Sparks are produced

Electrons transfer/jump off from the finger to the metal dome.
Here is a bigger Van de Graaff generator
An even bigger one!
A giant Van de Graaff generator
The biggest--25 Million Volts

Oak Ridge National Lab in Tennessee
Van de Graaff generator

Dome

Wire

Galvanometer

Gas pipe
Van De Graff

Spark produces when electron jumping from the small dome into bigger Dome and touch molecule of air.
Van de Graaff generator

- Sparks are produced
- The galvanometer pointer deflects (Ammeter boleh pakai juga, tapi mesti Van de Graff yang besar)
• Voltage – voltmeter – volt – to measure voltage
• Current – ammeter – ampere – to measure current flow
• Electron flow – galvanometer – to detect electron flow
Everyday phenomena caused by static electrical charges.

1. LIGHTNING

Lightning is produced by a discharge of electrical charges from one cloud to another or between a cloud and the Earth.

Negative static electrical charged build up on the cloud during a storm as strong wind rubs against water particles in the clouds/air. The negative charges leap to the ground or another cloud causing lightning as shown below.
Everyday phenomena caused by static electrical charges.

2. PETROL TANKER

On hot days, a moving petrol tanker becomes charged due to friction with the surrounding air. A metal chain is connected from the petrol tank to the ground so that static electrical charges can be transferred from the petrol tank to the ground and prevent explosion.

Complete the passage below by choosing the correct words regarding a phenomenon related to electrostatic charges in our daily lives.

A petrol tanker becomes charged with electrostatic charges as it moves. This is because the petrol tanker rubs against the air. Rubber tyres touch the charges from flowing to the metal. Therefore, a metal chain is fixed under the lorry so that charges flow through it as the chain moves. This is important as it prevents the sparks from causing a fire.
Everyday phenomena caused by static electrical charges.

3. TYRES OF AEROPLANE

Due to friction, aeroplanes become charged when flying in the air. Thus, when landing, there is a strip of metal conductor sliding against the ground to discharge the aeroplane.
Everyday phenomena caused by static electrical charges.

• 4. SPARK PLUG

• When a car engine is ignited, there is transfer of charges in the spark plugs that produces sparks and subsequently burns the fuel.
ELECTRICITY

• Electricity is a form of energy produced by electric current.
• Electricity is used in many ways, such as lightning up a bulb, heating a kettle or spinning a ceiling fan.
• Electricity can be obtained from various sources.
  Examples of sources of electrical energy are:
  – 1. simple cell
  – 2. dry cell
  – 3. wet cell (acid-lead accumulator)
  – 4. mercury cell and lithium cell
VOLTAGE & CURRENT

- Current is the rate of flow of charges (or electrons) through a conducting medium such as metal. Current increases when more electrons are flowing through a conductor.

- The flowing of electrons through a conductor is driven by voltages, produced by batteries or generators.

- Voltage is the difference in potential energy that causes electrons to flow from an area with more electrons to an area with fewer, producing an electric current.
Comparing current and voltage

**Similarity**

Current

The positive terminal of the measuring device must be connected to the positive terminal of the electrical source

Voltage

**Differences**

- Ammeter → Measuring device
- Amperes → Measuring unit
- A → Measuring unit symbol
- In series → Connection in electrical circuit
- Voltmeter → Volts
- V → In parallel
Measurement of $I$, and $V$

Diagram showing a circuit with a switch, dry cells, bulb, ammeter, and voltmeter. The text explains that the positive terminal of the measuring device must be connected to the positive terminal of the electrical source.

### Differences

- **Ammeter**: Measuring device, Amperes, $A$, In series
- **Voltmeter**: Measuring device, Volts, V, In parallel

The text explains the differences between ammeters and voltmeters in terms of their connection and measurement units.
CURRENT FLOW & ELECTRON FLOW

The direction of current and electron flow in an electric circuit.

• according to the conventional **current flow**, current flows **from** the **positive** terminal to the **negative** terminal as shown in **figure 7.9** below

• However according to the **electron flow**, electron flows **from** **negative** terminal to the **positive** terminal.
How you should be thinking about electric circuits:

**Voltage:** a force that pushes the current through the circuit (in this picture it would be equivalent to gravity)
Resistance: friction that impedes flow of current through the circuit (rocks in the river)
How you should be thinking about electric circuits:

Current: the actual "substance" that is flowing through the wires of the circuit (electrons!)
RESISTANCE

• electric current loses energy as it moves through a conductor because the particles in the conductor resist the flow of electrons.

• Resistance is the property of a material that opposes the flow of current (electrons) through it.

• When resistance increases, the current flow in a material decreases and vise versa. (CONTROL)

• Resistor is a substance that opposes the flow of electric charge in order to control the flow of electric current. Examples; rheostats, fixed resistors and bulbs.
Resistance

Mark ‘✓’ in the box for the thermometer that records the higher temperature after 10 minutes. Then, complete the spaces with suitable words on the factors affecting the value of resistance.

<table>
<thead>
<tr>
<th>(a) Length of wires</th>
<th>(b) Diameter of wires</th>
<th>(c) Type of wires</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

The **longer** the wire, the higher its resistance. The **smaller** the diameter of the wire, the higher its resistance. The iron wire has **higher** resistance as compared to that in copper wire.
Resistance

- ability opposes the flow of electrons
- High resistance allows only a small current
- Is measured in Ohms (Ω)
Resistance depend on

- Length of conductor
- Longer conductor, higher resistance
- Diameter/thickness of conductor
- Bigger diameter, lower resistance
- Type of conductor
- Copper & aluminium has low resistance
Measurement of $I$, and $V$
MEASURING ELECTRICITY

• Electric current is measured by using an ammeter.
• Ammeter is connected in an electrical circuit in series.
• Voltage is measured by using a Voltmeter.
• Voltmeter is connected in an electrical circuit in parallel.
• The symbol of current is I and its SI unit is the ampere (A).
• The symbol of voltage is V and its SI unit is the Volt (V).
• The symbol of resistance is R and its SI unit is the Ohm (Ω).

Experiment page 132 & Science Process Skill page 99-100

13 State the relationship between the length of conductor and the resistance in a conductor. (The longer the conductor, the higher its resistance.)
14 State the relationship between the thickness of conductor and the resistance in a conductor. (The thicker the conductor, the lower its resistance.)
15 Among lead, iron and copper, which has the lowest resistance? (Copper)
16 State the type of conductor that has high resistance to current that flows through it. (Resistor)
17 State the direction of the electric current flow in a circuit. (From the positive terminal to the negative terminal of a cell)
Ammeter

- Device measure electric current
- In unit amperes (A)
- Connect in series
Voltmeter

- Device **measure voltage**
- In unit **volts** (**V**)
- Connect in **parallel**
This is how we draw an ammeter in a circuit.

**SERIES CIRCUIT**

**PARALLEL CIRCUIT**
measuring voltage

This is how we draw a voltmeter in a circuit.

SERIES CIRCUIT

PARALLEL CIRCUIT
5. THE RELATIONSHIP BETWEEN CURRENT, VOLTAGE AND RESISTANCE.

1. The higher the resistance, the smaller the current that flows through the circuit.
2. The higher the voltage, the bigger the current that flows through the circuit.
3. Voltage is directly proportional to the current.
   \[ V \propto I \quad \text{or} \quad R = \frac{V}{I} \]

   The symbols, \( V \), \( I \) and \( R \) represent the following:
   - \( V \) = voltage (V)
   - \( I \) = Current (A)
   - \( R \) = resistance (Ω)

4. The relationship between voltage, current and resistance, \( R = \frac{V}{I} \) is known as **Ohm's Law**.

   ![Graph of current against voltage](image1)
   ![Graph of current against resistance](image2)
Would This Work?
1. Closed circuit
- Electric current can flow from one end of dry cell to the other and the bulb will light up.

2. Open Circuit
- Electric current cannot flow in the circuit and the bulb will not light up.
Would This Work?
Would This Work?
The Central Concept: Closed Circuit
Diagram 21 shows four symbols for a circuit diagram.
Rajah 21 menunjukkan empat simbol bagi suatu rajah litar.

Diagram 21
Rajah 21

Diagram 22 shows a complete circuit.
Rajah 22 menunjukkan satu litar lengkap.

Diagram 22
Rajah 22

Which combination of the symbols would be the most suitable to measure the resistance of a bulb in the complete circuit in Diagram 22?
Kombinasi simbol yang manakah paling sesuai digunakan untuk mengukur rintangan sebuah mentol dalam litar lengkap pada Rajah 22?

Diagram 23 shows a circuit where one of the bulbs has fused.
This will prevent the other three bulbs from lighting up.
Rajah 23 menunjukkan sebuah litar dengan keadaan satu daripada mentol itu telah terbakar.
Ini akan menghalang tiga mentol yang lain daripada menyala.

Diagram 23
Rajah 23

Which bulb shown in the circuit is fused?
Mentol yang manakah dalam litar itu yang telah terbakar?
A K    C M
B L    D N
Simple Circuits

• Series circuit
  – All in a row
  – 1 path for electricity
  – 1 light goes out and the circuit is broken

• Parallel circuit
  – Many paths for electricity
  – 1 light goes out and the others stay on
Drawing of complete circuit
Complete circuit
Series vs Parallel
Series circuit
Series circuit
Parallel circuit
Parallel circuit
**Similarity**

**Complete circuits**

**Series circuit**
- The components are connected in sequence from end to end
- There is only one loop

**Parallel circuit**
- The components are connected in branches
- There is more than one loop

**Differences**
measuring current

SERIES CIRCUIT

- current is the **same** at all points in the circuit.

PARALLEL CIRCUIT

- current is **shared** between the components.
fill in the missing ammeter readings.

[Diagram of two circuits: one with a current of 4A and another with a current of 3A, containing unknown ammeter readings represented by question marks.]
fill in the missing ammeter readings.
SERIES CIRCUITS

Explain what happens to the current in a series circuit when there is a break in the circuit.

The circuit is no longer complete, therefore current can not flow.

Explain what happens to the voltage across each bulb as more bulbs are added to the circuit. The voltage decreases because the current is decreased and the resistance increases.
PARALLEL CIRCUITS

Explain what happens to the current in each bulb as more bulbs are added to the circuit.

The current remains the same. The total resistance drops in a parallel circuit as more bulbs are added.

Explain what happens to the total current provided by the battery as more bulbs are added to the circuit.

The current increases.
6.3 Series Circuit and Parallel Circuit

1. A series circuit is a complete circuit that has only one path for current flow.
2. Each component in a series circuit is connected to the next to form a single path.
3. A parallel circuit is a complete circuit that has two or more paths for current flow. (PMR 2008)

Draw figure 7.15 and 7.16 page 137

7. CURRENT, VOLTAGE AND RESISTANCE IN A SERIES CIRCUIT

1. The current that flows through each bulb in a series circuit is the same.
   \[ I = I_1 = I_2 = I_3 \]

2. The voltage supplied by the electrical source is shared by all bulbs. The voltage across the circuit is the same as the sum of the voltage across each bulb.
V = V₁ + V₂ + V₃

3. The total resistance in a series circuit is the sum of the resistance in each bulb.

R = R₁ + R₂ + R₃

8. **CURRENT, VOLTAGE AND RESISTANCE IN A PARALLEL CIRCUIT.**

1. The current supplied by the electrical source in a parallel circuit is the same as the sum of the current that flows through each branch of the circuit.

I = I₁ + I₂ + I₃

2. The voltage across each bulb is the same as the voltage supplied by the electrical source.

V = V₁ = V₂ = V₃

3. The total resistance in the circuit is represented by the following formula.

\[
\frac{I}{R} = \frac{I}{R} + \frac{I}{R} + \frac{I}{R}
\]

\[
\begin{array}{c}
1 \\
2 \\
3
\end{array}
\]
In a series circuit,
1. the voltage supplied by the dry cells is shared by all the bulbs.

\[ V = V_1 + V_2 \]

2. the current that flows through each bulb is the same.

\[ I = I_1 = I_2 \]

3. the total resistance will increase if the number of bulbs increases. The resistance in the circuit is the total resistance of each bulb.

\[ R = R_1 + R_2 \]

In a parallel circuit,
1. each bulb receives the total voltage that supplied by the batteries.

\[ V = V_1 = V_2 \]

2. the total current is the same as the sum of the current flow through each circuit branch.

\[ I = I_1 + I_2 \]

3. the total resistance in the circuit decreases if the number of bulbs increases.

\[ \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \]
Series circuit

\[ V = V_1 + V_2 \]

\[ I = I_1 = I_2 \]

\[ R = R_1 + R_2 \]

Parallel circuit

\[ V = V_1 = V_2 \]

\[ I = I_1 + I_2 \]

\[ \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \]
measuring voltage
series circuit

- voltage is **shared** between the components
parallel circuit

- voltage is the **same** in all parts of the circuit.
measuring current & voltage

(a)

4A

6V

V

A

V

A

X
measuring current & voltage

b)

- 4A
- 6V

Voltage meters (V)
- A

Current meters (A)
- X
Comparing a series circuit and parallel circuit

**Series Circuit**
- Connection in circuit: In series, one bulb is connected.
- Other bulbs do not light up if one bulb is removed or fused.

**Parallel Circuit**
- Connection in circuit: In parallel, more than one bulb is connected.
- Other bulbs remain lighted if one bulb is removed or fused.

**Similarity**
- The electrical circuit and the electrical components are the same.

**Differences**
- Method of connection: The number of current pathways.
- The conditions of other bulbs when one bulb is removed or fused.
Comparing a series circuit and parallel circuit

<table>
<thead>
<tr>
<th>Device used to measure</th>
<th>Electric current</th>
<th>Electrical voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ammeter</td>
<td>Voltmeter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit</th>
<th>Ampere</th>
<th>Volt</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Symbol of unit</th>
<th>A</th>
<th>V</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Symbol of device</th>
<th><img src="image" alt="Series Circuit" /></th>
<th><img src="image" alt="Parallel Circuit" /></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>The way the device connected in an electric circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>In series</td>
</tr>
<tr>
<td>In parallel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammeter</td>
<td>To measure electric current</td>
</tr>
<tr>
<td>Voltmeter</td>
<td>To measure electric voltage/electrical energy</td>
</tr>
<tr>
<td>Position of crocodile clip</td>
<td>Brightness of bulb</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>X</td>
<td>Dim</td>
</tr>
<tr>
<td>Y</td>
<td>Bright</td>
</tr>
</tbody>
</table>

1. What inference can be made based on the observation?
   *The position of crocodile clip affects the brightness of bulb/ammeter reading.*

2. Based on the results in the table, draw a bar chart to show the ammeter reading with the different position of crocodile clips.

3. State the relationship between the following:
   (a) The length of wire and current
      The __________ the wire, the __________ the current flow.
   (b) The length of wire and the amount of resistance
      The __________ the wire, the __________ the resistance.
   (c) The amount of resistance and current
      The __________ the amount of resistance, the __________ the current flow.

4. State the relationship between the thermometer reading and time taken in the experiment on the left.
   The __________ the time taken, the __________ the thermometer reading.
Relationship between voltage, current and resistance

![Diagram of electrical circuit with voltmeter, ammeter, and dry cells]

![Graph of voltage against current]

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Current (A)</th>
<th>Voltage/Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0.1</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>0.2</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>0.3</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>0.4</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>0.5</td>
<td>20</td>
</tr>
</tbody>
</table>
**Hypothesis**  Electric current will **increase** when resistance **decreases**

**Variables**
(a) that is kept constant: Voltage/Type of wire/Thickness of wire
(b) that is manipulated: Resistance/Position of crocodile clip
(c) that responds: Current/Brightness of bulb/Ammeter reading

---

State the relationship between the following:
(a) The length of wire and current
   The **longer** the wire, the **smaller** the current flow.
(b) The length of wire and the amount of resistance
   The **longer** the wire, the **higher** the resistance.
(c) The amount of resistance and current
   The **higher** the amount of resistance, the **smaller** the current flow.

State the relationship between the thermometer reading and time taken in the experiment on the left.

The **longer** the time taken, the **higher** the thermometer reading.
Ohm’s Law, $R = \frac{V}{I}$, where $R =$ resistance ($\Omega$), $V =$ voltage (V), $I =$ current (A)

- Resistance increases, the flow of current decreases
Ohm’s Law

\[ I = \frac{V}{R} \]

- \( I \) = Current (Amperes) (amps)
- \( V \) = Voltage (Volts)
- \( R \) = Resistance (ohms)

Georg Simon Ohm (1787-1854)
1. What is the value of the resistor in the diagram, if the dry cells supply 3.0 V and the ammeter reading is 2.0 A?

2. If the bulb in the diagram has a resistance of 2 Ω, what is the reading shown on the ammeter, if the dry cells supply 3 V?

3. If a current of 2 A flows through the resistor of 2 Ω in the diagram, calculate the voltage supplied by the dry cells.
Diagram 14 shows a complete circuit. Rajah 14 menunjukkan satu litar lengkap.

1. The two bulbs in the diagram have a resistance of 0.5 Ω and 1.0 Ω respectively. What is the reading shown on the ammeter, if the voltage of the dry cells is 3 V?

Solution:

2. There are two resistors in the circuit shown in the diagram. Resistor $R_1$ has a resistance of 1 Ω. If a 3V voltage causes a current of 0.5 A to flow through the circuit, calculate the resistance of $R_2$.

Calculate the voltage, if the current flowing in this circuit is 2 A. Hitung voltan, jika arus yang mengalir di dalam litar ini ialah 2 A.

\[ V = IR \]

A 0.67 V  
B 1.50 V  
C 3.00 V  
D 6.00 V
PMR 2010 Question 37

7 Diagram 26 shows an electric circuit. 
*Rajah 26 menunjukkan satu litar elektrik.*

![Diagram 26]

What is the reading of the voltmeter when the switch is closed?
*Apakah bacaan voltmeter apabila suis ditutup?*

A 1.5 V  
B 3.0 V  
C 5.0 V  
D 6.0 V

PMR 2006 Question 36

8 Diagram 22 shows a complete electric circuit. 
*Bulb R does not light up when bulb S is burnt out.*
*Rajah 22 menunjukkan suatu litar elektrik lengkap. Mentol R tidak menyala apabila mentol S terbakar.*

![Diagram 22]

Which of the following statements correctly explains the situation?
*Antara pernyataan berikut, yang manakah menjelaskan dengan betul situasi itu?*

A The resistance in bulb R is too high
*Rintangan dalam mentol R terlalu tinggi*

B The voltage across bulb R is too low
*Voltan yang merentasi mentol R sangat rendah*

C Bulb R and bulb S are connected in series
*Mentol R dan mentol S disambung secara berstri*

D Electric current decreases as it flows through the circuit
*Arus elektrik menjadi berkurangan ketika mengalir melalui litar*
What is the total resistance in the circuit?
Apakah nilai keseluruhan rintangan di dalam litar?

A 12 Ω
B 11 Ω
C 5 Ω
D 3 Ω
• Mana nyala lebih terang?
• Apa jadi bila satu mentol terbakar?
• Mana nyala lebih terang?
• Apa jadi bila satu mentol terbakar?
• Mana nyala lebih terang?
• Apa jadi bila satu mentol terbakar?
37. The graph shows the relationship between voltage and current of a resistor.

Graf menunjukkan hubungan antara voltan dan arus dalam satu perintang.

![Graph showing the relationship between voltage and current.](image)

\[
\text{Resistance (} \Omega \text{)} = \frac{\text{Voltage (V)}}{\text{Current (A)}}
\]

The resistance in resistor is

Rintangan dalam perintang ialah

A  \ 2 \ \Omega
B  \ 3 \ \Omega
C  \ 5 \ \Omega
D  \ 6 \ \Omega
2007 Question 36
Diagram 23 shows a circuit where one of the bulbs has fused.
This will prevent the other three bulbs from lighting up.
*Rajah 23 menunjukkan sebuah litar dengan keadaan satu daripada mentol itu telah terbakar.*
*Ini akan menghalang tiga mentol yang lain daripada menyala.*

Diagram 23
*Rajah 23*

Which bulb shown in the circuit is fused?
*Mentol yang manakah dalam litar itu yang telah terbakar?*

A K  B L
C M  D N

2008 Question 35
Diagram 19 shows a complete electrical circuit.
*Rajah 19 menunjukkan satu litar elektrik yang engkap.*

Diagram 19
*Rajah 19*

Calculate the total resistance.
*Hitung jumlah rintangan.*

A 0.4  B 1.2
C 5.0  D 6.0
Diagram 20 shows a parallel circuit with three identical bulbs, P, Q and R.

Rajah 20 menunjukkan litar selari dengan tiga mentol yang serupa P, Q dan R.

What is the voltmeter reading across P if Q burns out?

Apakah bacaan voltmeter di P jika Q terbakar?

A 0 V  
B 4 V  
C 6 V  
D 12 V

Diagram 25 shows an electric circuit with four bulbs, K, L, M and N.

Rajah 25 menunjukkan satu litar elektrik dengan empat mentol, K, L, M dan N.

Which bulbs will light up when S1 is opened and S2 is closed?

Mentol manakah yang akan menyala apabila S1 dibuka dan S2 ditutup?

A K and N  
B L and M  
C M and N  
D K and L

K dan N  
L dan M  
M dan N  
K dan L
The electrical current flowing through each branch, \( I_1 \) and \( I_2 \), as shown in the diagram is 1 A. Both bulbs have the same resistance, which is 2 \( \Omega \). Calculate the voltage supplied.

The voltage supplied to the parallel circuit shown in the diagram is 2 V. What is the ammeter reading if both resistors \( R_1 \) and \( R_2 \) have a resistance of 2 \( \Omega \)?

Diagram 2.1 shows a series circuit with three identical bulbs \( K, L \) and \( M \).

(a) (i) State the brightness of bulbs \( K, L \) and \( M \) if the switch in this electric circuit is on.

(ii) Give one reason for your answer in 2(a)(i).

The current that flows through bulbs \( K, L \) and \( M \) is

(iii) What will happen to bulbs \( K \) and \( M \) if bulb \( L \) burns out?
What will happen to the bulbs if one of the bulbs burns out?

(b) Diagram 2.3 shows a complete electric circuit.
(i) What will happen to the ammeter reading if the wire M is replaced by a longer wire?

(ii) Give one reason for your answer in 2(b)(i).
5 (a) Calculate the resistance in this circuit.

Diagram 1.1

(b) Determine the reading of the ammeter.

Diagram 1.2

(c) What is the voltage of the circuit?

Diagram 1.3

7 (a) Diagram 2 shows a series circuit. Complete the following based on Diagram 2.

\[ I = I_1 = I_2 = I_3 \]

\[ V = \]

\[ R = \]

Diagram 2

(b) Diagram 3 shows a parallel circuit. Complete the following based on Diagram 3.

\[ I = I_1 + I_2 + I_3 \]

\[ V = \]

\[ \frac{1}{R} = \]

Diagram 3
Calculate the voltage of the energy source in Diagram 4.

\[ R = \frac{V}{I} \]

Calculate the resistance of bulb X.

\[ R = \frac{V}{I} \]
Current, voltage and resistance in a series circuit/parallel

Diagram (a)

Diagram (b)

Diagram (a)

Diagram (b)

(f) If current of 1.5 A flows through the circuit, and each bulb has a resistance of 1 Ω, calculate the voltage supplied by the dry cells. Use the following formula in your calculation:

\[ R = \frac{V}{I} \]
Diagram 6.1 shows an electric circuit.

(a) (i) Name the type of this circuit.

Namakan jenis litar ini.

(ii) State the brightness of bulb L when the crocodile clip is moved from R to Q.

Nyatakan kecerahan mentol L apabila klip buaya digerakkan dari R ke Q.

(iii) Give one reason for the answer in 6(a)(ii).

Beri satu sebab bagi jawapan dalam 6(a)(ii).

(iv) What happens to bulb M if bulb L is burnt out?

Apakah yang terjadi pada mentol M jika mentol L terbakar?

(b) Diagram 6.2 shows a complete electric circuit.

(i) Calculate the total resistance of this circuit.

Hitung jumlah rintangan litar ini.

\[ \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \]

(ii) What is the voltage of \( V_1 \) if the voltage of \( V \) is 3 volts?

Berpakah volan \( V_1 \) jika volan \( V \) adalah 3 volt?

(iii) Give one advantage of the circuit shown in Diagram 6.2 if it is used in a house.

Beri satu kebaikan litar yang ditunjukkan dalam Rajah 6.2 jika ia digunakan di dalam rumah.
Diagram 22 shows an electric circuit.

*Rajah 22 menunjukkan suatu litar elektrik.*

Calculate the voltage of P.

*Hitung voltan bagi P.*

- A 20 V
- B 12 V
- C 8 V
- D 4 V
MAGNETISM

• A magnetic field is the area around a magnet where magnetic effects or magnetic forces can be felt.

• Magnetic fields are represented by the magnetic lines of forces.

• The direction of the magnetic field can be seen by plotting using a compass.

• The magnetic field or the lines that represent magnetic force do not meet each other and are closest together near the poles.

• The lines of magnetic force begin from the north pole and end at the south pole.

• This is because the magnetic field is the strongest near the poles. Away from the poles, the lines are further apart as the field is weaker.

• The direction of the magnetic field can be detected by using a compass.

• A freely suspended magnet will eventually stop in a north-south direction. This principal is used in a compass.
Diagram (a)

Diagram (c)

Diagram (e)

X is a neutral point
Magnetic field

- Field of force that exists around a magnet

Magnetic field lines
Magnetic Field
Magnetic Field
Draw the magnetic field

- Pattern formed by iron filing
Direction of the magnetic field

• Point from the North pole to the South pole
Magnetic field strength

• Closer together – strong
• Far apart – weak
• Strongest at the two poles
Magnet used in a compass

- Always point to the Magnetic North
- This property used in compass

Magnetised needle
Test yourself (draw)
Solution
ELECTROMAGNETISM.

• A current flowing through a straight conductor produces a magnetic field around the conductor.
• The magnetic field produced around a straight conductor is circular in shape.
• An electromagnet is a conductor that has the same properties as a magnet.
• When current flows around a piece of iron, the iron becomes a magnet. However, its magnetism disappears when the current stops flowing.
• The strength of the magnetic field of an electromagnet can be increased by.
  – Increasing the number of coils in a solenoid.
• **Solenoid** is an electrical conductor wound into a cylindrical coil. When current flows through a solenoid, the magnetic field pattern formed resembles the magnetic field pattern of a permanent bar magnet.
  – Increasing the current that flows through the solenoid.
  – Reducing the diameter of a solenoid.
  – Iron core – magnetic field is stronger if a soft iron core (pure iron) is placed inside the solenoid.
Learning Outcomes:

• relate the current flow through a conductor to magnetism
• describe what an electromagnet is
Current carrying conductor
Current carrying conductor

• When current flow through straight conductor, it becomes magnetised
• Magnetic field lines form concentric circles around it
Right Hand Grip Rule

- Direction of current
- Direction of magnetic field

- Magnetic field
- Direction of current
Diagram 23 shows the right-hand grip rule.
*Rajah 23 menunjukkan petua gengaman tangan kanan.*

Diagram 23
*Rajah 23*

Which pair is correct about the direction of current and magnetic field?
*Pasangan manakah yang betul mengenai arah arus dan medan magnet?*

<table>
<thead>
<tr>
<th>Direction of current</th>
<th>Direction of magnetic field</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arah arus</em></td>
<td><em>Arah medan magnet</em></td>
</tr>
</tbody>
</table>
| A | P to Q  
P ke Q | Clockwise  
*Ikut arah jam* |
| B | P to Q  
P ke Q | Anticlockwise  
*Antiarah jam* |
| C | Q to P  
Q ke P | Clockwise  
*Ikut arah jam* |
| D | Q to P  
Q ke P | Anticlockwise  
*Antiarah jam* |
Electromagnet

- Conductor which becomes magnetised when electric current flows through it
- Is a temporary magnet
ELECTROMAGNETISM.

- The poles of solenoid can be identified in the following ways:
  - The pattern of the current can be seen from the ends. When a solenoid is viewed from its end, the pattern of current seen represents the pole of the end.
  - Left hand grip rule: When the hand is held as shown in figure below, the direction of the thumb represents the direction of the north pole while the direction of the other fingers represents the direction of the current.
Magnetic field strength

- Closer together – strong
- Far apart – weak
- Strongest at the two poles
Direction of the magnetic field

• Point from the North pole to the South pole
Which statement is true about an electromagnet? 

Pernyataan manakah yang benar tentang elektromagnet?

A  Uses electricity to induce a magnetic field 
  *Menggunakan elektrik untuk mengaruh medan magnet*

B  Made up of a piece of copper which is wound with coils of wire 
  *Diperbuat daripada sekeping kuprum yang dililit dengan wayar*

C  Has the permanent ability to attract magnetic materials 
  *Mempunyai keupayaan kekal untuk menarik bahan magnet*

D  Can maintain its magnetism when no electric current flows through the conductor 
  *Dapat mengekalkan kemagnetan apabila tiada arus elektrik mengalir melalui konduktor*
Which of the following shows the correct direction of the compass needle?

Antara berikut, yang manakah menunjukkan arah jarum kompas yang betul?

- A: J and M
- B: J dan M
- C: K and M
- D: K dan M

11. Rajah 9 menunjukkan empat kedudukan kompas.
COMPARE
6 Figure 6.1 shows a 3-pin plug. 
Rajah 6.1 menunjukkan plug 3-pin.

Figure 6.1 
Rajah 6.1

(a) On Figure 6.1, label one wire using the following words:
Pada Rajah 6.2, labelkan satu wayar menggunakan perkataan berikut:

<table>
<thead>
<tr>
<th>Neutral wire</th>
<th>Earth wire</th>
<th>Live wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wayar neutral</td>
<td>Wayar bumi</td>
<td>Wayar hidup</td>
</tr>
</tbody>
</table>

[1 mark]

(b) Figure 6.2 shows a connection of two electrical appliances to their plug. 
Rajah 6.2 menunjukkan sambungan dua alat elektrik kepada plug masing-masing.

Figure 6.2 
Rajah 6.2

Explain the advantage of the connection of the electrical appliance to the 3-pin plug, rather than to the 2-pin plug.
Terangkan kelebihan sambungan alat elektrik kepada plug 3-pin berbanding plug 2-pin.

[2 marks]

(c) Calculate the current flow in an iron labelled 2000 watts and 240 volts. Suggest the suitable fuse that can be used. Use the following formula:
Hitungkan arus yang mengalir dalam seteri yang bertanda 2000 watt dan 240 volt. Cadangkan fius yang sesuai digunakan. Gunakan rumus berikut:

\[
\text{Current} = \frac{\text{Power}}{\text{Voltage}} = \frac{\text{Kuasa}}{\text{Voltan}}
\]

The suitable fuse can be used is: 
Fius yang sesuai digunakan ialah 

A

[3 marks]

PMR 08

1 An air conditioner is marked 240 V, 3000 W. Calculate the current flowing through the air conditioner. 
Sebuah penghawa dingin bertanda 240 V, 3000 W. Hitung arus yang mengalir melalui penghawa dingin itu.

A 0.08 A 
B 1.08 A 
C 12.5 A 
D 13.5 A
(a) A night market fruit seller found that a bulb at his stall is brighter when using a shorter wire.

Seorang peniaga bawang-bawang pasar malam mendapati lampu mentolnya menyala lebih terang apabila menggunakan wayar yang lebih pendek.

Figure 8.1
Rajah 8.1

Figure 8.2
Rajah 8.2

(i) Based on the observations in Figure 8.1 and 8.2, state the difference in the brightness of the bulb.

Berdasarkan pemerhatian pada Rajah 8.1 dan Rajah 8.2, nyatakan perbezaan kecerahan lampu mentol.

(ii) What inference can be made based on Figures 8.1 and 8.2?

Apakah inferens yang boleh dibuat berdasarkan Rajah 8.1 dan Rajah 8.2?

(iii) State your hypothesis based on your observations in Figure 8.1 and 8.2.

Nyatakan hipotesis anda berdasarkan pemerhatian pada Rajah 8.1 dan Rajah 8.2.

(b) A pupil carries out an experiment to investigate the situation in Figures 8.1 and 8.2. Figure 8.3 shows the arrangement of apparatus for the experiment.

Seorang murid menjalankan eksperimen untuk menyiasat situasi dalam Rajah 8.1 dan 8.2. Rajah 8.3 menunjukkan susunan rada bagi eksperimen itu.

Figure 8.3
Rajah 8.3

The pupil takes the following steps:

Murdit menjalankan langkah-langkah berikut:

Step 1: Touch jockey at Q on the nichrome wire where the distance between P and Q is 30 cm.

Sentuh joki pada wayar wayar nikrom di Q, dengan keadaan jarak antara P dan Q adalah 30 cm.

Step 2: Switch on and record the ammeter reading.

Hidupkan suis dan catatan bacaan ammeter.

Step 3: Repeat Step 1 and Step 2 by using nichrome wire with the lengths of 40 cm, 50 cm, 60 cm and 70 cm respectively.

Ulang Langkah 1 dan Langkah 2 dengan menggunakan panjang wayar nikrom masing-masing 40 cm, 50 cm, 60 cm, dan 70 cm.
(b) (i) Record the ammeter reading in the space provided.
Catatkan bacaan ammeter pada ruang bacaan ammeter di bawah.

The length of nichrome
Panjang u煞ar nikrom = 30 cm
Ammeter reading = 0.72 A
Bacaan ammeter = 0.72 A

The length of nichrome
Panjang u煞ar nikrom = 40 cm
Ammeter reading = ...... A
Bacaan ammeter = ...... A

The length of nichrome
Panjang u煞ar nikrom = 50 cm
Ammeter reading = ...... A
Bacaan ammeter = ...... A

The length of nichrome wire = 60 cm
Panjang u煞ar nikrom = 60 cm
Ammeter reading = ...... A
Bacaan ammeter = ...... A

The length of nichrome wire = 70 cm
Panjang u煞ar nikrom = 70 cm
Ammeter reading = ...... A
Bacaan ammeter = ...... A

(ii) Complete Table 8.4 by recording the ammeter reading on the respective length of the nichrome wire.
Lengkapkan jadual 8.4 dengan mencatatkan bacaan ammeter yang sepadan dengan panjang u煞ar nikrom.

<table>
<thead>
<tr>
<th>Length of nichrome wire/cm</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panjang u煞ar nikrom/cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammeter reading / A</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacaan ammeter / A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8.4
Jadual 8.4
Diagram 23 shows an electric kettle that has been used for boiling water for 1 hour every day for 30 days.

Rajah 23 menunjukkan cerek elektrik yang digunakan untuk mendidihkan air selama 1 jam setiap hari selama 30 hari.

Calculate the total cost of the electrical energy used if the cost for one unit is RM 0.20.

**REVIEW & ANSWER**

**Answer:** C

Current $[A] = \frac{\text{Power}[W]}{\text{Voltage}[V]}$

\[
= \frac{3000 \text{ W}}{240 \text{ V}}
= 12.5 \text{ A}
\]
An electrical appliance labelled, 240V, 750W is used for 60 hours. What is the cost of the electrical energy used if the cost per unit is 30 sen?

A. RM3.60  
B. RM4.32  
C. RM6.75  
D. RM13.50

**REVIEW & ANSWER**

Answer: D

Total kilowatt-hours used

\[
= \left[ \frac{750}{1000} \times 60 \right] \text{ kWh}
\]

= 45 kWh

Cost = 45 kWh × RM0.30

= RM13.50

---

Table 3 shows the usage of two electrical appliances. Jadual 3 menunjukkan penggunaan dua peralatan elektrik.

<table>
<thead>
<tr>
<th>Electrical appliances (Peralatan elektrik)</th>
<th>Power (Kuasa)</th>
<th>Time taken (Masa diambil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kettle (Cerek)</td>
<td>2.0 kW</td>
<td>2 hours 2 jam</td>
</tr>
<tr>
<td>Air conditioner (Penyaman udara)</td>
<td>1.5 kW</td>
<td>4 hours 4 jam</td>
</tr>
</tbody>
</table>

Table 3  
Jadual 3

Calculate the total cost of the electricity used if the electrical energy is 21 sen per unit. Hitung jumlah kos elektrik yang digunakan jika tenaga elektrik adalah 21 sen seunit.

A. RM0.84  
B. RM1.26  
C. RM2.10  
D. RM13.44

**REVIEW & ANSWER**

Answer: C

Total electrical energy used

\[= [2.0 \times 2] \text{ kWh} + [1.5 \times 4] \text{ kWh} = 10 \text{ kWh}\]

Cost = 10 kWh × RM 0.21 = RM 2.10
Diagram 22
Rajah 22

Calculate the current that flows in this air conditioner.
Hitung arus yang mengalir dalam penyaman udara ini.

\[
\text{Current (A)} = \frac{\text{Power (W)}}{\text{Voltage (V)}}
\]

\[
\text{Aruş (A)} = \frac{\text{Kuasa (W)}}{\text{Voltan (V)}}
\]

A 0.004 A  
B 0.24 A  
C 4.17 A  
D 5.00 A

**REVIEW & ANSWER**

**Answer:** C

\[
\text{Current [A]} = \frac{\text{Power [W]}}{\text{Voltage [V]}} = \frac{1000 \text{ W}}{240 \text{ V}} = 4.17 \text{ A}
\]

**PMR 2005 Question 39**

12. The table shows three types of electrical appliances, the value of fuse and the current flow through them.

<table>
<thead>
<tr>
<th>Value of fuse</th>
<th>Water heater</th>
<th>Iron Seterika</th>
<th>Radio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nilai fius</td>
<td>Pemanas air</td>
<td>Seterika</td>
<td></td>
</tr>
<tr>
<td>Current flow</td>
<td>13 A</td>
<td>13 A</td>
<td>8 A</td>
</tr>
<tr>
<td>Arus yang</td>
<td>12 A</td>
<td>11 A</td>
<td>5 A</td>
</tr>
<tr>
<td>mengalir</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the information above, what will happen to the fuse if a 10 A current flows through each electrical appliance?

Berdasarkan maklumat di atas, apakah yang berlaku kepada fius jika arus 10 A mengalir dalam setiap alat elektrik?

<table>
<thead>
<tr>
<th>Water heater</th>
<th>Iron fuse</th>
<th>Radio fuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fius pemanas</td>
<td>Tiada perubahan</td>
<td>No change</td>
</tr>
<tr>
<td>Fius seterika</td>
<td>Melebur</td>
<td>Tiada perubahan</td>
</tr>
<tr>
<td>Fius radio</td>
<td>Melebur</td>
<td>Tiada perubahan</td>
</tr>
</tbody>
</table>

A  No change Tiada perubahan  
B  No change Tiada perubahan  
C  Melts Melebur  
D  Melts Melebur  

**Answer:** C
(i) Diagram 6.1 shows a bulb with its power rating.
*Rajah 6.1 menunjukkan satu mentol dengan kadar kuasanya.*

What is the meaning of 100 W?
*Apakah yang dimaksudkan dengan 100 W?*

(ii) Diagram 6.2 shows three bulbs, P, Q and R with different power ratings.
*Rajah 6.2 menunjukkan tiga mentol, P, Q dan R dengan kadar kuasa yang berbeza.*

Which bulb gives the brightest light?
*Mentol manakah yang memberi cahaya paling terang?*
Diagram 6.3 shows two rooms, S and T, of the same size using different power rating air-conditioner at 16 °C.

Rajah 6.3 menunjukkan dua bilik, S dan T, dengan saiz yang sama menggunakan pendingin hawa dengan kadar kuasa yang berbeza pada suhu 16 °C.

(i) Which room will cool faster?
Bilik manakah yang akan sejuk lebih cepat?

(ii) Give one reason for the answer in 6(b)(i).
Beri satu sebab bagi jawapan dalam 6(b)(i).
(c) An iron of 1.2 kW is used for two hours once a week.

(i) Calculate total electrical energy used.
Sebuah setrika 1.2 kW digunakan selama dua jam sekali seminggu.
Hitung jumlah tenaga elektrik yang digunakan.

\[
\text{Electrical energy used} = \text{Power (kW)} \times \text{Time (h)}
\]

\[
\text{Tenaga elektrik yang digunakan} = \text{Kuasa (kW)} \times \text{Masa (j)}
\]

(ii) Calculate total cost of the electrical energy if the price is 30 sen per kWh.
Hitung jumlah kos tenaga elektrik itu jika harganya ialah 30 sen per kWj.

[2 marks]

[2 markah]
1. Power Hydro station
2. Step-up transformer
3. Switch zone
4. National Grid System
5. Step-Down transformer
6. Consumer

Light industry

Heavy industry

houses
1 Which phenomenon does not produce electrostatic charges?
A Ironing a silk shirt  
B Combing hair  
C Washing clothes  
D Switching on an electric fan

2 Diagram 1 shows the conditions of polystyrene balls K, L and M.

![Diagram 1](2005)

What are the charges possessed by the balls K, L and M?
K L M
A Positive Negative Positive  
B Negative Positive Positive  
C Positive Positive Positive  
D Negative Negative Positive

3 A polythene ruler which has been rubbed with a piece of woollen cloth will be attracted to a positively-charged object. Which of the following explains the above occurrence?
A The polythene ruler receives negative charges  
B The polythene ruler releases negative charges  
C The polythene ruler has more positive charges than the object  
D The polythene ruler has the same negative charges as the object

4 Diagram 2 shows a Van de Graaff generator that is switched on.

![Diagram 2](2000)

What happens when a metal sphere is brought near the charged dome?
A The metal sphere is attracted to the dome  
B The metal sphere is pushed away from the dome  
C Sparks are produced between the dome and the metal sphere  
D The metal sphere gives out a bright light
5 The electrical circuit in Diagram 3 is set up. Bulb X still lights up when bulb Y is burnt out.

Diagram 3

Which of the following statements correctly explains the situation?
A The voltage supplied in circuit is too low
B The resistance in bulb X is low
C Bulb X and bulb Y are connected in parallel
D The voltage across bulb X is high

6 Diagram 4 shows a complete series circuit.

Diagram 4

Which of the following pairs of electronic components would be suitable to measure the resistance of a resistor in the circuit in Diagram 4?
K L M N
A Dry cell Ammeter Resistor Voltmeter
B Voltmeter Ammeter Resistor Dry cell
C Dry cell Voltmeter Resistor Ammeter
D Ammeter Resistor Dry cell Voltmeter

7 Diagram 5 shows a complete electric circuit.

Diagram 5

Calculate the total resistance for the electric circuit.
A 1.0 Ω
B 1.5 Ω
C 5.0 Ω
D 6.0 Ω

8 Diagram 6 shows an electric circuit with two bulbs.

Diagram 6

Which of the following shows the relationship between voltages $V_1$ and $V_2$?
A $V = V_1 + V_2$
B $V = \frac{V_1}{V_2}$
C $V = V_1 = V_2$
D $V = V_1 - V_2$

9 Diagram 7 shows a parallel circuit with two identical resistors X and Y.

Diagram 7

If the voltmeter P gives the reading of 3.0 V, what is the voltmeter reading across Y if resistor X is removed?
A 0 V
B 1.5 V
C 2.0 V
D 3.0 V

10 Diagram 8 shows an electric circuit.

Diagram 8

If the current in this circuit is 0.5 A, calculate the voltage across the bulbs?
A 1.5 V
B 2.0 V
C 2.5 V
D 4.0 V

11 Diagram 9 shows four positions of compasses.

Diagram 9

Which of the compasses A, B, C or D shows the correct direction of the compass needle?

12 Diagram 10 shows a circuit with four bulbs P, Q, R and S.

Diagram 10

One of the bulbs has fused and three other bulbs do not light up. Which of the following bulbs fused?
A P
B Q
C R
D S
13 Which of the following bulbs will light up?

A

B

C

D

14 Diagram 11 shows an electric circuit.

What will happen to the iron nail when the switch in Diagram 11 is on?
A It will become a transformer
B It will become an electromagnet
C It will become a permanent magnet
D It will become a conductor

15 Diagram 12 shows two bar magnets and two compasses.

Which shows the direction of the compass needles X and Y?
A
B
C
D

16 Which of the following statements is true about an electromagnet?
A The direction of magnetic lines of force cannot be determined
B The magnetic lines of force meet and cross one another
C The magnetism disappears when the electric current is cut off
D Made up of a straight conductors that carries electric current
Penutup

1. Baca Surah Al-`Ashr

2. Tasbih Kifarah.

`Maha Suci Allah yang juga Maha Terpuji. Aku bersaksi bahawa tidak ada Tuhan kecuali Engkau. Aku memohon ampunan dan bertaubat kepada-Mu' (Ahmad, Abu Daud, Al-Nasai)