**Electric Circuits (III)**

**B. Circuit analysis with a circuit board**

**Fig. 1: Circuit Board**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

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**6**

**7**

**8**

**D**

**B**

**9**

The table below represents the switches that may be closed or opened on the Circuit Board (see Fig. 1 above).

1. Using your knowledge of electric circuits, make your prediction by placing a tick (🗸) in the appropriate box to indicate the switches you would close to create the desired circuit to light up the bulb(s).
2. Circuit diagrams for each of the desired circuits (page 4) as well as multiple copies of the circuit board diagram (page 5 - 6) are provided for you to trace the path of current flow, to help you make your **predictions** for each desired circuit.
3. After making predictions for all the desired circuits, **test** your predictions by using an actual circuit board. If your predicted arrangement does not work, find one that works. When you have the desired result, fill in the ticks in the appropriate boxes.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Desired Circuit | Switches Closed | | | | | | | | | | | Switches Closed | | | | | | | | | | |
| **Prediction** | | | | | | | | | | | **Test** | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1 | Lamp C alone |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | Lamp D alone |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Lamp C & D in series |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | Lamp A & C in series |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 | Lamp B & D in parallel |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | Lamp A & C in parallel |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Lamp A, B & C in series |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | \*Challenge |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Adapted from Center for Nanoscale Systems Institute for Physics Teachers, Cornell University.

**Drawing Current Flow Using Circuit Diagrams**

|  |  |
| --- | --- |
| **1. Circuit Diagram for Lamp C alone**  **C** | **2. Circuit Diagram for Lamp D alone**  **D** |
| **3. Circuit Diagram for Lamp C & D in series**  **D**  **C** | **4. Circuit Diagram for Lamp A & C in series**  **CC**  **A** |
| **5. Circuit Diagram for Lamp B & D in parallel**  **B**  **D** | **6. Circuit Diagram for Lamp A & C in parallel**  **A**  **C** |
| **7. Circuit Diagram for Lamp A, B & C in series**  **C**  **B**  **A** | **8. \*Challenge Circuit** |

**Drawing Current Flow Using Circuit Board Diagrams**

**1. Current Path for Lamp C alone using Circuit Board Diagram**

**Circuit Board Diagram**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

**11**

**1**

**4**

**5**

**6**

**7**

**8**

**D**

**B**

**9**

**2. Current Path for Lamp D alone using Circuit Board Diagram**

**Circuit Board Diagram**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

**11**

**1**

**4**

**5**

**6**

**7**

**8**

**D**

**B**

**9**

**3. Current Path for Lamp C & D in series using Circuit Board Diagram**

**Circuit Board Diagram**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

**11**

**1**

**4**

**5**

**6**

**7**

**8**

**D**

**B**

**9**

**4. Current Path for Lamp A & C in series using Circuit Board Diagram**

**Circuit Board Diagram**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

**11**

**1**

**4**

**5**

**6**

**7**

**8**

**D**

**B**

**9**

**5. Current Path for Lamp B & D in parallel using Circuit Board Diagram**

**Circuit Board Diagram**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

**11**

**1**

**4**

**5**

**6**

**7**

**8**

**D**

**B**

**9**

**6. Current Path for Lamp A & C in parallel using Circuit Board Diagram**

**Circuit Board Diagram**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

**11**

**1**

**4**

**5**

**6**

**7**

**8**

**D**

**B**

**9**

**7. Current Path for Lamp A, B & C in series using Circuit Board Diagram**

**Circuit Board Diagram**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

**11**

**1**

**4**

**5**

**6**

**7**

**8**

**D**

**B**

**9**

**8. \*Challenge Circuit:**

**Circuit Board Diagram**

**C**

**A**

**Test Switch**

**2**

**3**

**10**

**11**

**1**

**4**

**5**

**6**

**7**

**8**

**D**

**B**

**9**