CAMBRIDGE IGCSE™ PHYSICS 0625 | TOPICS 4.3 · 4.4

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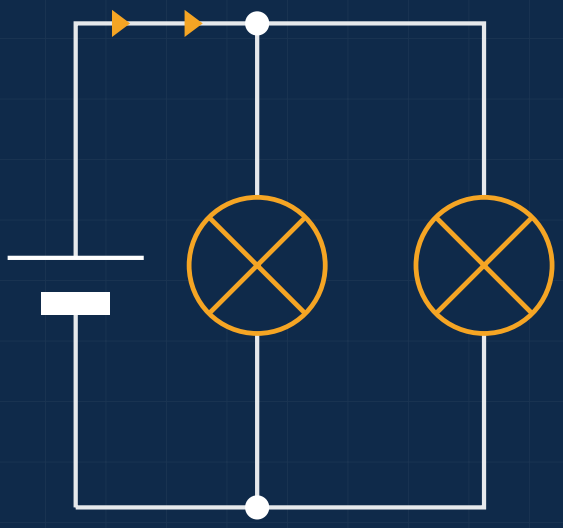
Electric Circuits & Safety

Free sample: knowledge organiser and Worksheet 1 with answers

Circuit symbols | Series circuits | Parallel circuits | Potential dividers | Sensors | Fuses & earthing | Exam-style questions

$$R = R_1 + R_2$$

$$V_1 / V_2 = R_1 / R_2$$



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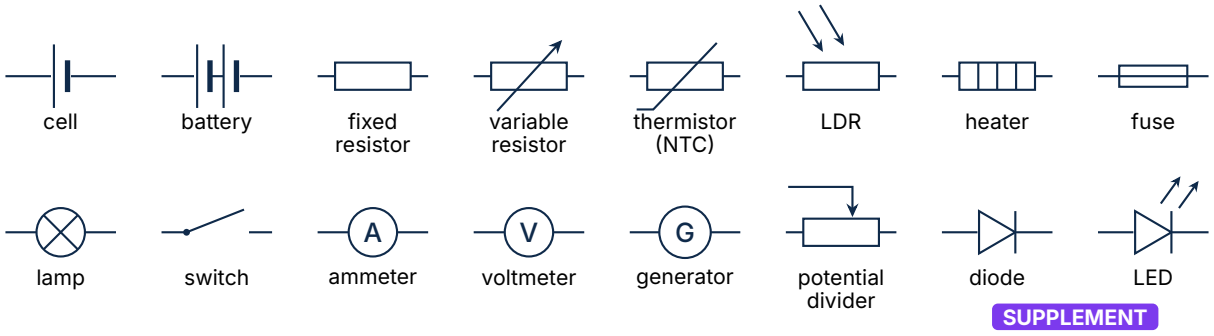
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Full pack: worksheets, exam paper, answers

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Knowledge organiser

Circuit symbols



SUPPLEMENT

Series circuits

The **current is the same** at every point.

Combined resistance: $R = R_1 + R_2 + ...$

e.m.f.s of cells in series add up.

A larger resistance has a larger p.d. across it (same current).

SUPPLEMENT The p.d.s across the components **add up** to the supply p.d.

Parallel circuits

The current from the source is **larger** than the current in each branch.

Two resistors in parallel have a **smaller** resistance than either one alone.

SUPPLEMENT Currents into a junction = currents out. Each branch has the **same p.d.**

SUPPLEMENT $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

How components behave

Thermistor (NTC): resistance **falls** as temperature rises.

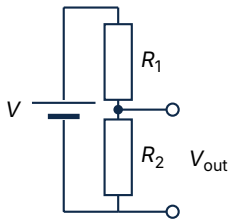
LDR: resistance **falls** as light gets brighter.

Variable resistor: changes the current (e.g. a dimmer).

Fuse: melts if the current is too big. **Relay:** a small current switches a larger one.

SUPPLEMENT **Diode / LED:** current flows in one direction only.

SUPPLEMENT Potential divider



The supply p.d. is shared in the ratio of the resistances:

$\frac{R_1}{R_2} = \frac{V_1}{V_2}$

Replace R_2 by a thermistor or LDR to make a temperature or light sensor.

Electrical safety (mains)

Hazards: damaged insulation (shock), overheating cables (fire), damp conditions (water conducts: shock), overloaded sockets and extension leads (too much current: overheating, fire).

Live (high p.d.), **neutral** (completes the circuit), **earth** (safety). The **switch** and **fuse** go in the **live** wire, so the appliance is not live when switched off.

Fuse: thin wire melts when the current exceeds its rating; choose the rating just above the normal current ($I = P/V$).

Trip switch: switches off automatically when the current is too big; can be reset.

Metal case must be **earthed**; a **double-insulated** (plastic) appliance needs no earth wire, and the fuse still protects the circuit and the cable.

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Interactive simulations

TRY IT LIVE

Explore the physics before (or after) you try the worksheets. Each simulation runs in any web browser on a phone, tablet or computer, with nothing to install. Scan the QR code, or click the link in the PDF.

Scan or click

4.3.2 SERIES AND PARALLEL CIRCUITS

Series and Parallel Circuits

Build series and parallel circuits with two resistors and read the meters.

Use with: Worksheet 2: Series circuits; Worksheet 3: Parallel circuits

benfizikyapamiyorum.com/icdp/circuits-series-parallel.html

Scan or click

4.3.3 ACTION AND USE OF CIRCUIT COMPONENTS

Potential Divider Sensors

Use a thermistor or an LDR in a potential divider and watch the output voltage change.

Use with: Worksheet 4: Potential dividers and sensors

benfizikyapamiyorum.com/icdp/circuits-potential-divider.html

How to get the most from them Make a prediction first, then test it in the simulation. Change one thing at a time and note what happens to the readings. Each simulation ends with a quick *Check yourself* question.

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Circuit symbols and components

WORKSHEET 1

CORE SUPPLEMENT

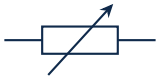
You will: recognise and draw the standard circuit symbols, describe how thermistors, LDRs and variable resistors behave in a circuit, and (Extended) describe the action of diodes and LEDs.

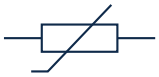
CORE all students SUPPLEMENT Extended (Supplement) students CHALLENGE stretch question

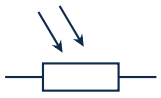
1 CORE Name each component. [8]

A 

B 

C 

D 

E 

F 

G 

H 

A _____ B _____

C _____ D _____

E _____ F _____

G _____ H _____

2 CORE Draw a circuit diagram that shows a battery, a switch, a lamp and a variable resistor connected in series, with a voltmeter measuring the p.d. across the lamp. [3]

3 CORE This question is about thermistors and light-dependent resistors (LDRs).

(a) State what happens to the resistance of an NTC thermistor when its temperature increases. [1]

.....

(b) State what happens to the resistance of an LDR when the light shining on it gets brighter. [1]

.....

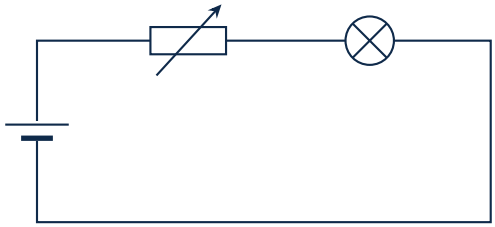
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(c) Suggest one use for each component. [2]

.....

.....

4 CORE The circuit shows a lamp in series with a variable resistor. The resistance of the variable resistor is increased.



(a) State and explain what happens to the current in the circuit. [2]

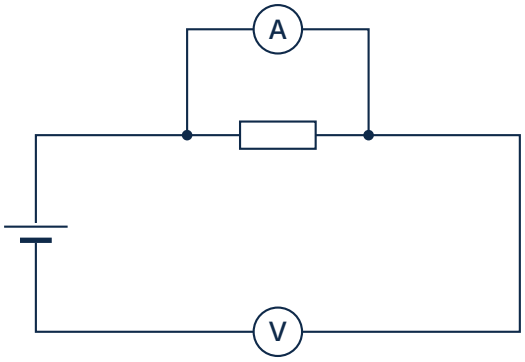
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(b) State what happens to the brightness of the lamp. [1]

.....

5 CORE A student wants to measure the current in a resistor and the p.d. across it. She draws this circuit.



Describe **two** mistakes in her circuit. [2]

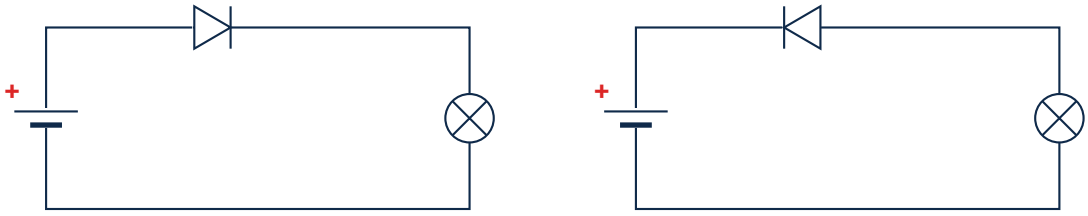
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Exam tip Draw circuit diagrams with a ruler: straight wires, square corners, and no gaps except in a switch. An ammeter goes **in series**; a voltmeter goes **in parallel** with the component.

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6 SUPPLEMENT The diagrams show two circuits. Each has a cell, a diode and a lamp.



circuit X **circuit Y**

(a) State which lamp lights. Explain your answer. [2]

.....

.....

(b) The diode in circuit X is replaced by a light-emitting diode (LED). Draw the symbol for an LED and state what happens if the LED is connected the other way round. [2]

.....

7 CORE Write the letter of the correct description next to each component. One description is not used. [5]

A melts and breaks the circuit if the current is too large
B its resistance decreases as the temperature increases
C a small current in its coil switches on a separate, larger current
D its resistance decreases as the light gets brighter
E its resistance can be changed to control the current
F gives out light when there is a current in one direction only

LDR _____ thermistor _____
fuse _____ relay _____
variable resistor _____

8 CORE Draw the circuit symbol for each component. [5]

(a) motor (b) electric bell (c) transformer (d) relay coil (e) d.c. power supply

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Answers: Worksheet 1

Mark codes: B1 independent mark C1 method mark, implied by a correct final answer A1 correct answer with unit. Accept answers that round correctly; allow error carried forward from earlier parts.

Worksheet 1 – Circuit symbols and components

1 A battery B1; B (open) switch B1; C variable resistor B1; D thermistor B1; E light-dependent resistor (LDR) B1; F heater B1; G fuse B1; H generator B1

2 Battery, switch, lamp and variable resistor in one series loop with correct symbols B1; no gaps except at the switch B1; voltmeter in parallel with the lamp only. B1

3 **(a)** It decreases. B1
(b) It decreases. B1
(c) Thermistor: temperature sensor, e.g. fire alarm, thermostat, oven or fridge control B1; LDR: light sensor, e.g. automatic street lamp or night light, camera light meter. B1

4 **(a)** The current decreases B1; the total resistance of the circuit is larger (and the e.m.f. is the same). B1
(b) The lamp gets dimmer. B1

5 The ammeter is in parallel with the resistor; it should be in series B1; the voltmeter is in series; it should be in parallel with the resistor. B1

6 **(a)** The lamp in circuit **X** B1; the diode lets current flow in one direction only, and in Y it is reversed (very high resistance), so no current flows. B1
(b) LED symbol: diode symbol with two arrows pointing away B1; it does not light (no current flows, because it is reversed). B1

7 LDR **D** B1; thermistor **B** B1; fuse **A** B1; relay **C** B1; variable resistor **E** B1 (F, an LED, is not used)

8 **(a)** motor: circle containing M B1
(b) electric bell: semicircle on two vertical legs (as in the syllabus) B1
(c) transformer: two coils either side of a pair of parallel lines (the core) B1
(d) relay coil: small rectangle with the wire through it, as in the syllabus B1
(e) d.c. power supply: two terminals (small circles) marked + and − B1

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Get the full pack

You have just used Worksheet 1. The full Electric Circuits & Safety pack contains:

- **Worksheet 1:** Circuit symbols and components
- **Worksheet 2:** Series circuits
- **Worksheet 3:** Parallel circuits
- **Worksheet 4:** Potential dividers and sensors
- **Worksheet 5:** Electrical safety
- **Multiple-choice practice:** 10 Paper 1/2-style questions
- **Practical skills:** an Alternative to Practical (Paper 6) question
- **Exam-style questions:** a 40-mark paper
- **Revision checklist** and knowledge organiser

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