

PRACTICE PAPER 01 (2026-27)

CHAPTER 11: ELECTRICITY (STEP-BY-STEP SOLUTIONS)

SUBJECT: SCIENCE

MAX. MARKS : 40

CLASS : X

DURATION : 1½ hrs

General Instructions:

- (i) All questions are compulsory.
- (ii) This question paper contains **20** questions divided into five Sections A, B, C, D and E.
- (iii) **Section A** comprises 10 MCQs and Assertion-Reason questions of **1 mark** each. **Section B** comprises 4 Very Short Answer questions of **2 marks** each. **Section C** comprises 3 Short Answer questions of **3 marks** each. **Section D** comprises 1 Long Answer question of **5 marks**. **Section E** comprises 2 Case Study Based questions of **4 marks** each.
- (iv) There is no overall choice. Internal choice is provided in Section E.
- (v) Use of calculators is not permitted.

SECTION - A

Questions 1 to 10 carry 1 mark each.

1. One coulomb of charge is equivalent to the charge contained in nearly

- (a) 1.6×10^{-19} electrons
- (b) 6×10^{18} electrons
- (c) 6×10^{23} electrons
- (d) 1.6×10^{19} electrons

Solution:

Ans: (b) 6×10^{18} electrons

$$\bullet n = 1 \text{ C} \div (1.6 \times 10^{-19} \text{ C}) \approx 6.25 \times 10^{18}.$$

2. To measure the current through a resistor and the potential difference across it, the ammeter and voltmeter are connected respectively

- (a) both in series
- (b) both in parallel
- (c) in series and in parallel
- (d) in parallel and in series

Solution:

Ans: (c) in series and in parallel

3. A wire has resistance R. If its length is doubled and its area of cross-section is halved (same material), its new resistance is

- (a) R/4
- (b) R
- (c) 2R
- (d) 4R

Solution:

Ans: (d) 4R

$$\bullet R = \rho l/A \rightarrow R' = \rho(2l)/(A/2) = 4\rho l/A = 4R.$$

4. The commercial unit of electrical energy, 1 kilowatt hour, is equal to

- (a) 3.6×10^3 J
- (b) 3.6×10^6 J
- (c) 1000 J
- (d) 3600 J

Solution:

Ans: (b) 3.6×10^6 J

$$\bullet 1 \text{ kW h} = 1000 \text{ W} \times 3600 \text{ s} = 3.6 \times 10^6 \text{ J}.$$

5. The resistance of the filament of a bulb rated 100 W, 220 V is

- (a) 2.2 Ω (b) 48.4 Ω
(c) 484 Ω (d) 22 000 Ω

Solution:

Ans: (c) 484 Ω

• $R = V^2/P = (220 \times 220)/100 = 48\,400/100 = 484\, \Omega$.

6. Three resistors of 6 Ω each are connected in parallel. Their equivalent resistance is

- (a) 18 Ω (b) 9 Ω
(c) 2 Ω (d) 3 Ω

Solution:

Ans: (c) 2 Ω

• $1/R_p = 1/6 + 1/6 + 1/6 = 3/6 = 1/2 \rightarrow R_p = 2\, \Omega$.

7. The heating element of an electric iron is usually made of

- (a) copper (b) tungsten
(c) nichrome (d) silver

Solution:

Ans: (c) nichrome

- Alloys like nichrome have high resistivity and do not oxidise (burn) readily at high temperatures.

8. The resistivity of a conductor depends on

- (a) its length
(b) its area of cross-section
(c) the nature of its material (and temperature)
(d) the current through it

Solution:

Ans: (c) the nature of its material (and temperature)

- Resistance depends on length and area; resistivity is a characteristic property of the material.

In the following questions 9 and 10, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) is true.

9. **Assertion (A):** A fuse wire is connected in series with the appliance it protects.

Reason (R): When an unduly high current flows, the fuse wire heats up, melts and breaks the circuit.

Solution:

Ans: (a)

- Only when it is in series does breaking the fuse stop the current to the appliance. R explains A.

10. Assertion (A): Electrical appliances in a house are connected in series.

Reason (R): In a series circuit, if one component fails, the circuit is broken and none of the components works.

Solution:

Ans: (d)

- (A) is false – household appliances are connected in parallel. (R) is a true disadvantage of series circuits.

SECTION - B

Questions 11 to 14 carry 2 marks each.

11. A current of 0.4 A flows through a bulb for 5 minutes. Find the charge that flows through it and the number of electrons that pass. (Charge on an electron = 1.6×10^{-19} C)

Solution:

$$Q = I \times t = 0.4 \text{ A} \times (5 \times 60) \text{ s} = 0.4 \times 300 = \mathbf{120 \text{ C. [1]}}$$

$$n = Q/e = 120 \div (1.6 \times 10^{-19}) = \mathbf{7.5 \times 10^{20} \text{ electrons. [1]}}$$

12. (a) Define 1 volt.

(b) How much work is done in moving a charge of 2 C across two points having a potential difference of 12 V?

Solution:

(a) The potential difference between two points is 1 volt when **1 joule of work** is done to move **1 coulomb of charge** from one point to the other: $1 \text{ V} = 1 \text{ J C}^{-1}$. [1]

(b) $W = V \times Q = 12 \times 2 = \mathbf{24 \text{ J. [1]}}$

13. State Ohm's law. What is the shape of the V-I graph for a conductor obeying this law, and what does it indicate?

Solution:

The potential difference V across the ends of a metallic wire is **directly proportional to the current I** through it, provided its **temperature remains the same**: $V \propto I$, or $V = IR$. [1]

The V-I graph is a **straight line passing through the origin**, showing that V/I ($= R$) is constant. [1]

14. (a) Why is tungsten used almost exclusively for the filaments of electric bulbs?

(b) Why are bulbs usually filled with nitrogen and argon?

Solution:

(a) The filament must get very hot to emit light without melting; tungsten is a **strong metal with a very high melting point (3380°C)**. [1]

(b) These **chemically inactive** gases prevent the hot filament from reacting/oxidising and so **prolong the life of the filament**. [1]

SECTION - C

Questions 15 to 17 carry 3 marks each.

15. A manganin wire is 1 m long and has an area of cross-section of 0.2 mm^2 . The resistivity of manganin is $44 \times 10^{-6} \Omega \text{ m}$.

(a) Find its resistance.

(b) Find the resistance of another manganin wire that is 2 m long and has double the diameter of the first wire.

Solution:

$$\mathbf{(a)} \quad A = 0.2 \text{ mm}^2 = 0.2 \times 10^{-6} \text{ m}^2 = 2 \times 10^{-7} \text{ m}^2.$$

$$R = \rho l/A = (44 \times 10^{-6} \times 1) \div (2 \times 10^{-7}) = 22 \times 10 = \mathbf{220 \Omega. [1\frac{1}{2}]}$$

(b) Doubling the diameter makes the area **4 times** ($A \propto d^2$): $A' = 8 \times 10^{-7} \text{ m}^2$; $l' = 2 \text{ m}$.

$$R' = (44 \times 10^{-6} \times 2) \div (8 \times 10^{-7}) = \mathbf{110 \Omega. (Check: R' = R \times 2/4 = 220/2.) [1\frac{1}{2}]}$$

- 16.** You are given three resistors of $4\ \Omega$ each. Show, with reasons, how you would connect them to get an equivalent resistance of (a) $6\ \Omega$ and (b) $8/3\ \Omega$. (c) What are the maximum and minimum resistances you can get using all three?

Solution:

(a) Connect **two in parallel** $(4 \times 4)/(4 + 4) = 2\ \Omega$, and this pair **in series** with the third: $2 + 4 = 6\ \Omega$. [1]

(b) Connect **two in series** ($8\ \Omega$), and this **in parallel** with the third: $(8 \times 4)/(8 + 4) = 32/12 = 8/3\ \Omega$. [1]

(c) Maximum (all in series) = $4 + 4 + 4 = 12\ \Omega$; minimum (all in parallel): $1/R = 3/4 \rightarrow 4/3\ \Omega$. [$1/2 + 1/2$]

- 17.** An electric oven rated $880\ \text{W}$ and a mixer rated $440\ \text{W}$ are both connected in parallel to a $220\ \text{V}$ supply.

(a) Find the current drawn by each appliance.

(b) Find the total current drawn from the supply.

(c) Find the resistance of each. Which has the higher resistance?

Solution:

(a) $I = P/V$. Oven: $880/220 = 4\ \text{A}$; mixer: $440/220 = 2\ \text{A}$. [1]

(b) In parallel, currents add: $4 + 2 = 6\ \text{A}$. [$1/2$]

(c) $R = V/I$. Oven: $220/4 = 55\ \Omega$; mixer: $220/2 = 110\ \Omega$. The **mixer** (lower power) has the higher resistance. [$1/2$]

SECTION - D

Question 18 carries 5 marks.

- 18.** In the circuit shown, a $12\ \text{V}$ battery is connected to a resistor $R_1 = 2\ \Omega$ in series with a parallel combination of $R_2 = 6\ \Omega$ and $R_3 = 3\ \Omega$.

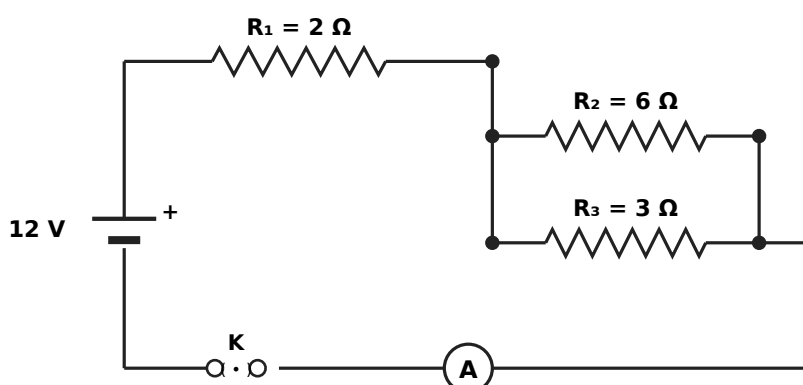


Figure: Circuit for Question 18

Calculate: (a) the equivalent resistance of the circuit; (b) the current shown by the ammeter; (c) the potential difference across R_1 and across the parallel combination; (d) the current through R_2 and through R_3 ; (e) the heat produced in R_1 in 1 minute.

Solution:

(a) Parallel part: $1/R_p = 1/6 + 1/3 = 1/6 + 2/6 = 3/6 \rightarrow R_p = 2\ \Omega$. Total $R = R_1 + R_p = 2 + 2 = 4\ \Omega$. [1]

(b) $I = V/R = 12/4 = 3\ \text{A}$. [1]

(c) $V_1 = I R_1 = 3 \times 2 = 6\ \text{V}$; $V_p = I R_p = 3 \times 2 = 6\ \text{V}$ (check: $6 + 6 = 12\ \text{V}$). [1]

(d) $I_2 = V_p/R_2 = 6/6 = 1\ \text{A}$; $I_3 = 6/3 = 2\ \text{A}$ (check: $1 + 2 = 3\ \text{A}$). [1]

(e) $H = I^2 R_1 t = 3^2 \times 2 \times 60 = 9 \times 2 \times 60 = 1080\ \text{J}$. [1]

SECTION - E (Case Study Based Questions)

Questions 19 and 20 carry 4 marks each.

19. A student connected a nichrome wire in a circuit with a battery, an ammeter, a voltmeter, a rheostat and a key. She recorded the following readings, keeping the temperature of the wire constant:

Potential difference V (volt)	1.5	3.0	4.5	6.0	7.5
Current I (ampere)	0.3	0.6	0.9	1.2	1.5

- (a) Which law is verified by these observations? State it. **(1)**
(b) Find the resistance of the wire. **(1)**
(c) Describe the shape of the V-I graph. If a nichrome wire of the same thickness but double the length is used, what current will flow when $V = 6.0$ V? **(2)**

OR

- (c) How should the ammeter and the voltmeter be connected in this circuit? What is the role of the rheostat? **(2)**

Solution:

(a) Ohm's law: $V \propto I$ at constant temperature ($V = IR$). [1]

(b) $R = V/I = 1.5/0.3 = 3.0/0.6 = \dots = 7.5/1.5 = 5 \Omega$ (constant for every reading). [1]

(c) A **straight line through the origin**, with slope $V/I = R$. [1]

$R \propto l$, so double length $\rightarrow R' = 10 \Omega$; $I = V/R' = 6.0/10 = 0.6$ A (half the earlier 1.2 A). [1]

OR

(c) Ammeter **in series** with the wire; voltmeter **in parallel** across the ends of the wire. [1]

A rheostat is a variable resistance used to **regulate (change) the current** in the circuit without changing the source voltage, so several readings can be taken. [1]

20. Read the passage and answer the questions that follow.

A family uses an electric iron rated 1000 W and a geyser rated 2000 W, both working on the 220 V household supply. The iron is used for 1 hour a day and the geyser for 1.5 hours a day. Each appliance is protected by a fuse, and the appliances in the house are connected in parallel. Electricity costs ₹7 per unit.

- (a) Find the current drawn by the iron. Which fuse - 3 A, 5 A or 10 A - should be used for it? **(1)**
(b) Find the resistance of the heating element of the iron. **(1)**
(c) Calculate the electrical energy consumed by the two appliances in 30 days and its cost. **(2)**

OR

- (c) Give two reasons why household appliances are connected in parallel and not in series. **(2)**

Solution:

(a) $I = P/V = 1000/220 \approx 4.55$ A. A **5 A** fuse should be used (slightly above the normal current). [$\frac{1}{2} + \frac{1}{2}$]

(b) $R = V^2/P = (220 \times 220)/1000 = 48\,400/1000 = 48.4 \Omega$. [1]

(c) Daily energy: iron = $1 \text{ kW} \times 1 \text{ h} = 1 \text{ kW h}$; geyser = $2 \text{ kW} \times 1.5 \text{ h} = 3 \text{ kW h}$; total = 4 kW h per day.

For 30 days: $4 \times 30 = 120 \text{ kW h (units)}$. [1] Cost = $120 \times ₹7 = ₹840$. [1]

OR

(c) (i) Each appliance gets the **full supply voltage** (220 V) and can draw the current it needs; in series the voltage would be shared. [1]

(ii) Each appliance can be **switched on/off independently**; if one fails, the others keep working. In series, failure of one breaks the whole circuit. [1]