Past-paper walk-through

Potential dividers ▪ 10.3

eXercise

Questions in this set

- 9702/12 N25 Q35 ▪ 1 mark
- 9702/12 N25 Q36 ▪ 1 mark
- 9702/14 J25 Q36 ▪ 1 mark

Question 35

9702/12 N25 ▪ Q35 ▪ 1 mark

The diagram shows a circuit with a battery of electromotive force (e.m.f.) 60 V and negligible internal resistance, a 20 kΩ resistor, a thermistor and a voltmeter. The resistance of the thermistor is 20 kΩ.

The temperature of the thermistor decreases, and this causes its resistance to change by 50%.

After this change, what is the reading on the voltmeter? **[1]**

A 20 V

B 24 V

C 36 V

D 40 V

Solution 35

A 20 V

B 24 V ✓

C 36 V

D 40 V

Why

- A thermistor's resistance *rises* as it gets colder, so 20 kΩ becomes $20 \times 1.5 = 30$ kΩ.
- The two form a potential divider across 60 V, with a total of 50 kΩ.
- The voltmeter reads the fixed resistor's share: $60 \times 20/50 = 24$ V.

Question 36

9702/12 N25 ▪ Q36 ▪ 1 mark

36 A potentiometer circuit is used to determine the electromotive force (e.m.f.) E_X of a cell. The circuit includes a second cell of known e.m.f. E_0 and negligible internal resistance, and a uniform resistance wire PQ of known length.

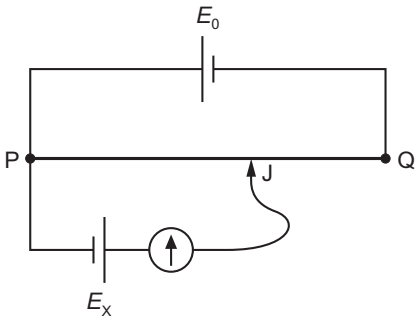
E_X is less than E_0.

The movable connection J can be positioned anywhere along the length of the resistance wire.

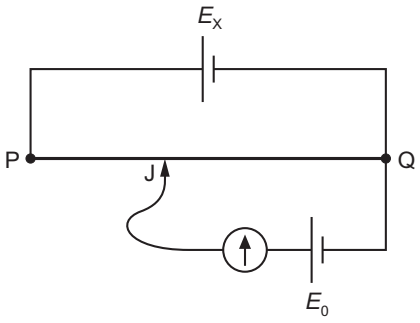
Which circuit is suitable for determining E_X?

A **B**

Question 36

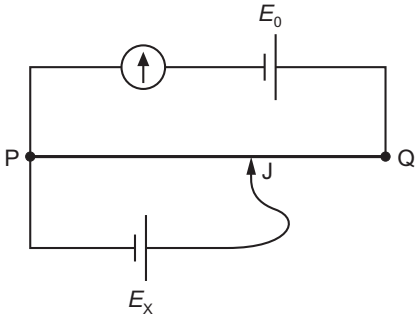


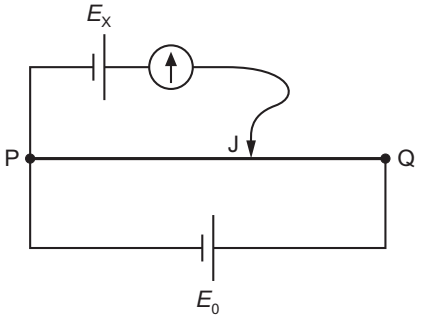
C



D

Question 36





Solution 36

Answer: **D**

Why

- The known cell E_0 must drive current through the whole wire PQ, setting up a uniform potential gradient along it.
- E_X goes in the second loop with the galvanometer, from one end of the wire to the sliding contact J.
- The two cells must oppose; since $E_X < E_0$, a null point then exists somewhere along PQ.

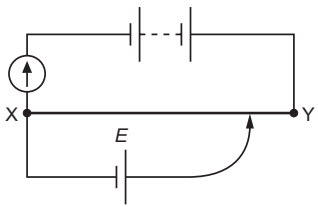
Question 36

9702/14 J25 ▪ Q36 ▪ 1 mark

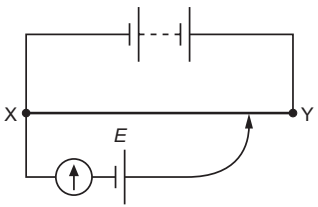
36 A potentiometer circuit may be used to determine the unknown electromotive force (e.m.f.) *E* of a cell. The circuit diagrams shown include a battery of known e.m.f. and negligible internal resistance, a uniform resistance wire XY and a galvanometer.

Which circuit diagram shows a suitable arrangement for determining *E*?

A

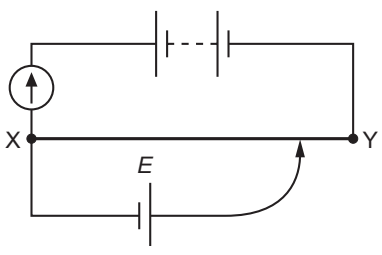


B

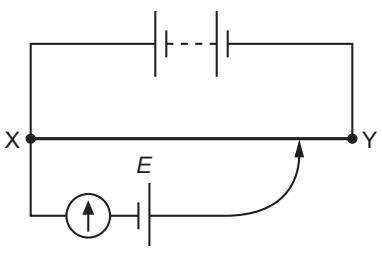


Question 36

C



D



Solution 36

Answer: **B**

Why

- The driver cell must sit across the *whole* wire XY, so there is a uniform potential gradient along it.
- The unknown cell goes in the other loop, in series with the galvanometer, joined to one end of the wire and to the sliding contact.
- The two cells must oppose each other, otherwise no balance point (zero deflection) can exist.