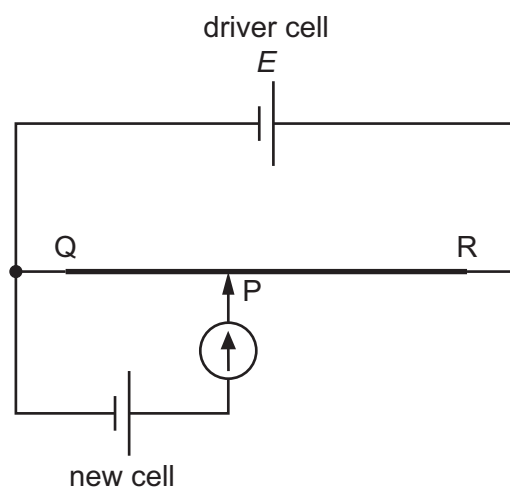


- 37 A potentiometer and a driver cell of electromotive force (e.m.f.) E are used to measure the e.m.f. of a new cell.

A sliding contact at P is moved along a resistance wire QR until the reading on the galvanometer is zero.



What is an essential requirement for the e.m.f. of the new cell to be measured accurately?

- A** The e.m.f. of the driver cell must be less than the e.m.f. of the new cell.
B The galvanometer must have a large resistance.
C The internal resistance of the new cell must be zero.
D The resistance per unit length of the wire QR must be constant.
- 38 The table shows the number of nucleons and the total number of particles (protons, neutrons and electrons) in neutral atoms of four nuclides W, X, Y and Z.

	number of nucleons	total number of particles
W	19	30
X	19	31
Y	21	32
Z	22	31

Which two nuclides are isotopes of each other?

- A** W and X **B** W and Y **C** X and Z **D** Y and Z

- 39 When a sample of a radioactive isotope decays by α -particle emission, the α -particles emitted have a single discrete energy.

When a sample of a radioactive isotope decays by β^- particle emission, the β^- particles emitted have a continuous range of energies.

What is the explanation for this?

- A An antineutrino is emitted with a β^- particle but not with an α -particle.
 - B An antineutrino is emitted with an α -particle but not with a β^- particle.
 - C The α -particles have much more energy than the β^- particles.
 - D The β^- particles have much more energy than the α -particles.
- 40 Some particles are a combination of three quarks.

Which combination of quarks does **not** result in a particle with a charge of either $+1.6 \times 10^{-19} \text{ C}$ or zero?

- A up, down, down
- B up, strange, strange
- C up, up, down
- D up, up, up



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