

IBSMO

International British Science & Mathematics Olympiad

Science — Sample Questions

Advanced Level

Grade 7–8

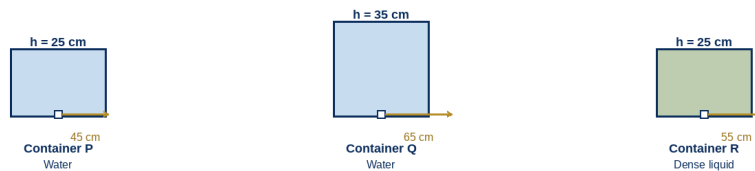
Question 1 — Physics — Fluid Pressure

Identical containers P, Q and R have identical holes at their base.

Container P: water at a height of 25 cm. Container Q: water at 35 cm. Container R: a liquid denser than water, at 25 cm.

When the holes are opened, initial spurt distances are measured: P → 45 cm, Q → 65 cm, R → 55 cm.

The water height in container P is then raised to 50 cm, with all other conditions unchanged.



How does the new pressure of the liquid in P compare to its initial pressure?

- A) It halves
- B) It stays the same
- C) It doubles ✓
- D) It quadruples

Answer: C. Liquid pressure follows $P = \rho gh$. Since the density and gravity are unchanged and the height doubles (25 cm → 50 cm), the pressure doubles. (The spurt-distance data is not needed for this question.)

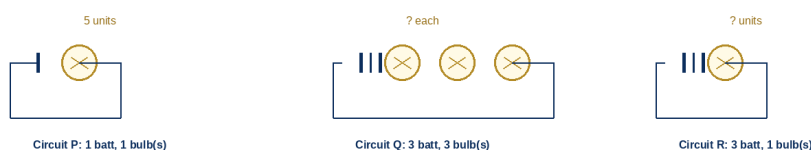
Question 2 — Physics — Circuits

Identical bulbs and identical batteries are used to build three circuits.

Circuit P: 1 battery + 1 bulb. Circuit Q: 3 batteries + 3 bulbs in series. Circuit R: 3 batteries + 1 bulb.

The bulb in Circuit P has a measured brightness of 5 units.

Assume the battery effect increases directly with the number of batteries, and identical bulbs in series share this total effect equally.



What is the sum of the brightness of one bulb from Circuit Q and one bulb from Circuit R?

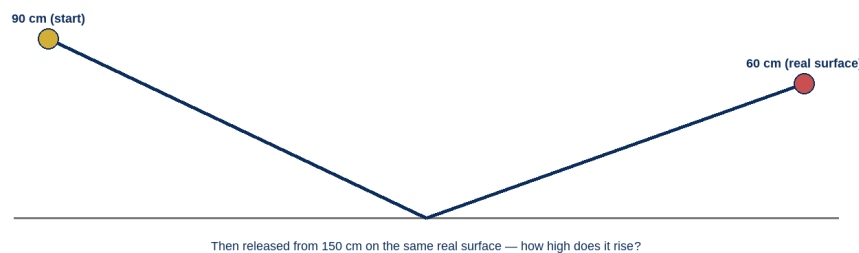
- A) 15 units
- B) 18 units
- C) 20 units ✓**
- D) 25 units

Answer: C. 3 batteries give a total effect of $3 \times 5 = 15$ units. In Circuit R, all 15 units go to the one bulb. In Circuit Q, the 15 units are shared equally among 3 bulbs, giving 5 units each. Sum = $5 + 15 = 20$.

Question 3 — Physics — Energy Loss

A toy car is released from a frictionless ramp at a height of 90 cm and rises to the same 90 cm on the opposite side. The same experiment is repeated on a real (non-frictionless) surface: the car reaches only 60 cm on the opposite side.

The car is then released from 150 cm on the same real surface.



Assuming the same fraction of starting energy is lost each time, approximately what height does the car reach on the opposite side?

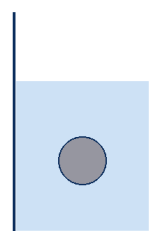
- A) 90 cm
- B) 100 cm ✓**
- C) 110 cm
- D) 120 cm

Answer: B. The fraction of energy retained is $60/90 = 2/3$. Applied to the new starting height: $150 \times 2/3 = 100$ cm.

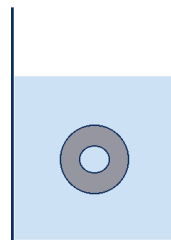
Question 4 — Physics — Volume and Density

An object has a mass of 150 g. When fully submerged, it displaces 50 mL of water.

A second object, made of the same material, has 1.5 times the volume of the first object, and additionally contains a hollow compartment of 20 mL.



Object 1: 150 g
Displaces 50 mL



Object 2: same material,
1.5x volume, 20 mL hollow

What is the difference, in mL, between the second object's total volume and the volume of its solid material?

- A) 15 mL
- B) 20 mL ✓**
- C) 25 mL
- D) 30 mL

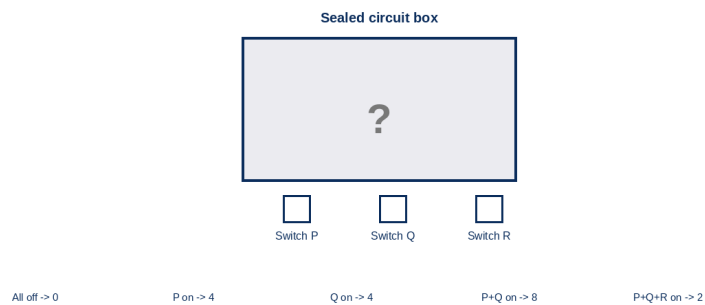
Answer: B. The second object's total volume is $1.5 \times 50 = 75$ mL. Its solid material is $75 - 20 = 55$ mL. The difference between total volume and solid volume is exactly the hollow space: 20 mL.

Question 5 — Scientific Reasoning — Black-Box Logic

A sealed electrical box has three switches, P, Q and R. Bulb brightness is measured:

All off $\rightarrow$ 0 units. P on only $\rightarrow$ 4 units. Q on only $\rightarrow$ 4 units. P & Q on $\rightarrow$ 8 units. P, Q & R all on $\rightarrow$ 2 units.

The internal wiring is unknown.



Which conclusion is most reasonable based on this data?

- A) P and Q's effects add together, but turning R on causes a change that reduces the total effect in the circuit ✓
- B) P and Q are definitely two batteries connected in series
- C) Switch R always turns the bulb off
- D) The box definitely contains exactly three batteries

Answer: A. P and Q clearly add ($4 + 4 = 8$, matching the measured value with both on). But adding R drops the brightness from 8 down to 2 — some interaction reduces the total effect, without us being able to say exactly how the box is wired.