Physics Form 11

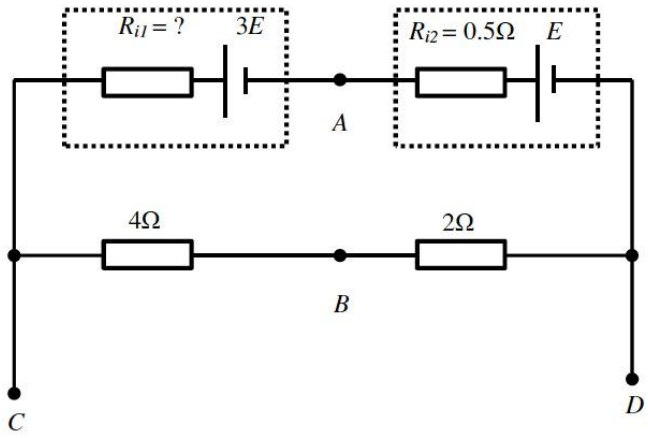
English

Use g = 9.82 m/s^2

Task 1.

a) Two batteries with EMFs *3E* and *E* and internal resistances R_{i1} and R_{i2} respectively are connected in series with two resistances as shown in the figure. Calculate the value of the unknown internal resistance R_{i1} so that a short-circuiting between *A* and *B* does not affect the voltage between *C* and *D*
(3 points)

b) With this calculated value of R_{i1}, calculate the electrical potential at *A* when *D* is earthed. (3 points)



Physics Form 11

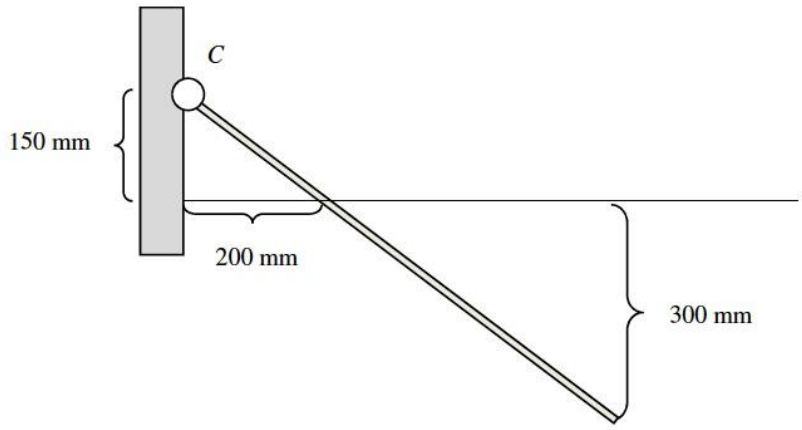
English

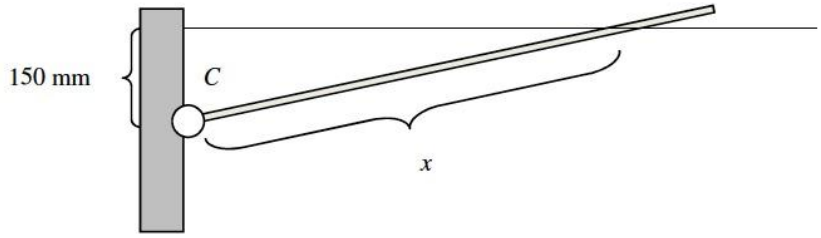
Task 2

A thin, straight and homogeneous wooden rod has one end fixed in a friction-free joint *C* and the other end partially immersed in water. The mass of the rod is 1 kg and its cross-sectional area is *A*. The rod is first in its equilibrium position as in the upper figure. The buoyancy force acts in the middle of the part which is beneath the surface of the water.

a) Calculate the density of the wood (3 points)

b) When the water level rises so that the joint *C* is below the surface of the water, the same rod adopts the position shown in the lower figure. Calculate the length *x* of that part of the rod which is under water (3 points)





Physics Form 11

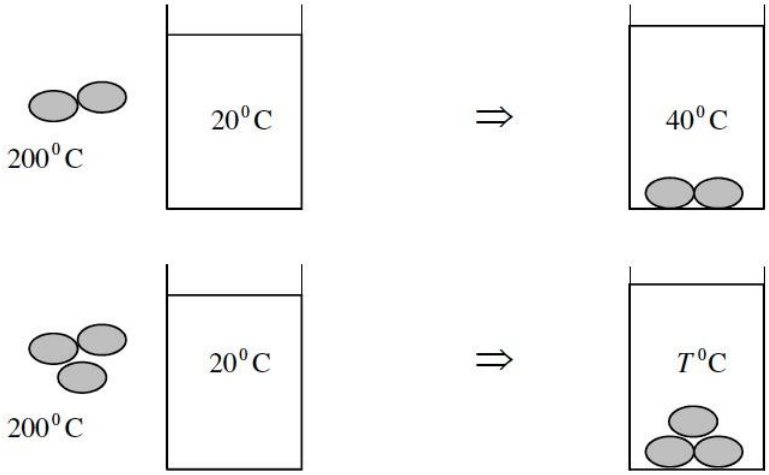
English

Task 3

Three stones which are alike in all respects are heated to 200°″C. If two of these stones are placed in a beaker of water at a temperature of 20°C, the water and stones attain a final temperature of 40°C. Assume that there is no loss of energy and that the heating of the beaker can be neglected.

a) If instead of two stones, all three stones – each at a temperature of 200°C – are placed in the same container, what will the final temperature T be? (3 points)

b) What is the smallest number of whole stones that must be placed in the container for the water temperature to reach 90°C?



Task 4

An air-balloon with mass m is approaching the ground with an acceleration a directed downwards. How much ballast, Δm, must be jettisoned for the balloon instead to have an acceleration a in an upward direction immediately after the ballast has been jettisoned?

Express your result in terms of m, a and g. Thereafter insert the values m= 400 kg and a = 0.01 g and calculate the value of Δm to the nearest kg. (6 points)