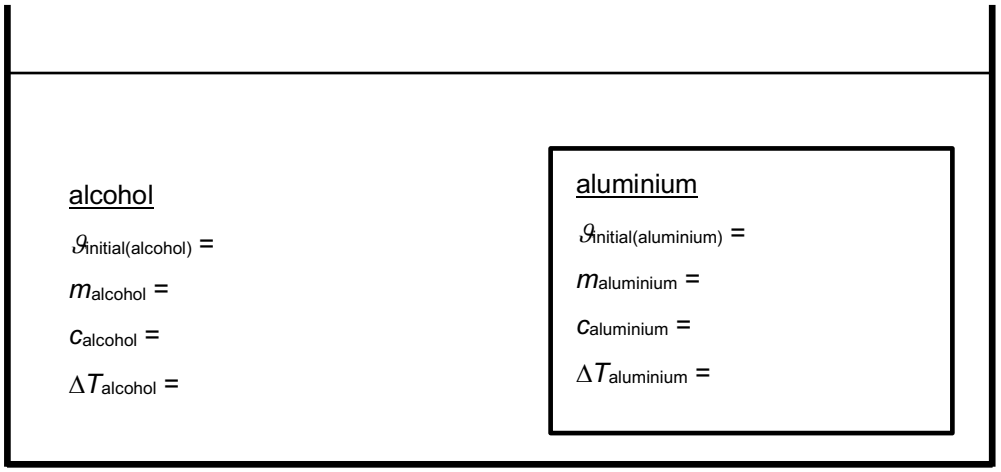
1. A hot aluminium cube (m = 63.0 g) is placed into 266 g alcohol of initial temperature of 18.0 °C. After a while, the temperature at equilibrium is 37.0 °C.

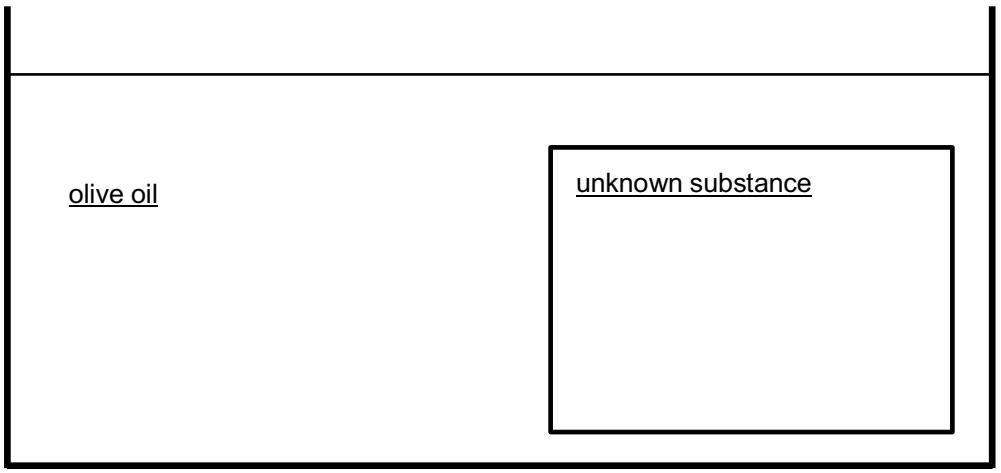
a) Write all the given quantities in the picture. There is one or two quantities which are not given – put a question mark there.
b) Draw an arrow to show the direction of the heat flow. Which one of the substances loses heat, which one gains heat?
c) By what amount does the internal energy of the alcohol increase?
d) By what amount does the internal energy of the aluminium decrease?
e) What was the initial temperature of the aluminium cube?



$\vartheta_{equilibrium} = \vartheta_{final(alcohol)} = \vartheta_{final(aluminium)} =$

2. A cube of an unknown material ($m_{unknown}$ = 192 g, $\vartheta_{initial(unknown)}$ = 15.0 °C) is placed into olive oil ($m_{olive\ oil}$ = 395 g, $\vartheta_{initial(olive\ oil)}$ = 45.0 °C). After a while, the temperature at equilibrium is 42.0 °C.

a) Write all the given quantities in the picture. There is one or two quantities which are not given – put a question mark there.
b) Draw an arrow to show the direction of the heat flow. Which one of the substances loses heat, which one gains heat?
c) Calculate the specific heat capacity of the unknown material. What is the unknown substance?



$\vartheta_{equilibrium} = \vartheta_{final(olive\ oil)} = \vartheta_{final(unknown\ substance)} =$

3. 2.30 dℓ of petroleum of 11.5 °C is mixed together with 4.93 dℓ of petroleum of 37.6 °C.

a) Draw a picture similar to problems 1. and 2. and write the given quantities in the picture. Draw an arrow to show the direction in which the heat flows.

b) What is the temperature at equilibrium?

4. You've just filled your bathtub with 112 ℓ of water. You realize that, unfortunately, the water is too hot ($\vartheta_{initial(water)}$ = 40.0 °C). You decide that you are going to use the knowledge you've learned in physics class at school!!! You are going to cool the water down in a new creative way! There's this old porcelain bust of your famous grandfather on the balcony … ($\vartheta_{initial(porcelain)}$ = –12.0 °C). Qickly you go get the bust and immerse it in the water ... after a while, the temperature at equilibrium is 38.0 °C.

a) What is the porcelain bust's mass?

b) On the balcony, there's also an iron cannon ball of mass 21.0 kg. What would have been the temperature at equilibrium, had you immersed the cannon ball in the water, instead of your grandfather's bust?

solutions:
1. b) 12.2 kJ c) 12.2 kJ d) 254 °C
2. c) 450 $\frac{J}{kg \cdot K}$ (iron)
3. 29.3 °C
4. a) 22.1 kg b) 39.0 °C