:KSODFHGLQWHPRIKDWLVXPHGVWKSODFHG
LQHXOQRIWKDWLVXPHG

D (SODLQWKWKHQXVDEQLWKHORZHVW
WRWRIWHPSDWXV@
(b) If the density of water is 1000kg m^{-3}, calculate the density of the
HQXGPDWV@

Answer
D :K QWRPHW
KPHGVRH
QHW **6W**
has a lower density because a greater volume must be displaced in
REHWRHTXOWKHZLWRIWKDW 6

b) The fraction submerged will be equal to the fraction of the density
RIWHWKDWPXWRYHQLW\

(8.2 y 1.2) u 1000 = 683 kg m^{-2}

RLQWKVDPHWKQHYVHRWKG

(9.6 y 1.2) u density = 683 kg m^{-3}

WKHQLWRIWKDGVNP $^{-3}$ 6

Question 6
It is often said that 90% of an iceberg is actually under the ocean's
VXDFHEWHVHDEHRVVRQWRWKLVPROHOLNH
(a) If we assume that the density of sea water is the same as fresh
water, 1000 kg m^{-3}FDOFXODWHWKHQLWRIWKLFHEHPDV@
(b) After a little research, it is shown that sea water is slightly more
HQHWKQHVWHIWHuHFWZOOWKVYHRQWRU
WRD PDV@

Answer
D 7K EHHQWW
which means its density is 92/100 the density of water

(92 y 100) u 1000 = 920 kg m $^{-3}$

(b) If the density of sea water is greater, then a larger number is used
for the density in the above calculation which gives a higher answer
for the density of the iceberg. 6

Question 7
EDO ^{3}RIKOLXKFHVHQLWNJ
m^{-3}. The rubber of the balloon weighs 12g and has negligible volume.
Taking the density of air to be 1.225kg m^{-3}
D FDOFXODWHWKHXWW>PDV@Q
(b) the initial acceleration of the balloon. (g=9.8 N kg^{-1}>PDV@

Answer
D 8WQUDFHW
the balloon.
Mass of air displaced = density x volume
= 1.225kg m^{-3} x 0.25m^{3} = 0.306kg 6
: HLKWRIDLUVSODFHGPDVVDYLWDWLRQOHOGWHQWK
(*g*) = 0.306kg x 9.8N kg^{-1} = 3.0N
Therefore the upthrust is 3.0N. 6

(b) For the acceleration we need to know the mass and the resultant
force.

7KHVXWDQRFHLVWKXWWKHLWRIEDOORQ

Mass of balloon and gas = mass of helium in balloon + mass of
rubber
=density of helium in balloon x volume of helium + mass of rubber
NP $^{-3}$ u 0.25m^{3}) + 12x10^{-3}kg = 0.053kg. 6
Weight of balloon and gas:
= mass x *g* = 0.053kg u 9.8N kg^{-3} = 0.52N
5HVXWDQW IRUFH 1 ±1 1 DV LW LV WKH QWLDO
acceleration there is no air resistance). 6

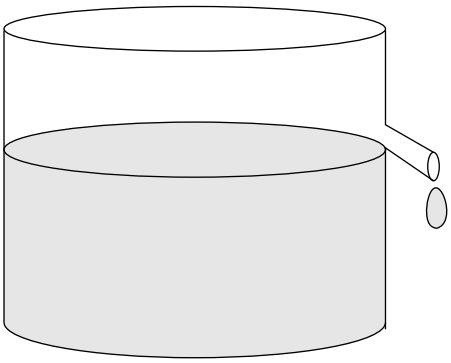
acceleration = F yP yP PV $^{-2}$

Experiment: Finding the density of a substance

density = mass y volume
:HFDQHGVSODFHPHQWRQWKHDFWYROXHRIHYHQHDU
shapes, and measure the mass using an electric balance

There are potentially two ways to do this. A measuring cylinder can
EHSDWLDOOQOHGZWKXWHDWKYROXHRIHFRHSPDOOREMHFW
FRXWKHQHDEHGQWKHZYROXHFHGWKGuHEQH
would be the volume of the object.

Alternatively a displacement can could be used for larger items.
7KHFDQVQOHQWLOWKHWHRPHVRWRIWKVSRXW



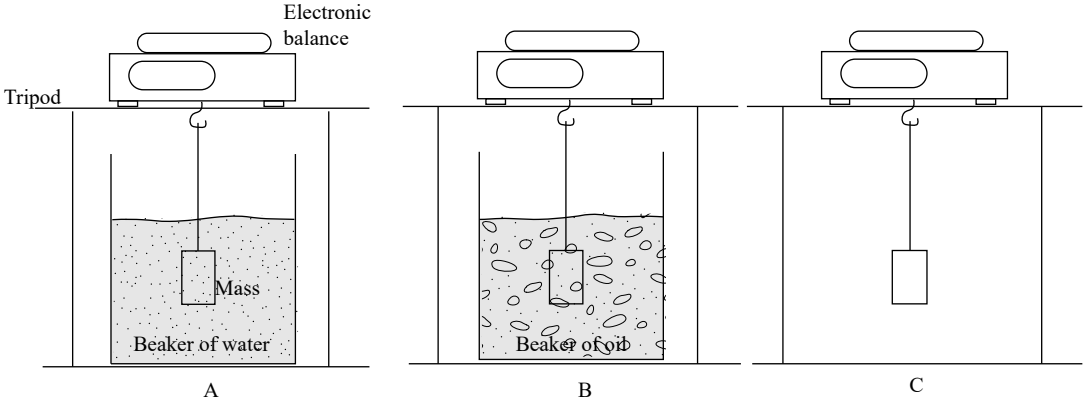
When an object is added water is displaced through the spout which
can be collected in a measuring tube or put on a balance to determine
the volume of water displaced and thus the volume of the object.

In both instances this requires the object to sink. If it does not it might
be possible to push it below the surface but any other object that enters
the water would also cause some displacement.

Be aware of bubbles on the surface of the item as these will cause an
additional volume of water to be displaced.

Question 8
An unknown mass is suspended from an electric balance (many have
hooks hidden underneath for this purpose, take a look) and the reading
on the balance is recorded when suspended in air, water, and oil.

Taking the upthrust in air to be negligible, describe how you could
use these three readings to determine the density of the oil, given the
density of water as 1000kg m^{-3}>PDV@



Answer

Suspending the mass in air (C) gives the weight of the suspended mass, W. We can use W = M*g* to find its mass, M.
Now suspending it in water (A) will give a resultant force W_w which will be less than W.
The difference, W-W_w = upthrust in water. ✓

This gives us the weight of the water displaced. Using w = m*g* will give us the mass of the water displaced.
Volume = mass / density will give us the volume of water displaced which is equal to the volume of the suspended mass. ✓
We can now determine the density of the suspended mass
Density = M/V ✓

Now suspend the mass in the oil (B) and get a new reading, W_o.
Again the difference would be equal to upthrust created by the oil.
$W - W_o$ = $upthrust_{oil}$ ✓
$Upthrust_{oil}$ = weight of oil displaced.

Calculate the mass of oil displaced as m_o=weight of oil displaced/*g* ✓
We already know the volume of the mass, so we know the volume of this mass of oil already. Therefore we can work out the density as usual
$Density_{oil}$ = V/m_o ✓

Acknowledgements: *This* ***Physics Factsheet*** *was researched and written by* ***Kieron Nixon*** *and published in January 2017 by* ***Curriculum Press****, Bank House, 105 King Street, Wellington, TF1 1NU. Physics Factsheets may be copied free of charge by teaching staff or students, provided that their school is a registered subscriber. No part of these Factsheets may be reproduced, stored in a retrieval system, or transmitted, in any other form or by any other means, without the prior permission of the publisher.* ***ISSN 1351-5136***