Example lift bag calculation

Below is an example of a lift bag calculation relevant to the Year 12 Marine and Maritime Studies ATAR course Unit 3 syllabus content:

* underwater wreck site excavation: techniques, processing and recording, recovery of artefacts, lift bags (purpose, use and calculations)

Example calculation

A 43.0 kg object with a volume of 15.0 L is resting on the sea floor at 38.0 m below sea level. The seawater has a density of 1.03 kg/L. Determine the volume of air at the surface that needs to be brought down to inflate a lift bag to make the object neutrally buoyant.

1. Calculate the mass of water the object displaces.

Mass of water the object displaces = volume of water displaced by object × density of water

 = 15.0 × 1.03

 = 15.45 kg

1. Calculate the buoyancy of the object.

Buoyancy = mass of water the object displaces – mass of object

 = 15.45 – 43.0

= -27.55 kg

The object is negatively buoyant by 27.55 kg.

1. Calculate the volume of air (gas) required at depth to produce neutral buoyancy.

Factor in the density of seawater to the buoyancy of the lift bag.

$$Volume of gas =\frac{buoyancy of object}{density of water}=\frac{27.55}{1.03}=26.75 L$$

1. Calculate the volume of air (gas) at the surface required to fill a lift bag so that it will have the required volume of air (gas) at the given depth.

Calculate the pressure at the given depth.

$$Pressure at given depth = \frac{Depth below sea level}{10}+1=\frac{38.0}{10}+1=4.8 ata$$

Use Boyle’s law to calculate the volume of air (gas) required at the surface (1 ata pressure).

$$P\_{1}V\_{1}=P\_{2}V\_{2}$$

$$1×V\_{1}=4.8×26.75$$

$$V\_{1}=\frac{4.8×26.75}{1}$$

$$V\_{1}=128.4 L$$

Therefore, at the surface, the volume of air that needs to be brought down is 128.4 L.