2

A lifting bag is a diving equipment which is used to lift heavy objects underwater by means of the bag's buoyancy. To retrieve a submerged cannon of mass 800 kg and density 8000 kg m^{-3} resting on the seabed back to the surface, an uninflated lifting bag of negligible mass and volume was attached to the cannon by a diver. The density of seawater is 1050 kg m^{-3}.

(a) Explain the origin of *upthrust*.

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…

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…[1]

(b) Show that upthrust acting on the cannon is 1030 N.

[1]

Air was suddenly released into the lifting bag, causing it to inflate and the cannon to be lifted off the seabed. The variation with time of the momentum of the cannon is shown in Fig. 2.1.

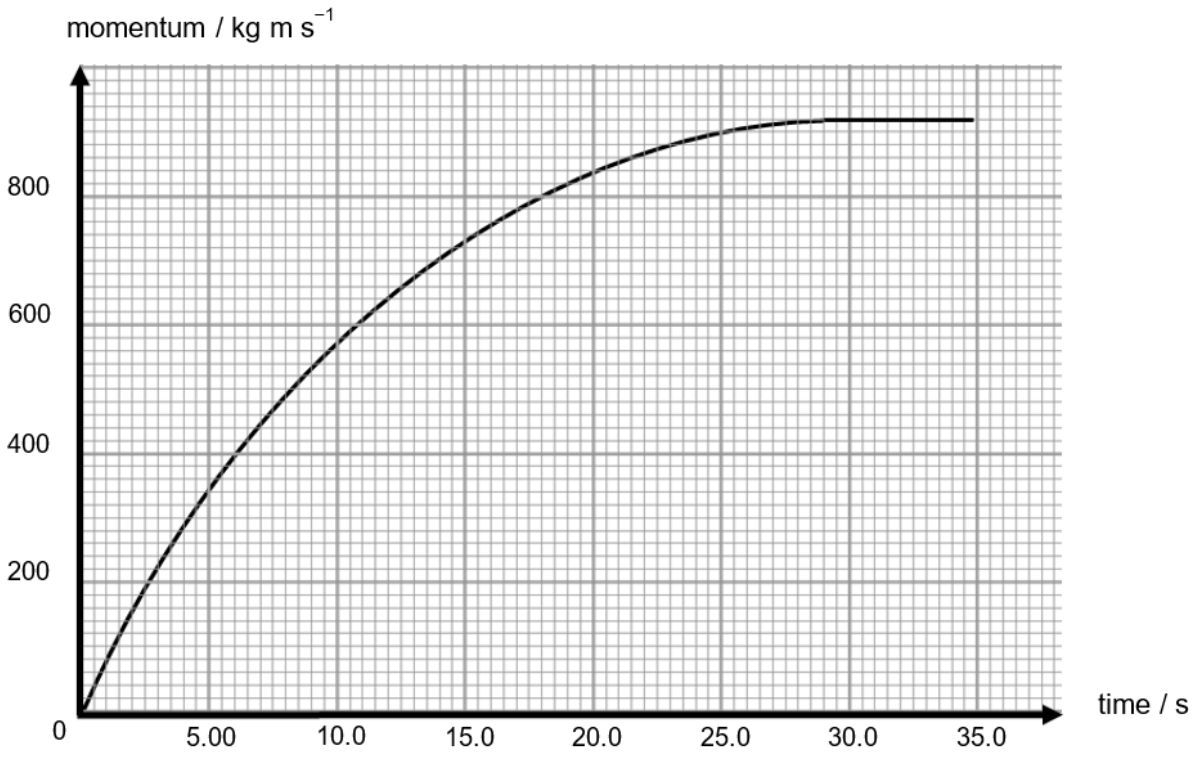

Fig. 2.1

(c) State *Newton's second law of motion.*

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… [2]

(d) Explain why the momentum of the cannon increases non-linearly as shown in Fig. 2.1.

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… [2]

(e) Using Fig. 2.1, estimate the volume of air that was released into the lifting bag.

volume of air = …… m^3 [3]

[Total: 9]