# WINCHESTER
## COLLEGE

# Election

## *2021*

## Science

# PHYSICS

THEORY SECTION

*Time allowed: 25 minutes*

**Write all your answers in the spaces on this question paper**

1    A blob of Plasticine is wrapped around a steel ball-bearing. It is found to have a mass of 54.0 g. It is placed in a measuring cylinder containing 58.0 cm³ of water. The level of the water in the cylinder increases so that it now reads 87.0 cm³.

(a)   Calculate the density of the blob.

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(b)   A piece of Plasticine is now torn off the outside of the blob and formed into a mini-blob. The mini-blob has a volume of 4.5 cm³ and has a mass of 5.5 g. Given that the ball bearing has a volume of 2.8 cm³, calculate the density of steel. Show all your working.

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(c)   The overall density of the blob is greater than that of Plasticine, because of the ball-bearing. Suggest and explain another way in which the presence of the ball-bearing might be detected without cutting into the blob.

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(d)  Suggest and carefully explain at least one way in which this demonstration could be used to illustrate properties of the Earth.

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2    The Aquatic Republic of Atlantis uses specially-trained dolphins as messengers. The dolphins swim at 15 m/s. When they reach their destination they immediately turn around and swim back to where they came from.

(a)  Dolphins from Waveton swim to Fishburg and return 2.5 hours later. Calculate the distance between Waveton and Fishburg in kilometres.

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(b)  A slow-moving container ship from Fishburg is sailing to Waveton. It is travelling at a constant speed and releases dolphins at a rate of one a minute. The dolphins arrive at Waveton with a gap of fifty seconds between them. Calculate the speed of the ship, showing all your working.

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3    A battery is connected to an electric motor, which is used to lift a load. The load is moving upward at constant speed and is attached to the motor by a piece of thin string. The current in the circuit is measured with an ammeter.

(a)  Carefully describe the energy transfers that are occurring in this system at this moment.

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(b)  Consider the tension in the string and the weight of the load. State whether they are the same size or different sizes and explain how you know this.

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(c)  The string breaks but the motor continues to turn. Explain what you would expect to happen to the current and why.

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**End of this paper**