OCR
RECOGNISING ACHIEVEMENT

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE A333/02/RB

PHYSICS A

Unit 3: Ideas in Context plus P7
(Higher Tier)

RESOURCE BOOKLET

JUNE 2009

To be opened on receipt

OCE/12777

MODIFIED LANGUAGE

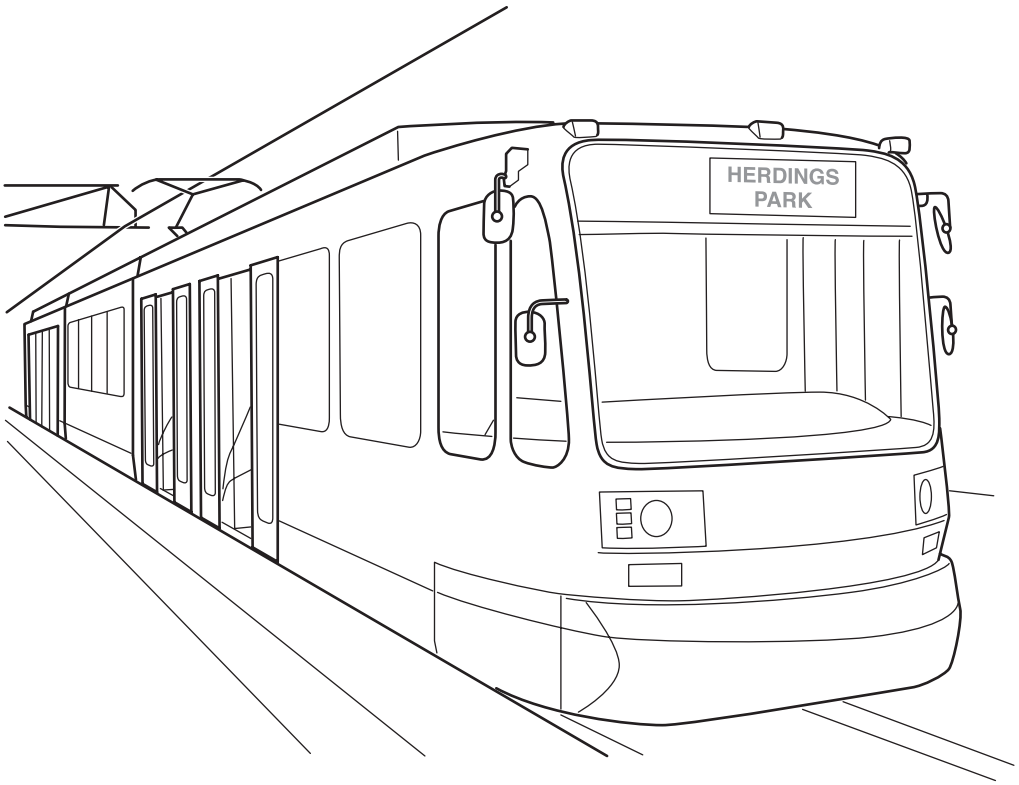
INSTRUCTIONS TO CANDIDATES

- This booklet contains the article required to answer question 1.
- Take this article away and read it through carefully.
- Spend some time looking up any technical terms or phrases you do not understand.
- For the examination on **Wednesday 10 June 2009** you will be given a fresh copy of this article, together with a question paper.
- You will **not** be able to take your original copy into the examination with you.

INFORMATION FOR CANDIDATES

- This document consists of **4** pages. Any blank pages are indicated.

Sheffield Supertram System



The supertram is 34.8 m long and 2.65 m wide. This makes it one of the largest articulated cars ever built for public transport. An empty supertram has a mass of about 50 000 kg. It can carry 88 people sitting down and an extra 162 passengers standing. The supertram has a top speed of 80 km/h. There is an enormous change in momentum when the supertram pulls away from a stop and reaches top speed.

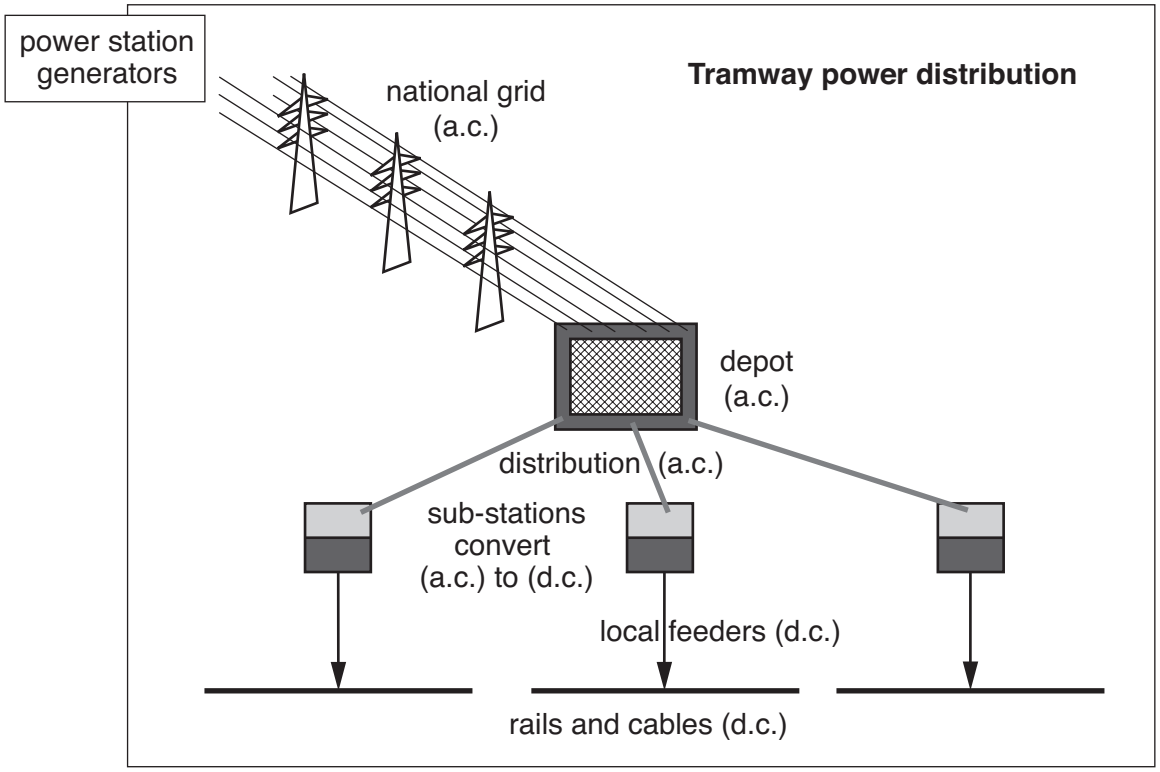
The steepest hill the supertram goes up and down has a slope of about 1 in 10. A lot of energy is needed for the tram to go up this hill in Sheffield. The gravitational potential energy of the supertram is mostly converted to kinetic energy when it is going down the hill. The kinetic energy is converted to electrical energy when the regenerative brakes are used to slow down the tram. The electrical energy can be stored in batteries or fed back into the tram circuit.

Electrical power

The tram uses electricity to work, usually from overhead cables. The electricity comes from the power supply, along the overhead cables and then flows down a pole. The pole sticks out of the top of the tram and touches the overhead cables.

The tram driver controls the flow of the electricity. He lets more electricity flow through when he wants to go faster.

The electricity flows through the motors, down to the wheels and into the rails. It flows back to the power supply along the rails. This means that if more than one supertram is on the tracks at the same time, they are in parallel in the electrical circuit.



The supertrams run on a 750 volt electrical supply. They use electricity from the national grid. This is transmitted as an alternating current (a.c.). The a.c. electricity is produced by generators in the power stations. The electricity is distributed across the tramway network as a.c. At local sub-stations near the rails it is transformed to the correct voltage for the overhead cable (750 volts) and converted to a direct current (d.c.).