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AS GCE APPLIED SCIENCE

G623/01/INSERT Cells and Molecules

PLAN FOR AN INVESTIGATION

INSERT

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INFORMATION FOR CANDIDATES

- The abstracts on pages 2 and 3 of this insert are to give you some background that you might find helpful in planning for the task that follows. Not all the information included will be directly relevant and you are expected to select the information that is relevant to the task.
- This document consists of **4** pages. Any blank pages are indicated.

‘Safe Drinking Water’

Cambodia is one of the poorest countries in Southeast Asia and has the least developed infrastructure in the region due partly to the history of genocide and conflict from the 1970s–1990s and the associated loss of investment and human capital.

Although water is abundantly available in Cambodia, the lack of infrastructure development means that the country faces serious challenges with respect to safe drinking water. Groundwater and surface water are used for drinking water. Groundwater is accessed through wells but is contaminated with arsenic in many areas. The Mekong River and the Tonle Sap Lake are the main sources of surface water, which is often stored in detention ponds. Typically, people collect the surface water themselves in buckets or other containers or have the water delivered to them by a tanker vehicle.

Owing to the emerging health problems associated with the presence of arsenic in groundwater supplies, many Cambodians in rural areas have switched from using groundwater sources that are generally low in thermotolerant coliform (TTC) bacteria, to surface water supplies that do not contain significant amounts of arsenic. However, surface water supplies are more likely to have high amounts of TTC bacteria. As a result, people who drink this water are at a higher risk of diarrhoeal diseases. Diarrhoeal diseases are the most common cause of death in children under 5 years of age. Both the number of TTC bacteria present and the turbidity of the water are indicators of water-borne faecal contamination.

The World Health Organisation states that TTC should not be detectable in any 100 cm^3 sample of water and the level of arsenic must be below 10 parts per billion in order for the sample to be considered safe to drink.

Since large scale public water treatment systems may be decades away for much of rural Cambodia, the Cambodian government and non-governmental organisations (NGOs) working in Cambodia are exploring low cost options for the treatment of drinking water. The ceramic water purifier is a viable option, as it is produced by NGOs in Cambodia using local resources.

The Ceramic Water Purifier (CWP)

Fig. 1.1 shows a typical ceramic water purifier.

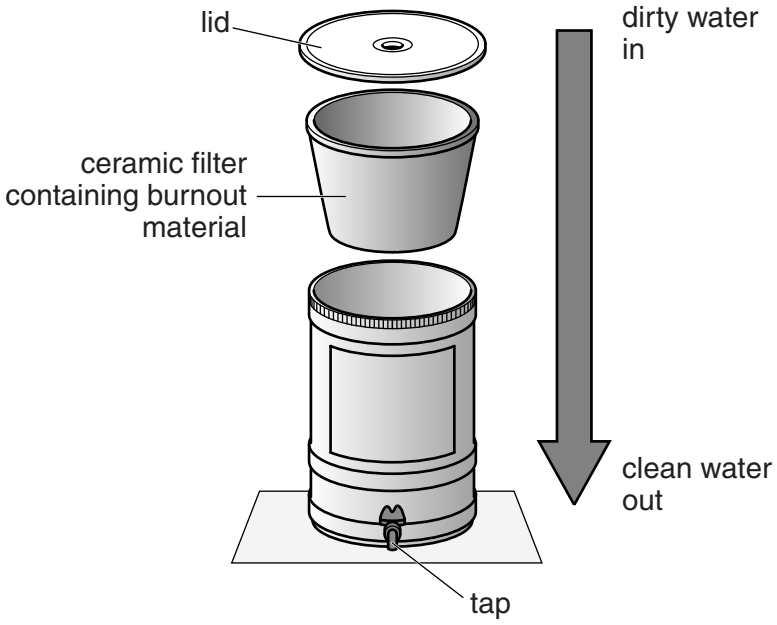

Fig. 1.1 ceramic water purifier

The ceramic water filter is made with locally available clay mixed with burnout material. The burnout material can be milled rice husks, sawdust or coffee husks, which undergo combustion to leave pore spaces when the clay is fired in a kiln. These spaces vary in size from 0.6 µm to 3.0 µm, and are dependent on the type of burnout material used. The pores increase the rate of flow of water through the CWP to make them a practical filtration material.

Clay and milled burnout material are mixed together and then an exact volume of water is added. After 10 minutes, the mixture is placed into a hydraulic press to be moulded into shape. The filters are then removed from the press and left to harden for several hours. They are then loaded onto drying racks. Drying times vary since they are dependent on weather conditions.

To ensure even and thorough heating, the filters are then put into a kiln at 100 °C for one hour to evaporate excess water. The temperature is then gradually increased to 866 °C to enable the firing process to occur over the next nine hours. The kiln is then allowed to cool slowly for 24 hours. The filters are then soaked for 3 hours and then their flow rates are measured. If they pass the flow rate test, the filters are dried and then sprayed, dipped or painted with a silver nitrate solution, which acts as a biocide, to increase the effectiveness of the purifier by reducing bacteria and algae on contact. The ceramic pot is then placed in a plastic container which allows for safe storage of clean water.

The CWP has been found to consistently improve water quality.

Fig. 1.2 The outside and inside of a ceramic water purifier