

The Design Game

Contents: Exercise in designing an energy-efficient home.

Time: 1 to 2 double periods.

Intended use: GCSE Physics and Integrated Science. Links with work on heat transfer and energy saving.

Aims

- To complement and revise prior work on heat transfer and energy conservation.
- To develop understanding of the use of insulation and passive solar heating to conserve energy.
- To develop awareness of the need to design and insulate a house carefully in order to conserve energy, and awareness of some of the factors that need to be considered.
- To develop awareness of some of the techniques used by an architect in designing a house.
- To provide an opportunity to practise design and problem-solving skills.

Requirements: Students' worksheets No. 106. Scissors and paste.

This unit is in three parts:

Part 1 Introduction

Part 2 Designing the bungalow

Part 3 Insulating the bungalow

In parts 2 and 3, it is important that students read all the points of information before marking the plan.

Teachers might like to increase the economic component of the task by imposing financial constraints – for example, by telling students they can only afford to double-glaze half their windows, or by giving them some representative costs and a fixed sum within which to work.

The final follow-up questions should be tackled if possible: it is particularly useful for students to compare their designs with one another.

Further resources

A pack of useful Design and Planning Games is available from:

Resources for Learning Development Unit

Bishop Road

Bishopston

Bristol BS7 8LS.

Acknowledgements This unit is based on a Design Task developed for the Open University T101 course. The drawings of household furniture are reproduced by permission of the Open University.

THE DESIGN GAME

Part 1 Introduction – Keeping your home warm

In a house, bungalow or flat heat escapes through the walls, roof, floor, windows and doors. By **insulating** a house and keeping the heat in for longer, we can *halve* the energy needed to heat it – and *halve* the fuel bills. Figure 1 shows how much heat escapes from different parts of a normal house.

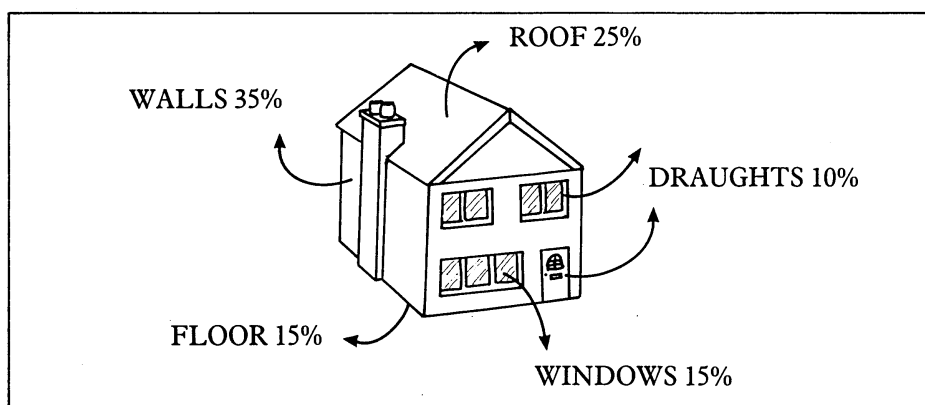


Figure 1 How a house loses heat

If we get the design of the house right, we can also use the Sun's energy to heat it.

The pictures in Figures 2 and 3 show a house in Milton Keynes, Buckinghamshire. The house is specially designed so it needs very little energy to heat. It has a lot of insulation in the loft and walls as well as double glazing. This insulation helps to keep heat in.

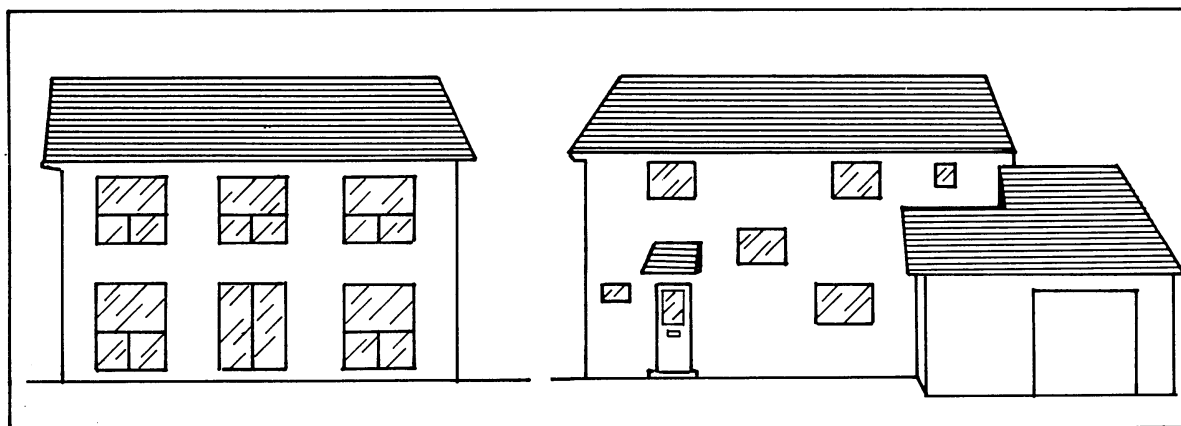


Figure 2 South facing – large windows

Figure 3 North facing – small windows

The house also uses the Sun's heat to keep it warm. The house designers have built the house facing North–South, with large windows on the South side and small windows on the North side. This is called **passive solar heating**. These houses have much smaller heating bills than normal houses.

In this unit you are going to imagine that you are an architect – a person who designs buildings. You are going to *design an energy-saving bungalow*. To do this you will need to make use of insulation and the Sun's heat as in the Milton Keynes houses. You are going to design a bungalow for a young couple who have no children.

Part 2 Designing the bungalow

- A Look at the piece of paper which is marked out in squares (page 4). Each square has a side of 2cm. This represents 1 metre in a real bungalow on this site. You will use this paper to draw a plan of the bungalow and its rooms. Read B, C, D, and E, and answer questions 1 to 6, before you draw the plan.
- B You will need to mark out the rooms on the paper. You will need:
- a bedroom
 - a living room
 - a kitchen
 - a bathroom
 - hallways (if you want them)
- C Before you start marking out the rooms there are a lot of things to think of. Answer questions 1 to 3.
- D You can use the Sun's heat to help keep the bungalow warm. Look at Figure 4, then answer questions 4 to 6.

Questions

- 1 Which rooms will the couple spend most of the time in and which least?
- 2 Which rooms should be biggest and which smallest?
- 3 Which rooms will need to be kept especially warm?

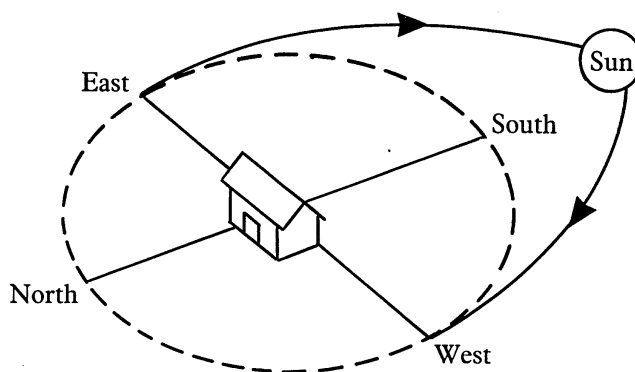


Figure 4 Movement of the Sun during the day

- E When you decide where to put the rooms you must follow building regulations. Some of these are:
- The bathroom entrance should not be next to the kitchen entrance.
 - Each room must have a window.
 - The bungalow should be easy to live in. For example, you would not want to have to go through the bedroom to get to the kitchen.
 - Do not put windows at the corner of the house or it might fall down.

To help you judge the size of rooms, look at the sheet which has drawings of household furniture on it (page 5). You can cut out the ones you want. You do not have to use them all. Move them around the site and stick them on once you have decided where they will go. Remember to leave space for the doors to open.

Remember: the larger the bungalow the more expensive it will be to heat.

Now mark in your design for the bungalow on the site in pencil:

- 1 Mark and name the rooms
- 2 Mark doors in green (including front and back door)
- 3 Mark windows in blue

Questions

- 4 Where does the Sun:
 - (a) rise
 - (b) set
 - (c) shine from for most of the day?

It is important to decide on which side of the house you put each room (North is marked on the site). If you are going to spend a lot of time in the living room you might build it facing South with large windows. This means you will get a lot of sunlight in the living room.

- 5 Which side might you put the rooms you use least?
- 6 Would you put big windows or small windows in these rooms? Why?

Part 3 Insulating the bungalow

Now you have designed your bungalow you are going to decide how best to insulate it. Insulation will help to stop heat escaping from the bungalow. Read F, G and H below.

F *Cost* It costs money to insulate a house. Double glazing and cavity wall insulation can be expensive. If you do insulate a house it will save money on fuel bills – but is it worth it? For example, suppose insulating a house costs £2000 in materials and labour and saves £200 a year on fuel bills. It will take 10 years to get your money back. This is called the **payback period**. If you are not going to stay long in a house it might not be worth insulating it completely, although an insulated house might sell for more.

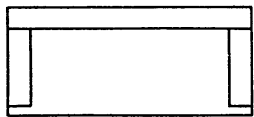
G *The loft* and outside walls are already insulated.

H *The windows* could be double glazed.

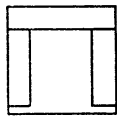
Decide which windows you will double glaze and mark them with crosses. (A double glazed window will now be blue with crosses.)

Final questions

- 7 *Are there any other ways you could insulate your bungalow? If so how? Mark in any other ways on your site plan.*
- 8 *Why have you designed your bungalow as you have? How does it compare with those of other members of the class?*
- 9 *Could your design be improved in any way? If so how?*



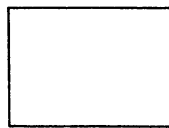
3-seater settee



armchair



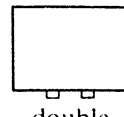
easy chair



play-pen



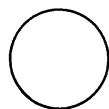
single wardrobe



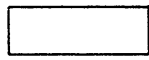
double wardrobe



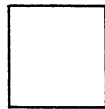
coffee table



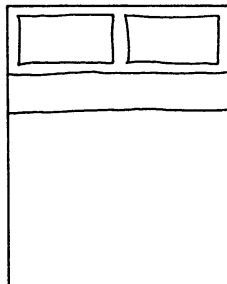
coffee table



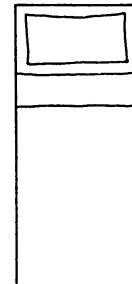
bookcase



card table



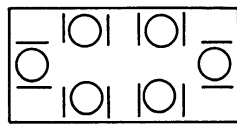
double bed



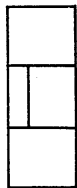
single bed



cot



dining table for 6



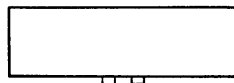
radiogram



TV



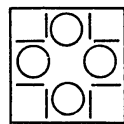
carry cot



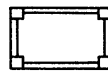
sideboard



dining chair



dining table for 4



trolley



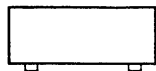
stool



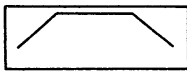
high chair



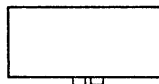
small chest of drawers



large chest of drawers



dressing table



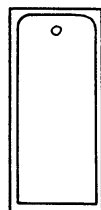
large double wardrobe



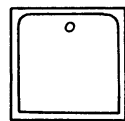
bedside table



automatic washing machine



bath



shower



wash basin



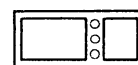
WC



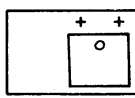
bidet



single-tub washing machine



twin-tub washing machine



sink and single drainer



cupboard base unit



cooker



refrigerator



tumble drier



spin drier



ironing board