A Guide to Diagrams, Plans and Models

Teaching Approach

This series deals with assembly diagrams, floor, elevation and design plans and models. This is a highly practical unit of work, and it is essential that learners produce their own 2-D and 3-D plans and models.

Reading and using assembly diagrams involves interpreting symbols and instructions given in both diagrammatic and verbal form. Learners need to relate the information in the assembly instructions to the real objects. This is a skill that requires plenty of practice, so give learners opportunities to work with toys such as Lego or hobby kits for building models and the written instructions for building particular models that are supplied with them. It will be very frustrating for learners if they are given only one complex project to complete, as they need to develop the skills set before working on more demanding assembly diagrams. Asking learners to write a set of instructions for a given set of assembly diagrams is a good way to give them practice in interpreting diagrams.

Learners worked with floor and layout plans in Grade 10. In Grade 11, they are introduced to elevations, which are 2-D representations of objects in the same way that floor plans are. They should still work with simple buildings in Grade 11, such as single-room huts and simple RDP houses. Learners need to make a connection between what they can see on floor plans to the elevation views, using the compass directions: North Elevation, South Elevation, East Elevation and West Elevation.

The elevation views show a building from the side, front and back views, and they are drawn to an accurate scale. Work with scale is now extended to calculating an appropriate scale for drawing plans and building models.

Learners should use floor and elevation plans to analyse the layout of structures, interpret the symbols used and to do calculations involving the quantities of materials needed for building, as link to the Measurement topic. Examples of these kinds of calculations are given in the task questions.

The focus in Grade 11 is to use models to investigate packing arrangements. Again, this section of work links to the Measurement topic, as learners do perimeter, area and volume calculations to decide on the most cost-effective packaging arrangements. It is vital that learners should do this practically, as making useful packaging involves considerations other than measurement and calculation. For example, the packaging for an object should not be exactly the same size of an object – there has to be enough space to put the object in to the packaging. This section of work can be extended to designing protective packaging and promotional packaging.

These videos can be watched in any order, with the task video to follow at the end of the section.

Video Summaries

Some videos have a 'PAUSE' moment, at which point the teacher or learner can choose to pause the video and try to answer the question posed or calculate the answer to the problem under discussion. Once the video starts again, the answer to the question or the right answer to the calculation is given.

Mindset suggests a number of ways to use the video lessons. These include:

- Watch or show a lesson as an introduction to a lesson
- Watch of show a lesson after a lesson, as a summary or as a way of adding in some interesting real-life applications or practical aspects
- Design a worksheet or set of questions about one video lesson. Then ask learners to watch a video related to the lesson and to complete the worksheet or questions, either in groups or individually
- Worksheets and questions based on video lessons can be used as short assessments or exercises
- Ask learners to watch a particular video lesson for homework (in the school library or on the website, depending on how the material is available) as preparation for the next days lesson; if desired, learners can be given specific questions to answer in preparation for the next day's lesson

1. **Assembly Diagrams and Instructions**

   The video lesson gives learners a general approach to following assembly diagrams and instructions systematically.

2. **Working with Plans and Elevations**

   This lesson introduces elevations as another 2-D scale representation of a building and shows the information and detail that can be seen on these views.

3. **Investigating Packaging Arrangements**

   We investigate ways in which manufacturers could package tennis balls in either a rectangular prism or a cylindrical container. We do calculations to see which would use the least material.

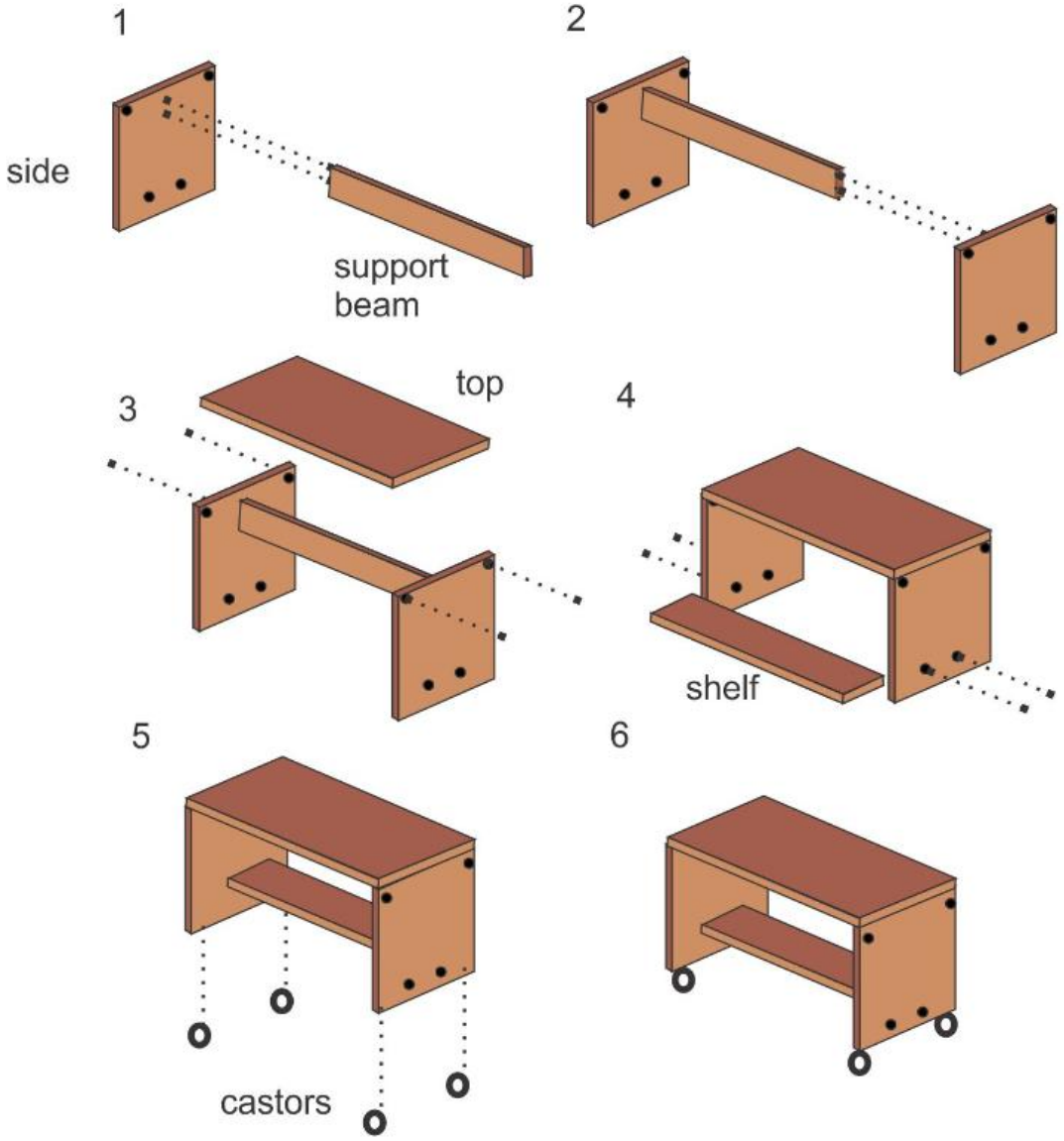
Resource Material

1. Using Assembly Diagrams	http://letsbuilditagain.com/lego-instructions.php	A list of thousands of complete step-by-step printable LEGO® instructions in order by set number. This is very useful for giving learners practice in working with instructions written in words and diagrams.
	http://www.ikea.com/ms/en_US/customer_service/assembly_instructions.html	A collection of downloadable assembly instructions PDFs for flat packed furniture.
	http://www.youtube.com/watch?v=p2LuJq9gd70&list=PL15A515A86B812861	A simple video on wiring a South African plug correctly.
2. Working with Plans and Elevations	http://www.bbc.co.uk/schools/gcsebitesize/maths/geometry/3dshapesrev2.shtml	A simple explanation and activity on different views of 3-D objects. This gives practice in viewing and drawing 3-D objects from different positions and in visualizing the 2-D plan for a particular view.
	http://www.sitesunion.com/rdp.html	This page gives examples of different Reconstruction and Development Programme (RDP) house designs.
	Part 1: http://www.youtube.com/watch?v=8H30lP2M2e8 Part 2: http://www.youtube.com/watch?v=nbfi_1_3MI8 Part 3: http://www.youtube.com/watch?v=-t4DPRJ8S0A Part 4: http://www.youtube.com/watch?v=IKkKB00HI48	This series of four video clips shows how to make an architectural model of a house from foam board, using the original floor plan of a house as the base. Learners need to do practical work for themselves, of a much simpler room or house, to an appropriate scale.
	http://www.ehow.com/how_5102046_build-scale-model-building.html#page=0	A website giving some simple steps for building a model from elevation plans.
3. Investigating Packaging Arrangements	https://mathsurgery.wikispaces.com/plans+and+elevations	This page includes an activity that merges skills in reading plans to investigating packaging.
	http://www.mr-d-n-t.co.uk/nets.htm	This website has nets for some different packaging containers.

Task

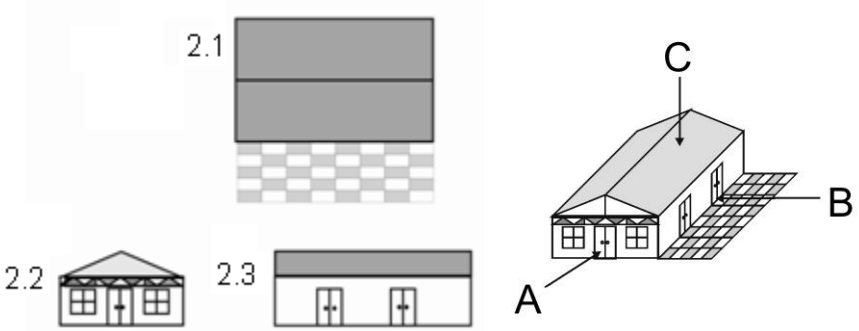
Question 1

Write instructions to accompany this assembly diagram for a TV stand:



Question 2

Match the letters of these elevations to the views of the building.



Question 3

A rectangular box used to package a statue measures 85 cm × 22 cm × 60 cm. Calculate the volume of protective packaging material needed inside the box if the volume of the statue is 108 821 cm^3.

Question 4

A set of 24 cylindrical candles are packaged in a rectangular box measuring 38,4 cm × 12,8cm × 23 cm.

4.1 Calculate the volume of the box.

4.2 Calculate the volume of 24 candles if the diameter of 1 candle is 6,4 cm and the height is 11,5 cm.

4.3 Calculate the amount of empty space.

Question 5

Two hundred tubes must be packed so that there are 20 in a box. Each tube has the dimensions length 15 cm, diameter 3 cm. The packaging box must be rectangular.

(Remember that 10 000 cm^2 = 1 m^2.)

5.1 If the tubes are packed in five layers of four tubes in each, what would the length, width and height of each box be? Remember to add 0,25cm to each dimension of the box, so that the tubes will fit into it.

5.2 How much cardboard would be needed to construct the box?

5.3 If the tubes were packaged in two layers of ten tubes, what would the length, width and height of the box be?

5.4 How much cardboard would be needed for the box?

5.5 The cardboard costs R6,95 per m^2. What would the cardboard for the cheaper box cost?

Task Answers

Question 1

Step 1: Connect the support beam to one of the sides using screws supplied.
Step 2: Connect the other side to the support beam.
Step 3: Connect the top of the cabinet and secure the screws on all four sides.
Step 4: Insert the shelf and secure it with screws.
Step 5: Insert the castors by clicking them into the spaces at the bottom of the cabinet sides.
Step 6: Assembly is complete.

Question 2

2.1 C
2.2 A
2.3 B

Question 3

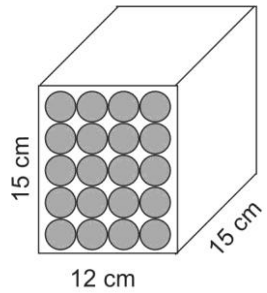
Capacity of box = 85 cm × 22 cm × 60 cm = 112 200 cm^3
112 200 cm^3 – 108 821 cm^3 = 3 379 cm^3

Question 4

A set of 24 cylindrical candles are packaged in a rectangular box measuring
38,4 cm × 12,8 cm × 23 cm.
4.1 Volume =38,4 cm × 12,8 cm × 23 cm= 11 304,96 cm^3
4.2 Volume of a cylinder = area of circular base × height
$= \pi r^2 \times 11{,}5$ cm
$= \pi(3{,}2)^2 \times 11{,}5$
$= (3{,}142)(3{,}2)^2 \times 11.5$
= 370 cm^3
370 × 24 = 8880 cm^3
4.3 Space for filler material = 11 304,96 – 8 880 cm^3 = 2 424,96 cm^3.

Question 5

5.1 Length: 15 cm, width: 12 cm, height 15 cm
Add 0,25 cm to each dimension for packing:
. 15,25 × 12,25 × 15,25 cm

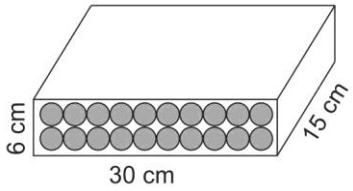


5.2 Total surface area of cardboard = 4(12,25 × 15,25)+ 2(15,25 × 15,25)
= 1 128,85 cm^2

5.3 Length: 15 cm, width: 30 cm, height 6 cm

Add 0,25 cm to each dimension for movement/packaging:

Length: 15,25 cm, width: 30,25 cm, height 6,25 cm



5.4 Total surface area

$= 2(6{,}25 \times 30{,}25) + 2(6{,}25 \times 15{,}25) + 2(15{,}25 \times 30{,}25)$

$= 1\ 494{,}50\ cm^2$

5.5 The first arrangement used less cardboard.

Convert 1 128,85 cm^2 to square metres:

There are 10 000 cm^2 in a square metre, so divide 1 128,85 by 10 000 = 0,113 m^2

Cost: = 0,113 m^2 × R6,95 per m^2 = R0,79.

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