Western Cape Government
Education

basic education
Department:
Education
REPUBLIC OF SOUTH AFRICA

2015
Senior Phase Grade 8 & 9

Technology Training and Facilitation Manual

Teachers and HoDs / Subject Heads

Participant's Manual

Dear Teacher

Welcome.

In the light of concerns on learner performance and limited teacher capacity, a plan has been initiated by the national Department of Basic Education to strengthen teacher capacity and curriculum management by Heads of Departments or Subject Heads.

During the two and a half days you will spend time developing your subject content knowledge; focusing on graphic communication skills and pedagogy to teach the content areas namely; structures and systems and control: mechanical and electrical.

The teaching of graphic communication skills across the phase and across the terms per grade has been a challenge for many teachers who do not have a formal qualification to teach Technology. This training will improve your knowledge and skills so that you can teach with confidence.

This manual is compiled by the Directorate: Curriculum GET of the Western Cape Education Department. The content of this training manual is based on the training material developed by the national Department of Basic Education.

TEACHING SENIOR PHASE TECHNOLOGY

"TEACH BETTER, LEARN BETTER"

Teaching Strategies in Technology

	THE FOLLOWING RESOURCES WILL BE USED DURING THE TRAINING:
1.	National Curriculum Statement: Curriculum and Assessment Policy Statement: Technology Senior Phase Grade 7-9.
2.	Text books as used by the teacher for Grade 8 and 9
3.	DBE Sasol Inzalo workbooks (Electronic copy) for Grade 8 and 9
4.	Teacher resource KIT for Systems and Control: Electrical (Grade 8) and Electronics (Grade 9)
5.	Pen, pencil, ruler, eraser, scissors, glue stick, plastic drinking straws, pins, used A4 paper, corrugated card, newsprint, koki pens

PROGRAMME

Day 1

Welcome and Introduction		30 min
Module 1: Graphic Communication Skills		
Activity 1	Graphic Communication - Types of Lines	20 min
Activity 2	Graphic Communication - Scale up or Down	30 min
Activity 3	Graphic Communication - Orthographic Projection	40 min
TEA BREAK		**10:30 – 11:00**
Module 2: Structures		
Activity 4	Plan a lesson on Structures	60 min
Activity 5	Build a simple Model	60 min
LUNCH BREAK		**13:00 – 14:00**
Module 3: Systems and Control: Mechanical		
Activity 6	Gear Ratios	30 min
Activity 7	Plan a lesson on Mechanical Advantage	90 min

Day 2

Module 4: Graphic Communication Skills		
Activity 8	Graphic Communication: Oblique	120 min
Activity 9	Graphic Communication: Isometric	
Activity 10	Graphic Communication: 1 Point Perspective	
TEA BREAK		**10:30 – 11:00**
Activity 11	Graphic Communication: 2 Point Perspective	120 Min
Activity 12	Graphic Communication: Crating	
LUNCH BREAK		**13:00 – 14:00**
Module 5: Systems and Control: Electrical / Electronic		
Activity 13	Teaching Electric/ Electronic Circuits	120 min

Day 3

Module 6: Managing Technology		
Activity 14	Managing the Mini-PAT	60 min
Activity 15	Roles and Responsibilities of an HOD.	60 min
Tea Break		**10:30 – 11:00**
Activity 16	Monitoring Teaching, Learning and Assessment	120 min
Close / Lunch		**13:00**

Broad Outcomes of the training

By the end of this training you will be able to:

- Demonstrate the following basic graphic communication skills using suitable line types;
    - Orthographic projection
    - Oblique projection
    - Isometric projection
    - 1 Point Perspective projection
    - 2 Point Perspective projection
- Develop strategies to teach basic graphic communication skills
- Develop a lesson plan to teach structures
- Demonstrate making skills by building a simple model in groups
- Develop a lesson plan to teach mechanical advantage
- Develop a teaching strategy to teach electrical / electronic concepts
- Manage the teaching process of the Mini PAT
- Identify the roles and responsibilities of the HOD / Subject Head
- Monitor teaching, learning and assessment using suitable instruments

Setting The Scene

Welcome

ACTIVITY A -Teaching Strategies

OUTCOMES

At the end of this activity participants must be able to discuss teaching strategies to enhance teaching.

METHOD In pairs

INSTRUCTIONS

- Read the paragraph below and reflect on your present teaching strategy.

Technology is referred to as a practical subject. The weighting of the formal assessment tasks supports this, as 70% of the learner's mark is based on their practical work done per term and only 30% of the learners' mark is allocated for theory. Yet many teachers teach technology as a theoretical subject. Learners are not given the opportunity to develop the important design process skills of investigate, design, make, evaluate and communicate. This is evident in the work presented during the annual moderation process across all districts. Learner workbooks, if used, mainly reflect knowledge based learning. How do we change this practice?

Change can start with the teacher. Planning for a technology lesson needs careful consideration to initiate discussions with learners and the development of skills set within real life contexts. Textbooks or workbooks may provide suitable context for discussion but it will remain the teacher's challenge to bring it alive within a classroom context.

- In pairs discuss how you can approach your Technology lesson to keep it alive in the classroom when:
    i. Testing learners' prior knowledge

ii. Introducing learners to a new concept.

-

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator** (Refer to Note 1 and 2)

Note 1.
Using the Grade 7-9 Sasol Inzalo workbooks
Learner Workbooks and Teacher Guides

The Gr 7-9 workbooks were designed to be printed resources for learners to write and draw in. Each grade has its own learner book and a separate teacher guide. The workbooks following the sequence and pace of the technology curriculum as set out in the CAPS document.

Structure of the learner workbook and teacher guide

Book A deals with terms 1 and 2:
Book B deals with terms 3 and 4:

These books are an amalgamation between a workbook and textbook. They have spaces for learners to write and draw whilst completing their tasks. Learners may write in these books, take notes, and make them their own. The use of an additional notebook for writing, recording designs, doing rough drawings, etc. is also required.

Planning lessons around the workbook content

The workbooks are a tool for teachers to use in the classroom and to assist with their teaching. Teachers will still need to plan lessons using the CAPS as a benchmark to decide which activities to do as there are sometimes more activities provided than what is possible within the time allocation. This is the same when using a textbook

The Teacher's Guide

Each workbook is accompanied by a Teacher's Guide. The Teacher's Guide is structured to provide the content of the learners' book, but with all the model solutions written in. Additionally, there are teachers' notes embedded within the content.

Note 2:

INTRODUCING THE 5E's
HOW TO USE THE 5ES APPROACH TO TEACH TECHNOLOGY

The 5 E's is an instructional model based on the constructivist approach to learning, which says that learners build or construct new ideas on top of their old ideas.
Each of the 5 E's describes a phase of learning, and each phase begins with the letter "E": **Engage, Explore, Explain, Elaborate, and Evaluate**. The 5 E's allows learners and teachers to experience common activities, to use and build on prior knowledge and experience, to construct meaning, and to assess their understanding of a concept

The constructivist teacher sets up problems and monitors learners' exploration, guides learners' inquiry, and promotes new patterns of thinking. Working mostly with raw data, primary sources, and interactive material, constructivist teaching asks learners to work with their own data and learn to direct their own explorations. Ultimately, learners begin to think of learning as accumulated, evolving knowledge.

The five stages of a learning cycle using the five E's are described below:

Engage

The first stage of learning is engagement. The 'engage' activity should make connections between past and present learning experiences. This can be done by engaging learners using questions or a task related to the new concept to be learned. The activities should provide an opportunity for learners to talk about their prior experiences with the concept.

Questions for Consideration

- What do learners already know about the concept?
- What do they want to know?
- What will they explore?

Explore

During the second stage the teacher should provide a common activity, task or series of activities in which learners engage. Part of the exploration phase could be for learners to predict what they think would happen during an activity. The activities should provide learners the opportunity to collect and organise data that will allow them to generate explanations for the phenomenon under investigation.

Questions for Consideration

- What is the precise concept that learners will explore?
- What activities must the learners do to become familiar with the concept?
- What kinds of observations and records should the learners keep?
- What kinds of instructions will the learners need? How can you give the instructions without telling the concept?

Explain

During the third stage, the teacher should lead a discussion around the learners' data. The teacher introduces vocabulary, ideas, concepts, etc. as necessary. The teachers and learners may construct an explanation for the phenomenon under investigation.

Questions for Consideration

- What kinds of information or findings should the learners talk about?
- How can you help learners summarize their findings?
- How can you guide the learners and refrain from telling them what they should have found, even if their understanding is incomplete?
- What concept “labels” should the learners discover?
- Why is the concept important?

Elaborate

During the fourth stage, the teacher should provide opportunities for learners to extend and elaborate upon their understanding by providing new and/or related experiences for them to apply what they have learned.

Questions for Consideration

- How can you connect with learners' prior experiences?
- How does the concept relate to the science program goals?
- What questions can be used to encourage discovery of the concept's importance?
- What new experiences will help to apply or expand the concept?
- What is the next concept related to the learners present one?

Evaluate

During the fifth and final stage, the teacher should assess and evaluate the learners' understanding of the concept/ phenomenon through any appropriate manner.

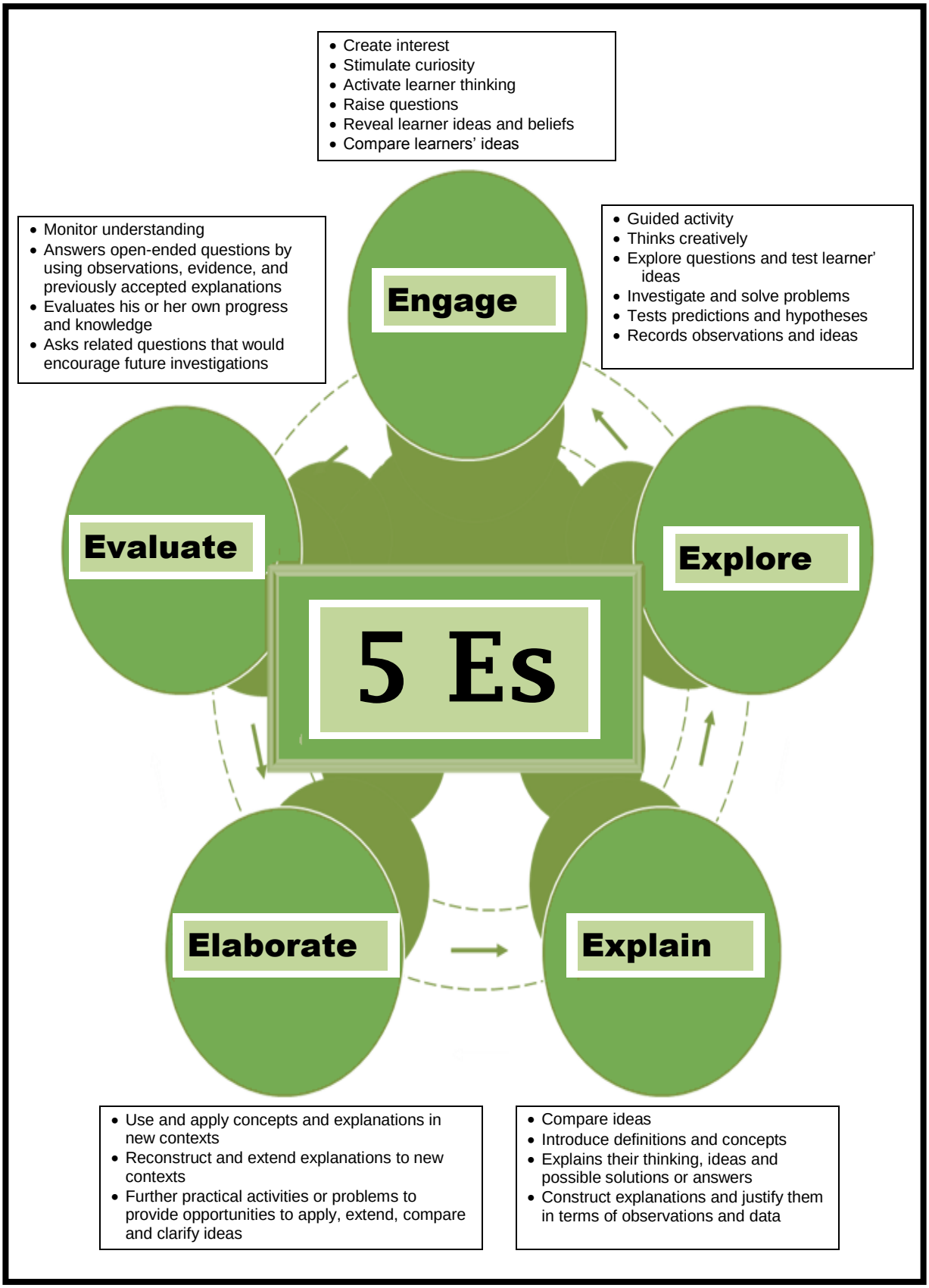
Questions for Consideration

- What are the appropriate learning outcomes you should expect?
- What types of hands-on evaluation techniques can the learners do to demonstrate the basic process skills?
- What techniques are appropriate for learners to demonstrate the skills?
- How can pictures help to show how well they can think through problems?
- What types of questions will help to reflect on what they have discovered?

DEVELOPING LANGUAGE SKILLS: READING AND WRITING

- Strengthen learners’ language ability while teaching Technology,
- Incorporate ‘Balanced Language Approach” as a strategy to enhance languages, (Reading and viewing; communicating / discussing, listening and writing, speaking)
- Strengthen technology language using word walls

Summary of the 5 E's



Baseline Assessment

ACTIVITY B Make a Gift Box

OUTCOME

At the end of this activity participants must be able to demonstrate their making skills to make a gift box that will be used as a teaching aid during this workshop.

METHOD Individually

INSTRUCTIONS

You will need the following: a scissors, ruler, pen or pencil, glue and Annexure 16 on the inside of the back cover of this document.

- Cut out the 2-dimensional development of the packaging for a gift box given as annexure 16 (inside of the back cover).
- Score along all folded lines. (These are indicated on the drawing as a broken line, but will be indicated as a feint construction line in a formal drawing.)
- Fold into a 3-dimensional object and glue tabs.

(The gift box will be used as a teaching aid when developing your graphic communication skills.)

- Write down the meaning of the following words:

i. 2-Dimensional (2-D):

ii. 3- Dimensional (3-D):

iii. Template:

iv. Development:

v. Scoring:

vi. Net:

- In groups discuss how you can address language across the curriculum in a Technology lesson.
- In pairs discuss the features of the making process that can be used for assessing the **MAKE** component of the Mini-PAT and explain the task of the teacher during this process.

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

MODULE 1

Graphic Communication Skills

ACTIVITY1 Types of lines

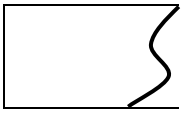
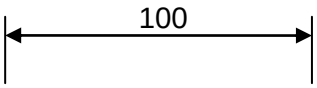
OUTCOME
At the end of this activity participants must be able to name, identify and describe different types of lines used when drawing.

METHOD Individually

INSTRUCTIONS

- Study the table below
- Use a sharp pencil and make a copy of each line type in the space allowed below each given illustration. Focus on the quality of your line.

Line type	Line illustrated	Description and used for
Construction line	———————	Lines are feint lines that are used when planning out the drawing.
Visible line (Outlines)	———————	Lines are heavier than the construction lines. They are the lines that are used to show visible edges.
Hidden line	- - - - - - - - - - - - - - -	Lines are short dashes of equal length and spacing. The lines are used to show something that is hidden for example like a hole or an edge- shows hidden detail.

Wavy line		Lines are heavier and used to indicate where sections of an object have been removed to make it fit on a page.
Dimension line		Lines show the measurement between two points. And are drawn finely. **Units are always in millimetres** (mm) so the unit is not normally indicated on the drawing.
Centre line / Chain line		Consists of a long line and a dash repeated; used to show the centre lines of a symmetrical object.

- Identify and label the different type of lines used in the drawing labeled as **Illustration 1** below

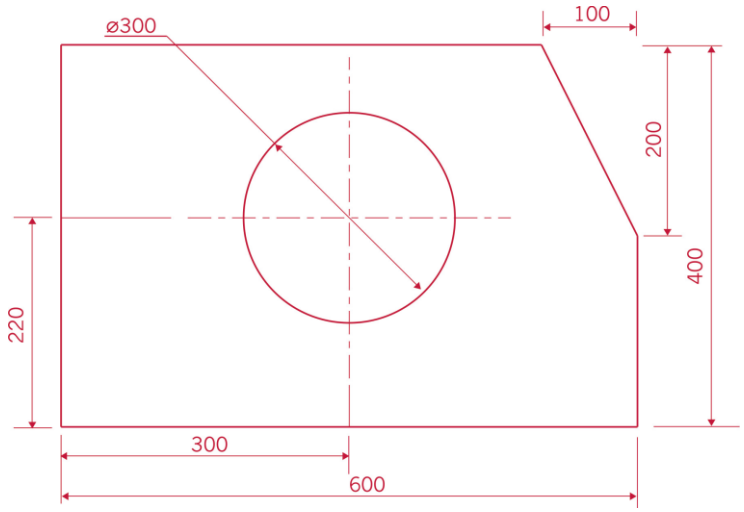


Illustration 1: Dimensions can be horizontal, vertical, aligned or rotated.

Dimensioning is the process of adding measurement annotation to a drawing.

- Study illustration 2 and then copy the dimension lines to illustration 3.

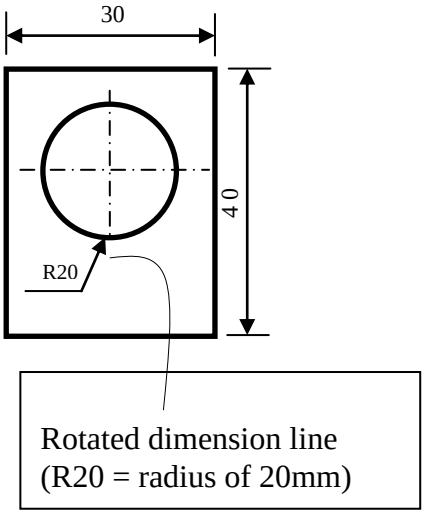


Illustration 2

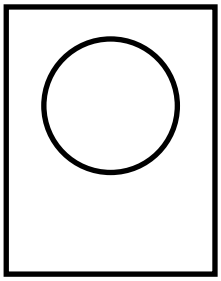


Illustration 3

- List the challenges when teaching learners how to use the line types and dimension lines and suggest strategies to overcome them.

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

Graphic Communication Skills

ACTIVITY 2 Scale Up or Down

OUTCOME

At the end of this activity participants must be able to read, calculate and interpret scale correctly.

METHOD In pairs and Individually

INSTRUCTIONS

2.1 Calculating scale

- Read the information below and study the examples provided.

You need to scale objects and products as in many cases they are far too big (or too small) to be able to draw their actual size on paper. It is important to remember that if you are scaling down or up then all the measurements must be altered by the same factor. A ratio is used in scale drawings of maps and buildings. The scale of a drawing = **Drawing length : Actual length**

Ratios can be converted into fractions, as used in mathematics.

For example if your drawing is to be a tenth of what it actually is then you need to divide the **actual** dimensions by ten to get your **drawing** dimensions.

I.e. Ratio is 10:100 (all units in millimetres)

i. $\frac{\text{Drawing}}{\text{Actual}} = \frac{10}{100} = \frac{1}{10}$ answer 1:10 (scaling down)

If your drawing must be 10x bigger: then the ratio of 100:10 (all units in millimetres)

ii. $\frac{\text{Drawing}}{\text{Actual}} = \frac{100}{10} = \frac{10}{1}$ answer 10:1 (scaling up)

Note: You will always indicate the actual dimension (true length) on the scaled drawing.

- In pairs calculate the scale to the ratios and indicate if you are scaling up or down.

1. 100 : 25

---

2. 20 : 60

---

3. 100 : 20

---

4. 50 : 100

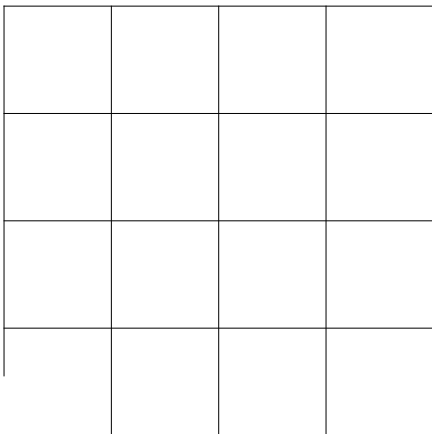
NOTE:
A scale table is constructed by listing all the dimensions to be shown; their drawing sizes and then their actual sizes.

- Complete the scale table below for a scale of 1 : 10.

Dimension	Drawing size	Actual size
Overall length	100	
Inner length		750
Overall height	60	
Inner height		230
Breadth		550
Diameter of circle	5	

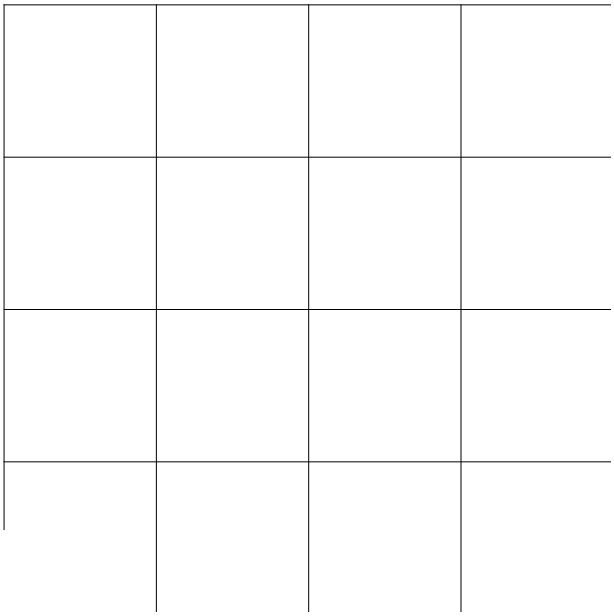
2.2 Using grid lines to interpret scale

- Use the grid lines to help you sketch the mobile phone illustrated below.



- Complete the scale for the drawing done above: _____ : _____

- Use the grid lines to help you scale up the mobile phone illustrated below.



Complete the scale for the drawing done above _____ : ____

2.3 Develop a teaching plan

- In pairs discuss strategies to teach scale to a Grade 8 and or 9 Class.
    - Use the headings below to guide your discussion and lesson plan.
    - Present your lesson plan on a sheet of newsprint to the group.

Instructional model used to teach new concepts

		What can you use?	What will you do to?
1	ENGAGE	Capture learners' attention Get attention by engaging them on an activity / demonstration Ask a question Pose a problem	Develop shared norms Determine readiness for learning Establish learning goals
2	EXPLORE	Resolve problem Use their experience Teacher provides background, information, materials Observe and listen	Prompt inquiry Structure inquiry
3	EXPLAIN	Teacher directs learners to first two steps and asks for explanations Teacher puts the explanations into subject terminology and procedures	Present new content Develop language and literacy Strengthen connections
4	ELABORATE	Teacher challenges with a new example or situation Encourages interaction with new sources Expand, enrich, extend concepts	Facilitate substantive conversation Cultivate higher order thinking Monitor progress
5	EVALUATE	Include formative assessment Summative assessment at the end of a concept Learners receive feedback Teachers report on outcomes	Assess performance against standards Facilitate student self-assessment

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

Graphic Communication Skills

ACTIVITY 3 Orthographic Projection

OUTCOME
At the end of this activity participants must be able to explain and apply orthographic conventions.

METHOD In pairs and Individually

INSTRUCTIONS
3.1 Assessing for prior Knowledge
- Read through the fact sheets numbered 1 and 2 and discuss any concepts not understood with a partner.

Fact Sheet 1.

Orthographic drawings can also be known as working drawings or production drawings. They are also referred to as a **2-Dimensional drawing**.

WHAT IS PROJECTION IN A DRAWING?
Any object may be viewed in many different views. When drawing an object on paper we use points, lines or planes (surfaces) to show a view. To draw different views we use a line to project points across from its present position to draw a new view.

WHAT ARE ORTHOGRAPHIC DRAWINGS?
Orthographic drawings is a way of drawing a three dimensional object as two dimensional views. They are accurate drawings which are followed exactly when making a final design. They contain specific information that is needed to produce a final design. Details need to include dimensions, materials and construction instructions.

ORTHOGRAPHIC DRAWINGS IN EVERYDAY LIFE
Orthographic drawings can be found in any type of manufacturing industry, including architects, builders and other individual crafts people.

WHY DO WE NEED ORTHOGRAPHIC DRAWINGS?
Without orthographic drawings we would be unable to make and construct things to what has been planned.

WHAT EQUIPMENT DO I NEED?
For now you will need a sharp pencil, a ruler, set squares and perhaps a compass.

DIFFERENT TYPES OF ORTHOGRAPHIC DRAWINGS

There are two different types of orthographic drawings. The first is called first angle projection which is used in the United Kingdom and the second is called third angle projection, which is used in the United States of America. We will work in **First Angle** orthographic projection.

DIFFERENT VIEWS

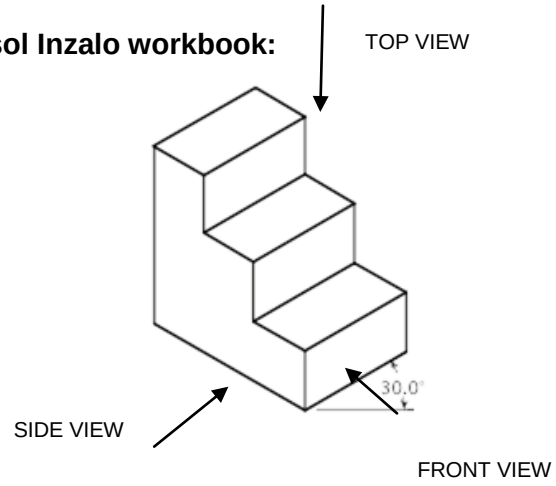
When you draw an object or a product you can draw it in up to four different views: Front View, Side View**/s** and Plan / Top View.

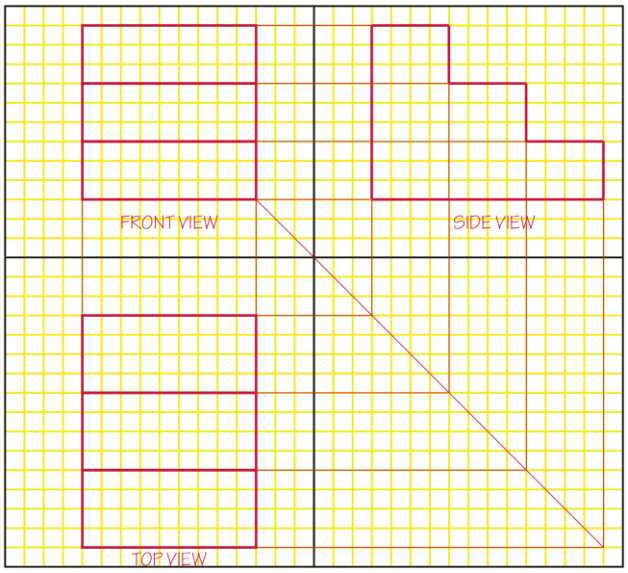
Fact Sheet 2.

POSITIONING OF VIEWS

Now that you know of the three different views that an object is drawn in, it is important that you now learn how to position these.

Grade 9 Example in DBE Sasol Inzalo workbook:





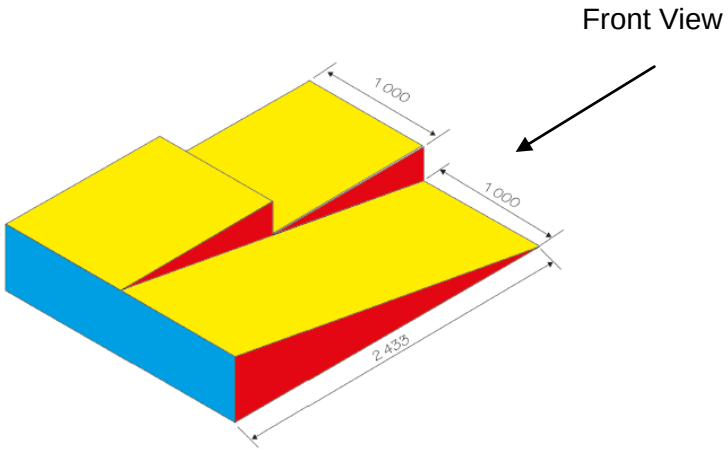
Note:

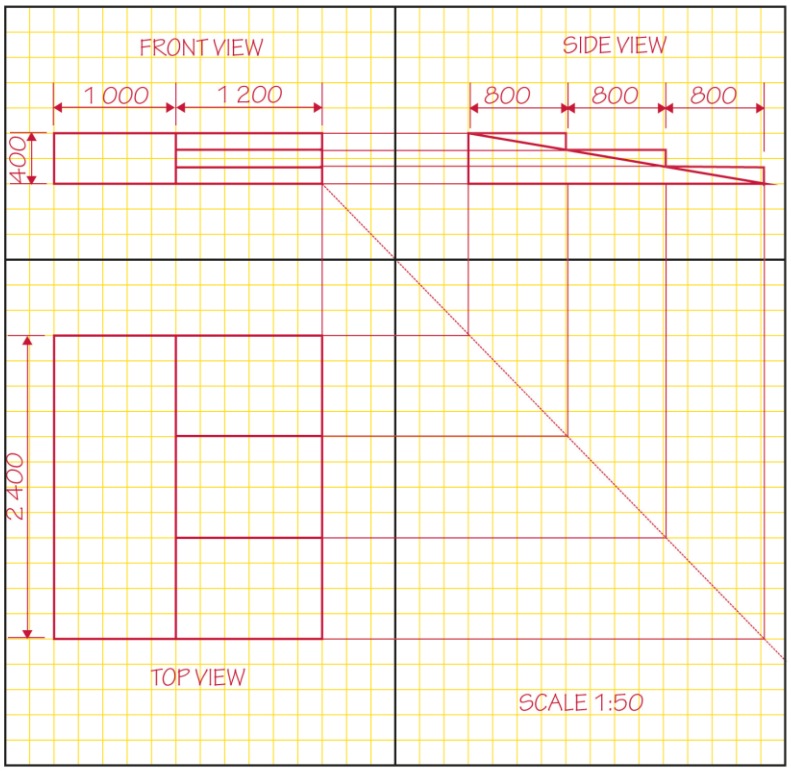
- Always select the view with the most visible detail as your front view.
- When drawing, always draw the side view with the most visible detail.
- It is never a good idea to write the labels inside of the drawing. See the Grade 9 drawing on the next page, as a better example.

- In pairs refer to the CAPS policy document and determine the minimum level of application that a grade 7 learner must have when entering Grade 8.

- Study the 3- dimensional drawing of a structure with a ramp and a set of steps and compare the drawing with the Orthographic View of a “similar” design.

Grade 9 Example In the DBE Sasol Inzalo workbook.





- In pairs find and list the mistakes in the Orthographic Drawing given for the three dimensional drawing above. Use the table below for your answers.

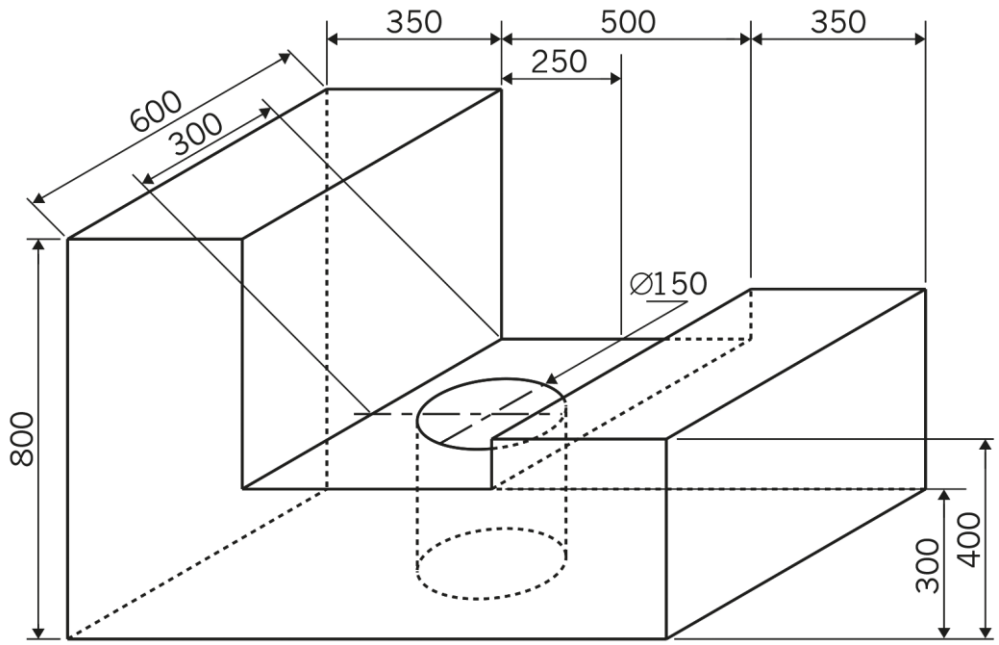
1.
2.
3.
4.

3.2 Test your understanding of Orthographic Projection

- Individually draw the shape given below in orthographic projection.
  Use the grid paper provided on the next page.

Instructions:

1. Draw the object in orthographic projection to a suitable scale.
2. Determine the correct orientation of the answer sheet for your drawing.
3. Plan the layout of the drawing so that it fits neatly in the middle of the page: Front, Side and Top View.
4. Include all visible, hidden and any four dimension lines.
5. Label all views; include a title and your name on the drawing sheet.



- Use the assessment instrument below and assess a peers drawing.

Description	Marks allocated	Learner marks
Line work (consistency and corners)	**6**	
Neatness of the drawing (presentation)	**3**	
Lettering (in CAPITAL letters)	**3**	
Correctness (interpretation)	**2**	
Layout (use of space on the page/planning)	**2**	
Scale (writing and proportionality of the drawing)	**1**	
Projection Lines (consistency and sufficiency)	**4**	
Title	**1**	
Name (Initial and Surname)	**1**	
Frame	**2**	
TOTAL	**25**	

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator:** refer to Annexure 1 and discuss implication.

Activity 3.2

MODULE 2

Structures

ACTIVITY 4 Plan a lesson on Structures

OUTCOME

At the end of this activity participants must be able to present a lesson plan on structures using the principles of the 5Es instructional model.

METHOD In pairs

INSTRUCTIONS

Plan a lesson on Structures

- Study the summary of the concepts to be taught in Grade 8 and 9. below
- Your facilitator will allocate each pair a concept to develop a lesson plan.
- Prepare a lesson plan following the Instructional Model illustrated on the next page.
- Write up your lesson plan on a sheet of newsprint and present it to the group.

Grade 8 Term 1	Grade 9 Term 1
Reinforcing: struts, ties. Stabilising: base size, base angles, centre of gravity, ground anchors. Strengthening structures using folding, tubing, triangular webs and internal cross-bracing. Pylons (link: electrical systems, the national grid). Components of frame structures: arch, beam, cantilever, column.	Strength of materials under the action of forces: compression, tension, torsion, and shear. Properties of construction materials: mass, density, hardness, stiffness, flexibility, corrosion. Suitability of materials (fitness-for-purpose) in terms of properties, safety and cost effectiveness.
Mini-PAT Task: Frame structure using mechanisms.	**Mini-PAT Task**: Identify and solve problems related to community on the far side of a river.

Grade: Lesson Topic:			
Instructional model used to teach new concepts			
		What can you use?	What will you do?
1	ENGAGE	Capture learners' attention Get attention by engaging them on an activity / demonstration Ask a question Pose a problem	
2	EXPLORE	Resolve problem Use their experience Teacher provides background, information, materials Observe and listen	
3	EXPLAIN	Teacher directs learners to first two steps and asks for explanations Teacher puts the explanations into subject terminology and procedures	
4	ELABORATE	Teacher challenges with a new example or situation Encourages interaction with new sources Expand, enrich, extend concepts	
5	EVALUATE	Include formative assessment Summative assessment at the end of a concept Learners receive feedback Teachers report on outcomes	

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

Structures

ACTIVITY 5 Build a simple Model

OUTCOME
At the end of this activity participants must be able to: work as a group to build a model.

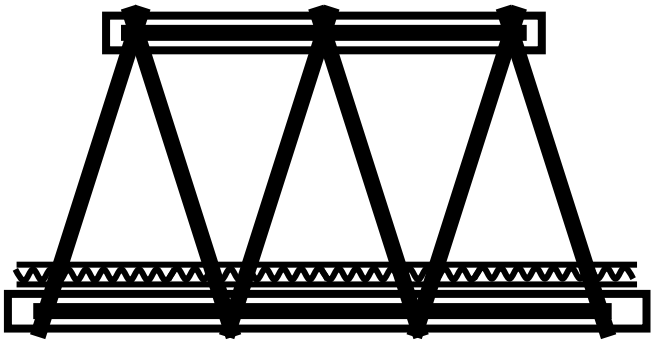
METHOD Individually and in groups

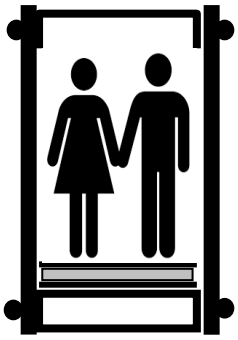
INSTRUCTIONS

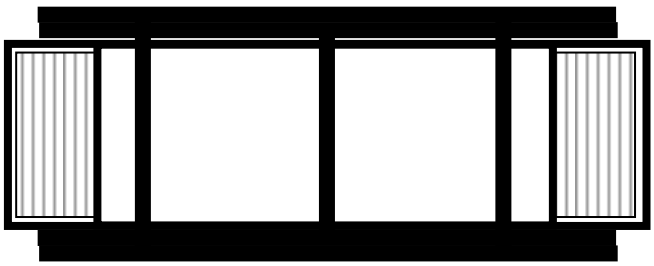
- Individually read the case study below. and follow instructions from the facilitator

Example of a bridge that a pupil designed

Gerda's bridge is a through truss bridge. It is 660 mm long, 150 mm wide and 250 mm high. The trusses are made of plastic drinking straws / paper tubes and are joined by pins / paper fasteners. Each of the two trusses has five equal triangular frames. The deck has a surface made of laminated paper / corrugated card.







5.1 Your facilitator will demonstrate the following concepts as an enabling activity;

- How to strengthen a sheet of paper by rolling it into a “straw”.
- How to join plastic drinking straws.

5.2 In groups of 4, decide on a suitable scale and **PLAN** for the making of Gerda’s Model Bridge considering the material provided by the facilitator.

Design notes / Drawings

5.3 Allocate a task to each member of the groups for the making of the bridge and indicated the work breakdown below:

Member A

Member B

Member C

Member D

5.4 Use the materials provided and build the model of the Bridge as planned.

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

MODULE 3

Systems and Control: Mechanical

ACTIVITY 6 Gear Ratios

OUTCOME

At the end of this activity participants must be able to explain gearing up and down and do simple calculations to indicate gear ratios.

METHOD In pairs

INSTRUCTIONS

6.1 Study the fact sheet below and Annexure 3

Fact Sheet:

Illustration 1 is of two spur gears connecting. When gears connect we say that they mesh. The input gear is called the driver and the arrow indicates that it will turn clockwise. The driven gear or output gear will turn in an anti-clockwise direction. Note that because the driver gear has 5 teeth and the driven gear has 10 teeth the driver gear will turn two full revolutions for the driven gear to turn one revolution. This can be stated as a gear ratio of 2 : 1. This will give us MECHANICAL ADVANTAGE (torque increases) because the rotational speed of the output gear is slower than the rotational speed of the input gear. It is also referred to as gearing down as the output turns slower than the input.

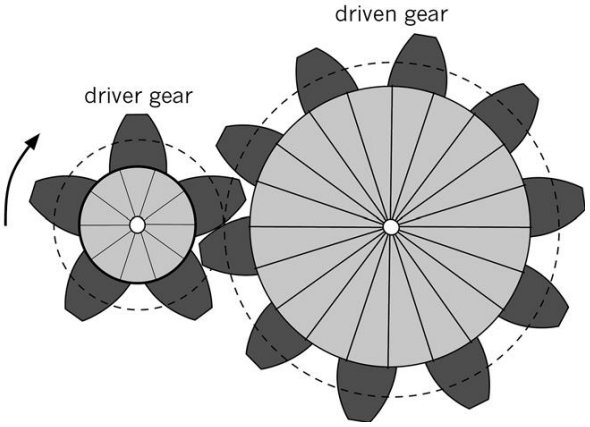


Illustration 1: Small driver and large driven gear

Illustration 2 shows the driver gear as the larger gear and the driven gear as the smaller gear. When the driver gear now turns one revolution the driven gear will turn two revolutions. This will be stated as a gear ration of 1 : 2. This gear ratio will give SPEED ADVANTAGE (torque decreases) as the output gear will turn faster than the input gear. This is also referred to as gearing up.

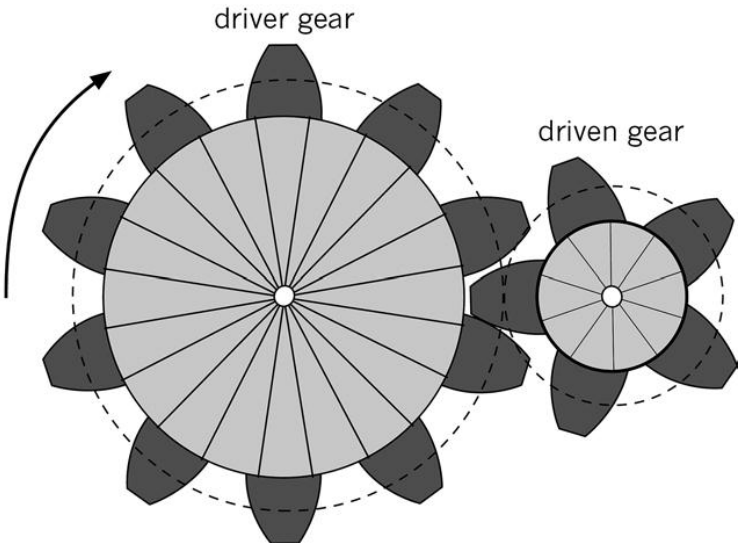


Illustration 2: Large driver and small driven gear

Illustration 3 is of a driver and a driven gear of the same size. The smaller gear in the middle is called the idler gear. An idler gear turns between a driver and a driven gear. It allows the driver and the driven gears to turn in the same direction. An idler gear does not change the mechanical advantage of a gear system. When two gears mesh, they turn in opposite directions. This is called counter rotation. When an idler is used between two gears, the direction of rotation of the driver and driven gear is the same.

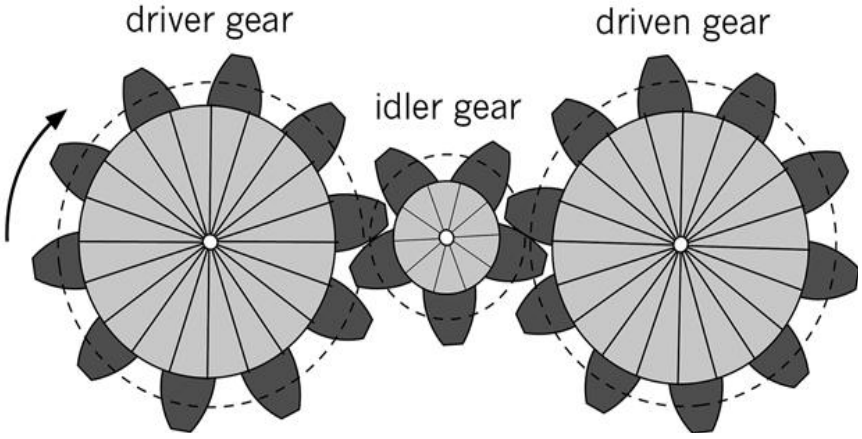
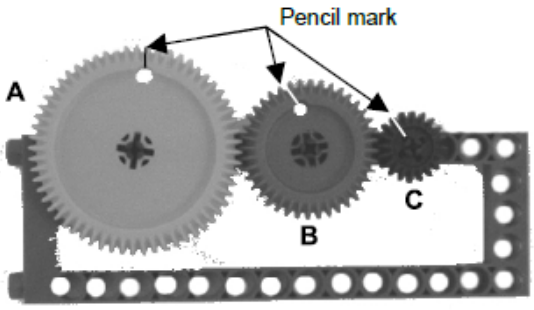


Illustration 3: Idler gear

6.2 Study the illustration given below and answer the questions that follow.



Gear A = 60 Teeth
Gear B = 40 Teeth
Gear C = 20 teeth

i. How many times must you turn gear B in order to make gear A turn once?

_____

The gear ratio will be _____ (gear B) to _____ (gear A)

ii. How many times must you turn gear C in order to make gear B turn once

_____

The gear ratio will be _____ (gear C) to _____ (gear B)

iii. If gear A is turned once, how many times will gear C turn?

The gear ratio will be _____ (gear A) to _____ (gear C)

iv. What is the comparison between the gear ratios of the larger gears compared to the smaller gears?

---

v. Circle the correct one: The smaller gears always turn **FASTER / SLOWER** than the bigger gears if they are connected in series.

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

Systems and Control: Mechanical

ACTIVITY 7 Plan a lesson on Mechanical Advantage

OUTCOME

At the end of this activity participants must be able to: present a lesson plan on mechanical advantage using the principles of the 5Es instructional model.

METHOD In groups

INSTRUCTIONS

- Study the summary of the concepts below to be taught in Grade 8 and 9.
- Prepare a lesson plan to teach learners about mechanical advantage using one of the following mechanism allocated by the facilitator; levers, gears (spur), pulleys and hydraulic / pneumatics.
- Prepare a lesson plan following the Instructional Model illustrated on the next page.
- Write up your lesson plan on a sheet of newsprint and present it to the group.

Grade 8 Term 3	Grade 9 Term 2
Simple mechanisms as components of more complex machines designed to provide users with a **mechanical advantage:** • Linked **lever** systems. • Gears (link to term 1: spur, bevel, rack and pinion, worm). • **Gears** – driver, idler, driven; velocity ratio/force multiplication. • Belt drive and chain drive systems – chain block, bicycle or motor cycle gear cogs. • Hydraulic/pneumatic systems. • **Mechanical advantage – including simple calculations.** • Systems diagrams.	Interacting mechanical systems and sub-systems. • Hydraulic principles: incompressibility of liquids, pressure in liquids, force transfer. • **Hydraulic/pneumatic systems** that use restrictors, one-way valves: hydraulic press/jack. • **Gear systems** – spur, bevel, rack and pinion, and worm. • Mechanical control mechanisms – ratchet and pawl; cleats; bicycle brakes; disc brakes. • Belt-drive systems with more than one stage. • **Pulley systems** – fixed pulley, moveable pulley, and multiple pulleys (block and tackle). • Systems where mechanical, electrical or pneumatic systems are combined.
Mini-PAT Task: Mine shaft headgear	**Mini-PAT Task**: Identify and solve problems that can be solved by mechanical systems integrated with either electrical/electronic or hydraulic or pneumatic.

Develop a teaching plan

- Use the headings below to guide your discussion and lesson plan.
- Present your lesson plan on a sheet of newsprint to the group.

Instructional model used to teach new concepts

		What can you use?	What will you do to?
1	ENGAGE	Capture learners' attention Get attention by engaging them on an activity / demonstration Ask a question Pose a problem	Develop shared norms Determine readiness for learning Establish learning goals
2	EXPLORE	Resolve problem Use their experience Teacher provides background, information, materials Observe and listen	Prompt inquiry Structure inquiry
3	EXPLAIN	Teacher directs learners to first two steps and asks for explanations Teacher puts the explanations into subject terminology and procedures	Present new content Develop language and literacy Strengthen connections
4	ELABORATE	Teacher challenges with a new example or situation Encourages interaction with new sources Expand, enrich, extend concepts	Facilitate substantive conversation Cultivate higher order thinking Monitor progress
5	EVALUATE	Include formative assessment Summative assessment at the end of a concept Learners receive feedback Teachers report on outcomes	Assess performance against standards Facilitate student self-assessment

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

MODULE 4

Graphic Communication Skills

ACTIVITY 8 Oblique Projection

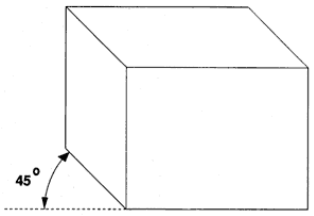
OUTCOME
At the end of this activity participants must be able to demonstrate the drawing principles for oblique projection.

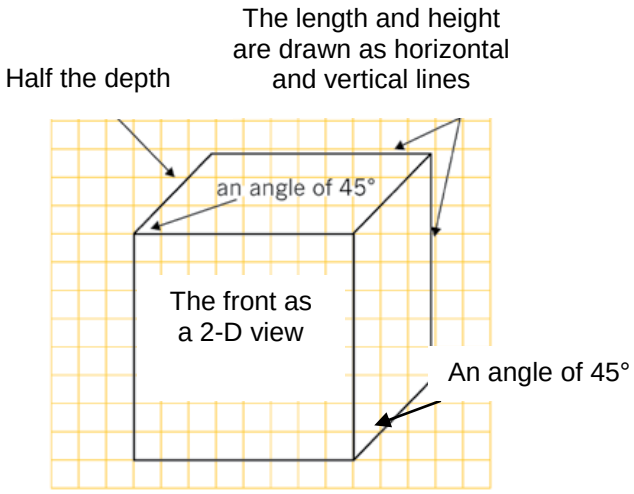
METHOD Individually and in pairs

INSTRUCTIONS

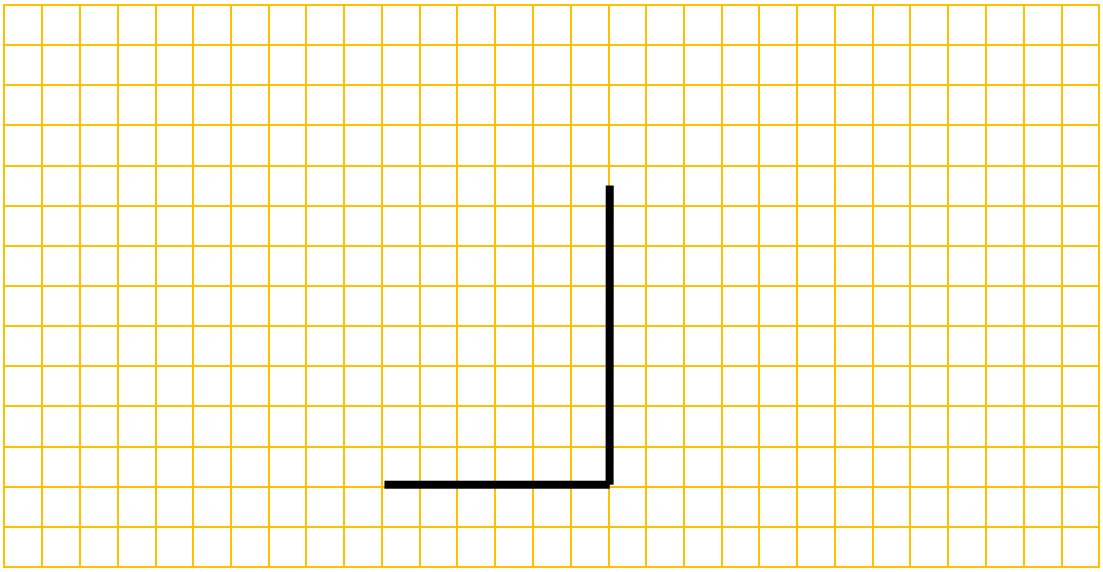
- Read the information below and study the illustrations of a CUBE drawn in oblique.
- Complete activities 8.1, 8.2, 8.3 and 8.4.

An oblique drawing is a 2-Dimensional view of an object with a forced depth to give it a 3-Dimensional view. One way to draw an oblique view is to draw the front view of the object you are looking at in two dimensions, i.e. flat, and then draw the other sides at an angle of 45 degrees, but instead of drawing the sides full size they are only drawn with half the depth creating 'forced depth' – this adds an element of realism to the object. Even with this 'forced depth', oblique drawings look very unconvincing to the eye. For this reason oblique is rarely used by professional designer and engineers.



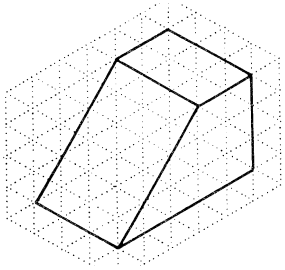


8.1 Complete a **CUBE** in Oblique Projection using the axis as a guide.

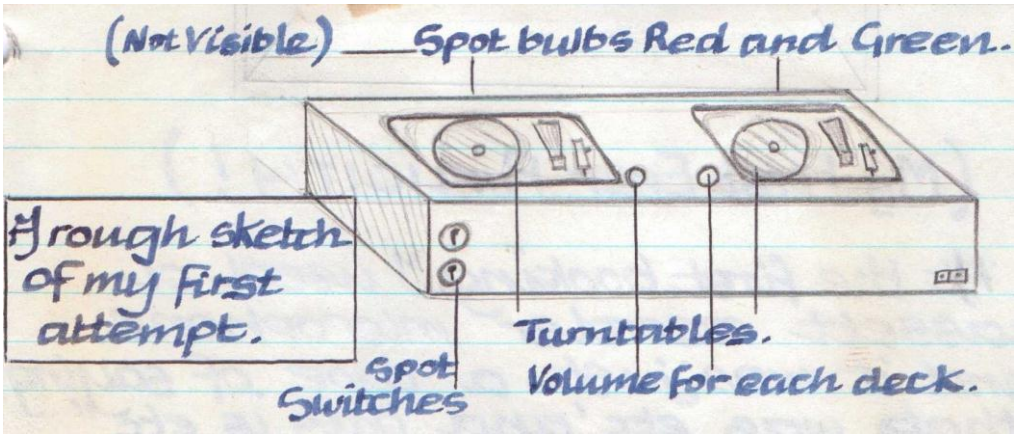


8.2 Complete an Oblique Drawing of the wedge below to scale 1 : 1.
The dimensions of the full block are 60 x 35 x 35 mm.

NB: Always draw the original full block first and then cut away the required sections.



8.3 Make a design sketch (freehand) in Oblique Projection of the turn-table shown below. As this is a Design Sketch it is not drawn to any true dimensions; however, the sketch must be in proportion.



- Complete the table below by indicating the grade and terms the skill is required in the Senior Phase. The delegates will require their CAPS policy document.

	Term 1	Term 2	Term 3	Term 4
Grade 7				
Grade 8				
Grade 9				

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator** Confirm the correctness of their findings.

Graphic Communication Skills

ACTIVITY 9 Isometric Projection

OUTCOME
At the end of this activity participants must be able to: demonstrate the drawing principles for isometric projection.

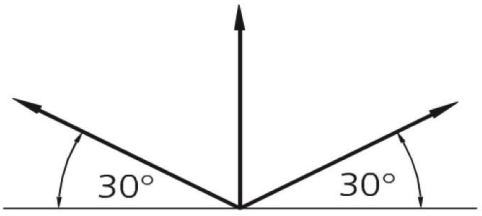
METHOD Individually and in pairs

INSTRUCTIONS

- Read the information below and study the illustrations provided.
- Complete activities 9.1, 9.2, 9.3 and 9.4.

What is an ISOMETRIC DRAWING?
An isometric drawing is a pictorial (picture) representation of an object showing three sides of the object simultaneously. All inclined lines are drawn at an angle of *30°.*

In an isometric drawing all three the planes of an object are visible at the same time. This means that three dimensions will be shown on the drawing. One corner is drawn nearest to the person looking at the object. Out of this corner three lines are drawn. These lines are called the **isometric** axes. On these axes the dimensions of the object are measured and marked. The isometric axes consist of three lines namely a perpendicular line on to the base and two sloping (inclined) lines drawn at *30°,* one to the right of the perpendicular and one to the left. All lines parallel to the isometric axes are known as **isometric lines.** All lines not parallel to the isometric axes are known as **non-isometric lines.** Dimensions are only measured along isometric lines and not from non-isometric lines.



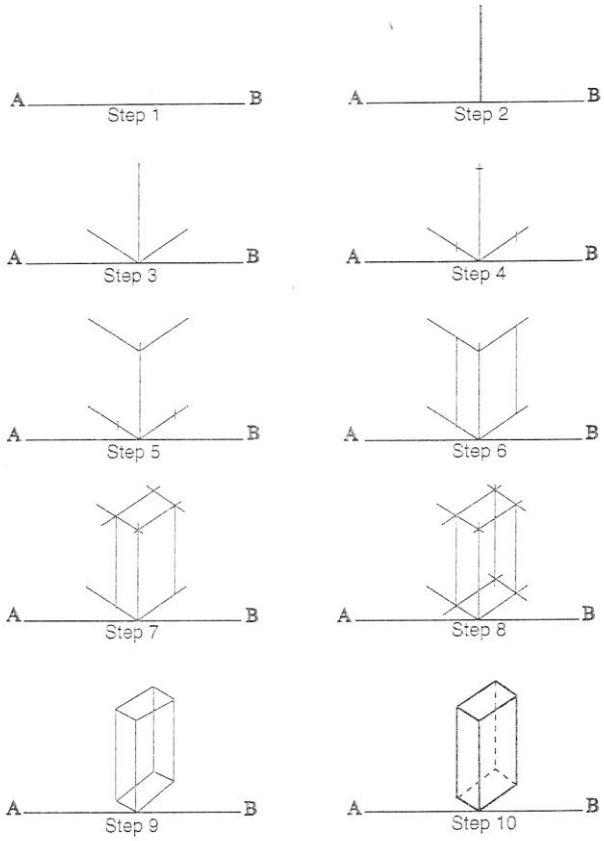
All vertical lines on the object are drawn as vertical lines on the drawing. All lines which are horizontal on the object are drawn at *30°* to the horizontal on the paper.
Isometric drawings show three sides of an object visible; and three sides not seen with the eye. The picture of the object is:

i. a pictorial and clear view
ii. to help one visualise shapes of objects
iii. a true image of an object seen

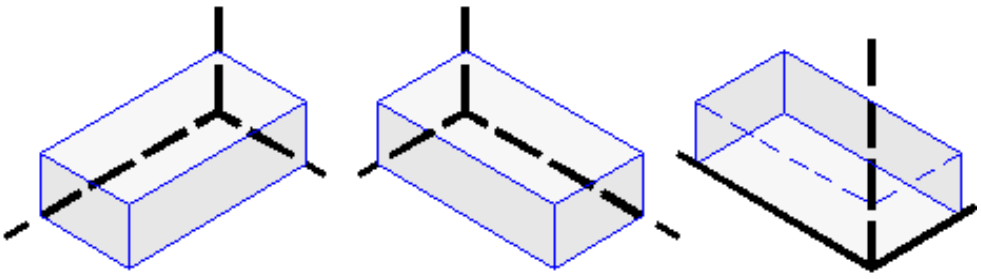
Basic steps in drawing an isometric drawing

Step 1: Draw a baseline: horizontal any length.
Step 2: Draw a vertical line to a centre point on the horizontal line.
Step 3: Draw two lines 30° from the centre point to both sides.
Step 4: Measure out the length, width and thickness of the block.
Step 5: Draw lines 30° from the mark of the height.
Step 6: Draw vertical lines to meet 30° lines on top and at the bottom.
Step 7: Draw 30° lines to the inside to complete the top section.
Step 8: Fill in all hidden lines.
Step 9: Erase lines that cross the end points.
Step 10: By using corresponding lines complete the visible and hidden lines.

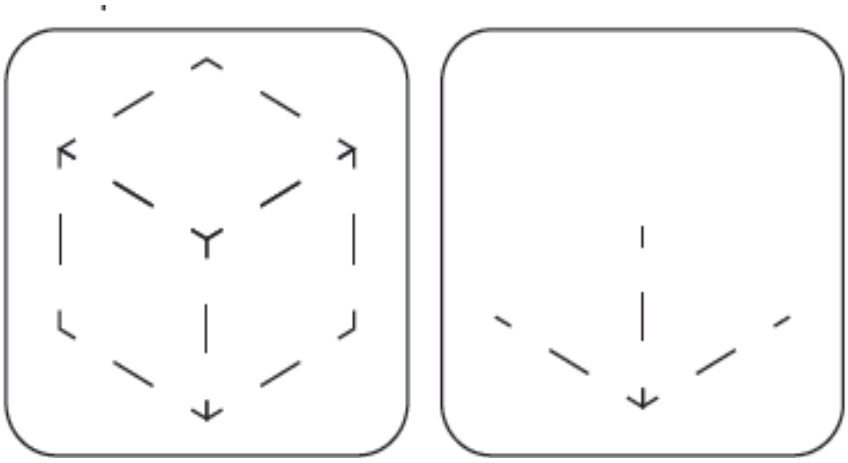
NB: Check all corners; It should have 3 lines meeting in each corner.



Isometric drawings in different positions:

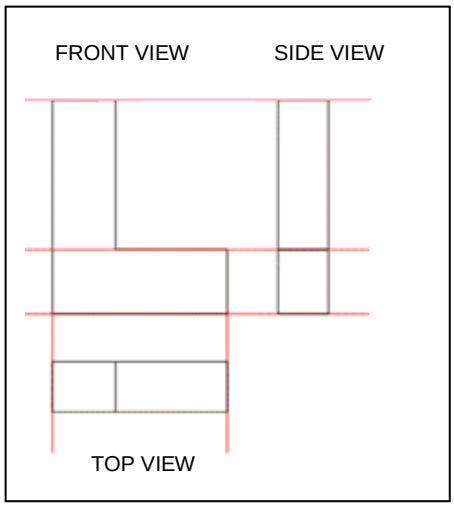


9.1 Trace the visible lines for the cube in the isometric position and then complete the cube with the axis indicated and add the hidden lines.



9. 2 Draw using a ruler and on the grid below a rectangular block in any suitable isometric position. Show all visible and hidden lines.
The block dimensions are: 35 x 20 x 10 mm. (Draw to a scale of 2 : 1)

9.3 Three views of a block in the shape of the letter **"L"** is given as part of an INCOMPLETE construction orthographic drawing. Sketch freehand the shaped block in an isometric position. As this is a design sketch no dimensions are needed but the drawing must be in proportion. Use rendering techniques to add tone, shadow and texture to the object.



- Complete the table below by indicating the grade and terms the skill is required in the Senior Phase. The delegates will require their CAPS policy document.

	Term 1	Term 2	Term 3	Term 4
Grade 7				
Grade 8				
Grade 9				

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator** Confirm the correctness of their findings.

Graphic Communication Skills

ACTIVITY 10 One Point Perspective

OUTCOME

At the end of this activity participants must be able to demonstrate the drawing principles for one-point perspective.

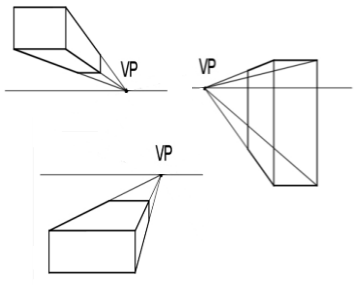
METHOD In pairs and Individually

INSTRUCTIONS

- Read the information below and study the illustrations provided.
- Complete activities 10.1, 10.2, and 10.3

<u>One Point Perspective (one Vanishing Point)</u>

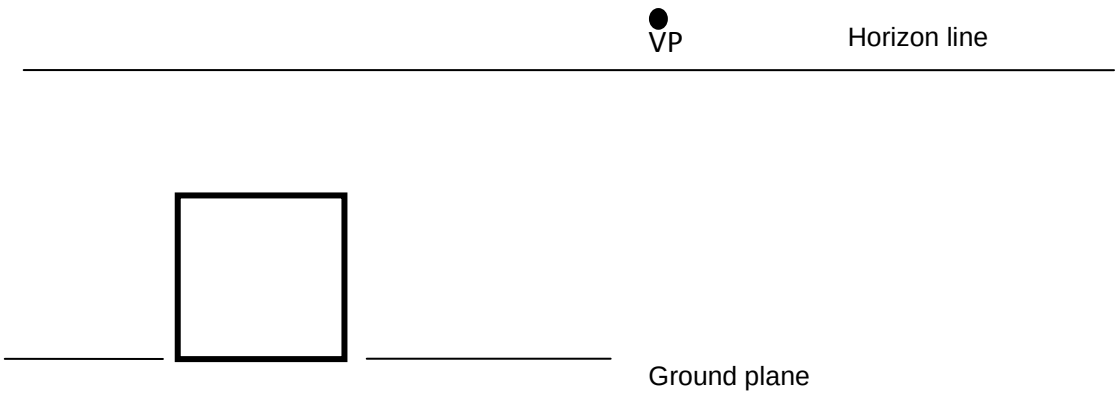
A drawing has one-point perspective when it contains only one vanishing point on the horizon line. This type of perspective is typically used for images of roads, railway tracks, hallways, or buildings viewed so that the front is directly facing the viewer. Any objects that are made up of lines either directly parallel with the viewer's line of sight or directly perpendicular (the railroad slats) can be represented with one-point perspective. These parallel lines converge at the vanishing point.



Working in pairs try the following:

a) With your partner standing at the other end of the room position the palm of your hand in such a way so that it looks like your partner is standing on your palm.
b) Use a finger and your thumb of one hand and measure the height of your partner. What happens as you move closer or further away?

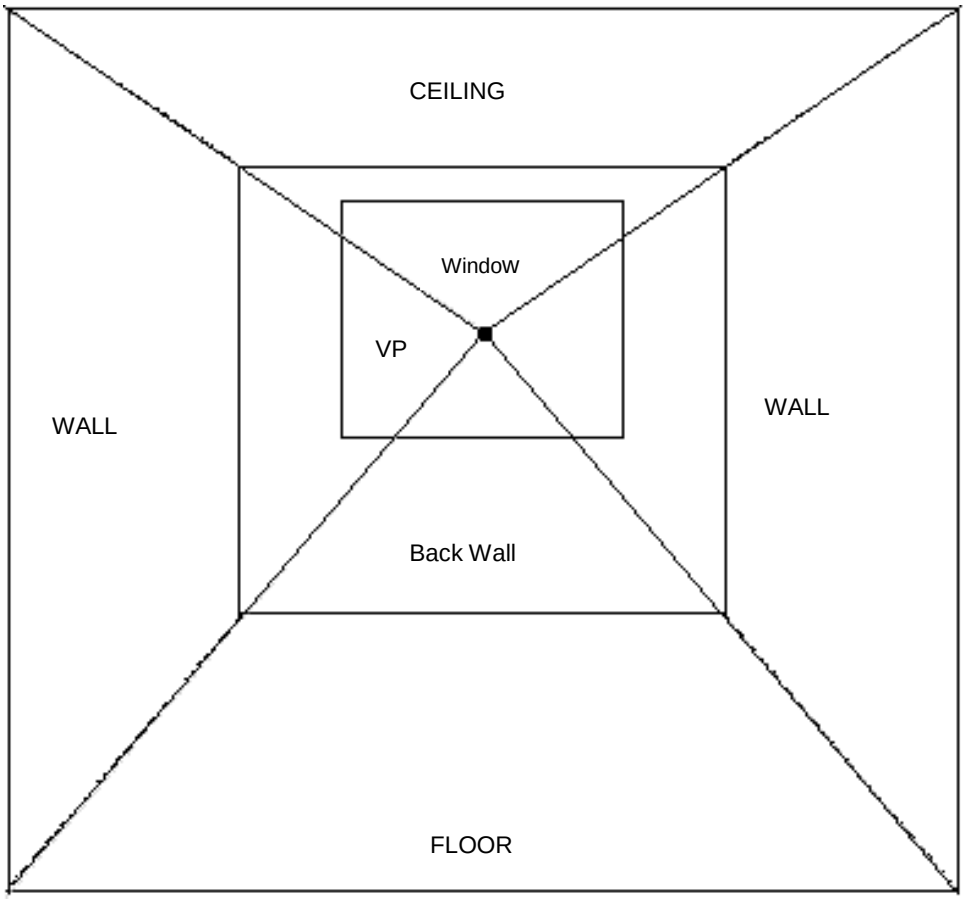
10.1 Complete the cube below in One Point Perspective. (Do not use a ruler)



10.2 Study the objects on worksheet 1. Complete the shapes in one point perspective adding a suitable thickness. The cube has been completed for you and three other objects have been started. Use a straight edge to complete the drawings.

An Expanded Opportunity

In the box room below, draw a rectangular box placed on the floor and in the middle of the room. This must be done without a ruler. Show all construction and projection lines.



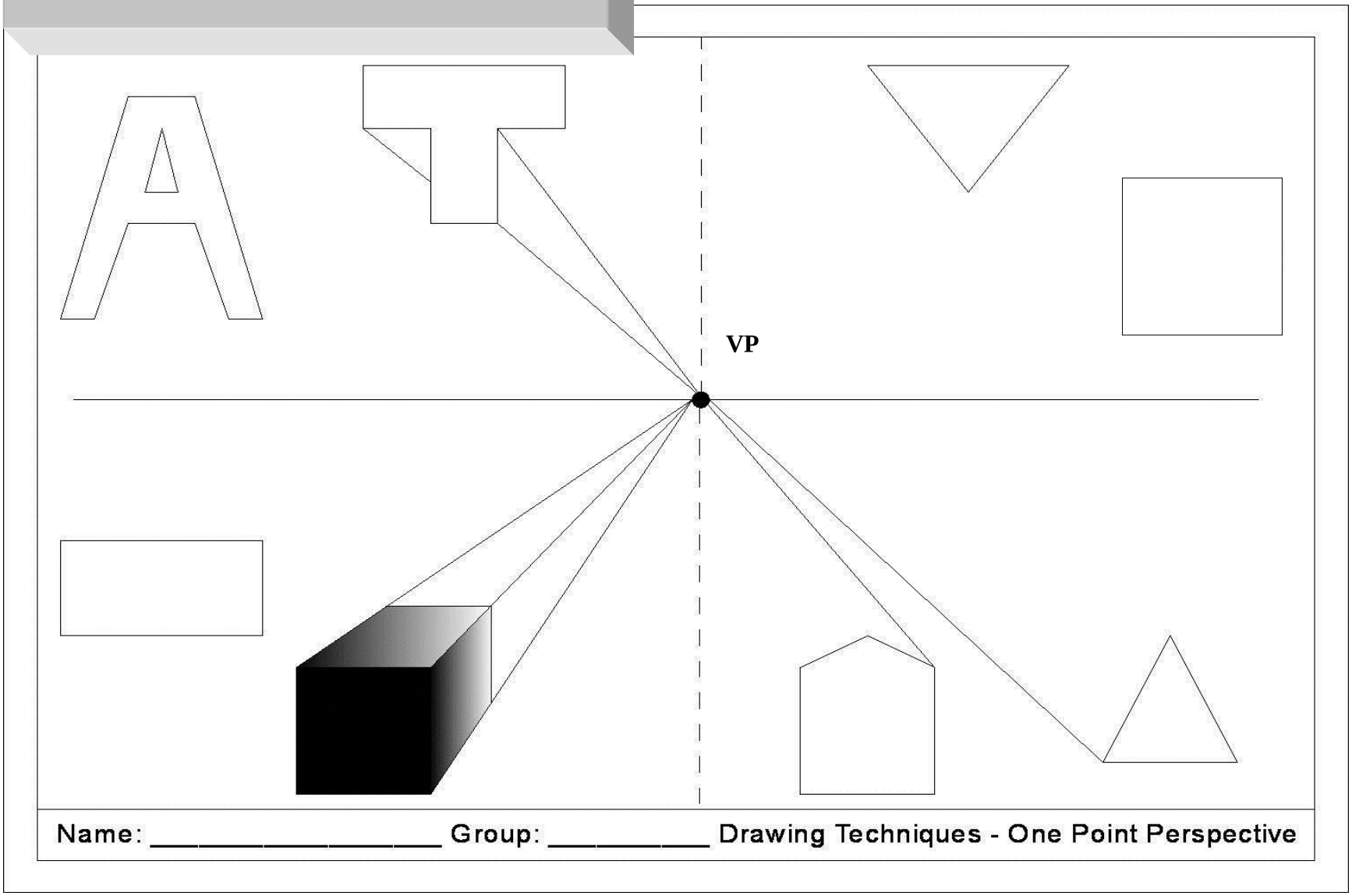
10.3 Complete the table below by indicating the grades and terms this skill is required in the Senior Phase. (The delegates will require their CAPS policy document.)

	Term 1	Term 2	Term 3	Term 4
Grade 7				
Grade 8				
Grade 9				

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator** (Confirm the correctness of their findings)

WORKSHEET 1: One Point Perspective Activity 10.2



Graphic Communication Skills

ACTIVITY 11 Two point Perspective

OUTCOME
At the end of this activity participants must be able to demonstrate the drawing principles for two-point perspective.

METHOD In pairs and Individually

INSTRUCTIONS

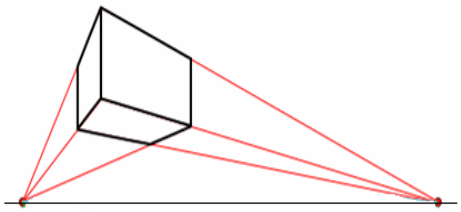
- Read the information below and study the illustrations provided.
- Complete activities 11.1, 11.2, 11.3, 11.4, 11.5 and 11.6

Two Point Perspective (Two Vanishing Points)

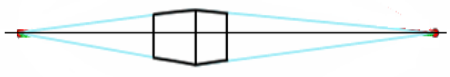
Perspective in the graphic arts is an approximate representation, on a flat surface (such as paper), of an image as it is seen by the eye. The two most characteristic features of perspective are that objects are smaller as their distance from the observer increases; that they are foreshortened, i.e. that the size of an object's dimensions along the line of sight are relatively shorter than dimensions across the line of sight.

Perspective is a realistic way of drawing objects in 3D. We have already looked at single point perspective, two point perspective using two vanishing points and when an object is drawn in this way it is even more realistic than if it were to be drawn with a single vanishing point

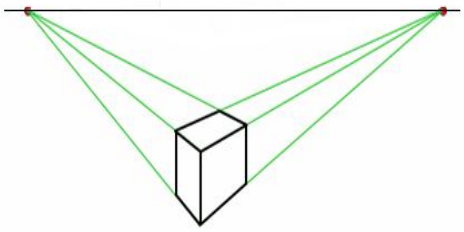
From below



Street Level / Head On

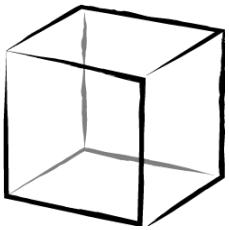


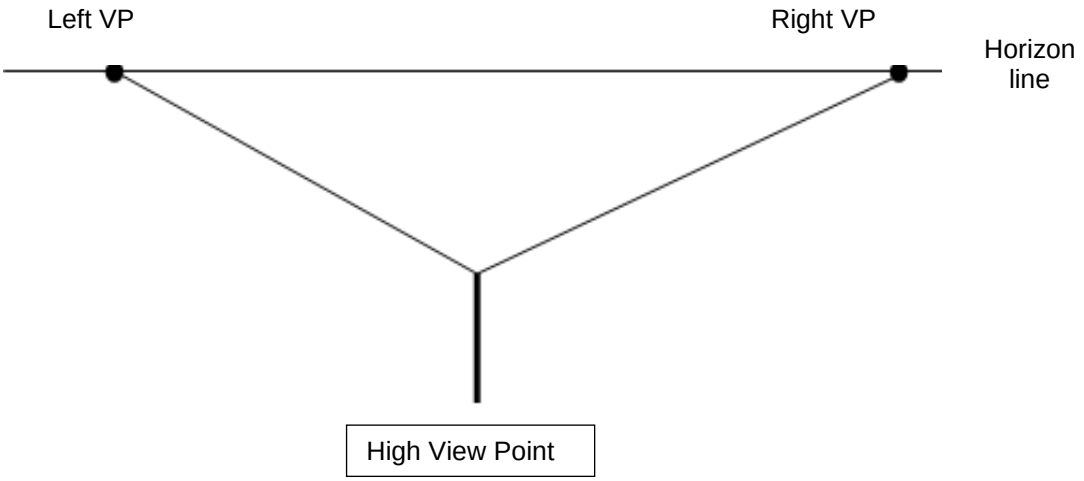
From above



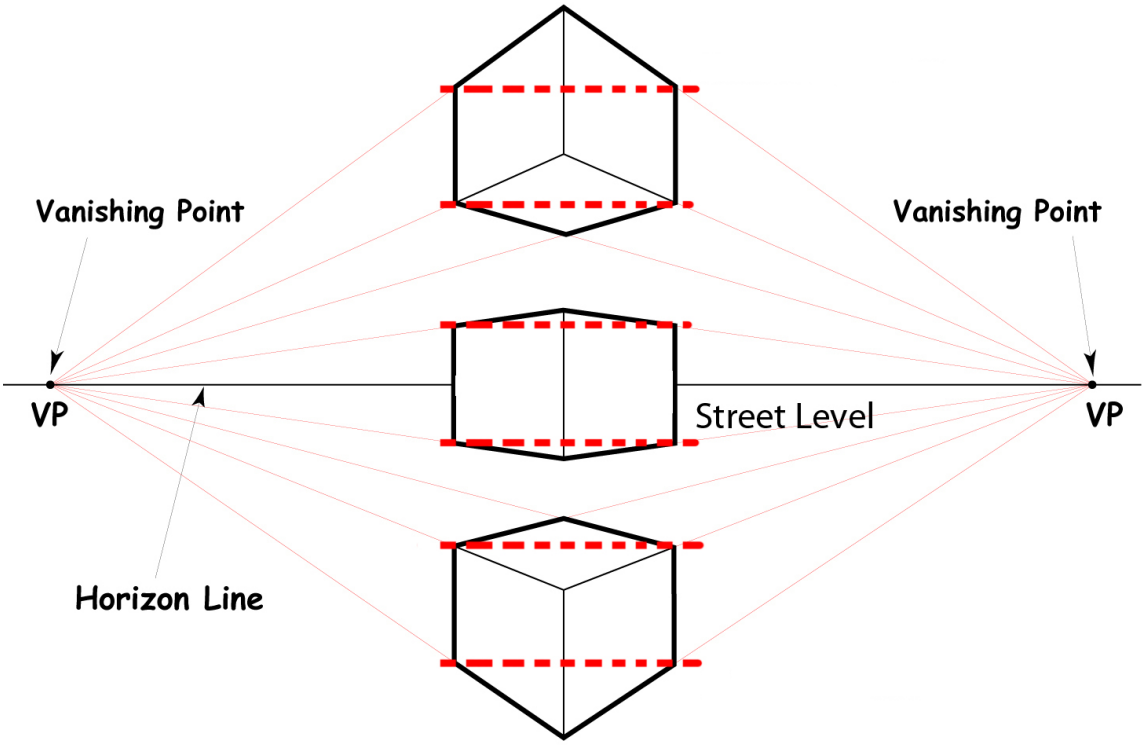
11.1 Complete a two point perspective view of the given cube.

- The drawing has been started for you with the HEIGHT line indicated and the two vanishing points placed.

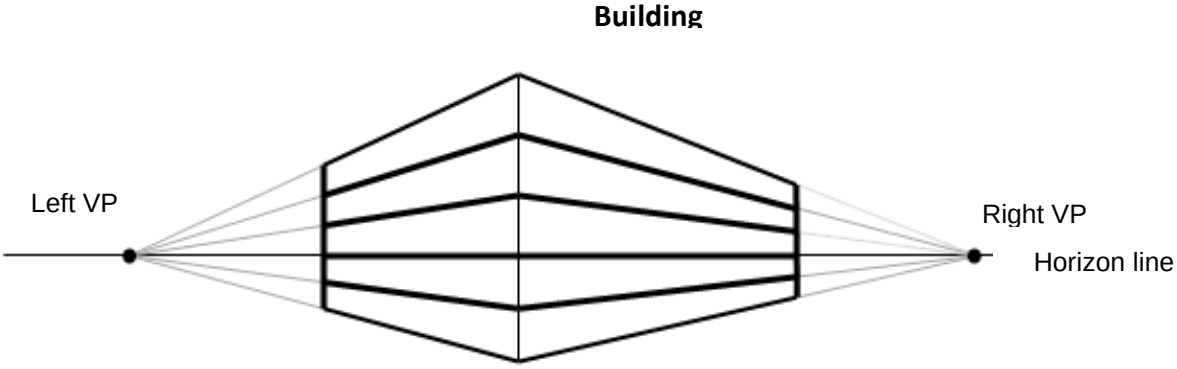




The illustrations below indicate different eye view points an object can be viewed from.



Example of the lines of a building extended out to find the **Vanishing Points** & the **Horizon line.**



11.2 Complete the statement below**.**

- Is the example above drawn from a 'High', 'Mid' or a 'Low' viewpoint?

  Answer:
- I think that the example above is drawn from a _____ viewpoint because

11.3 Complete the three drawings in two point perspective started on **Worksheet 1.**

11.4 Now see if you can finish the stepped block indicated on **Worksheet 2** in Two Point Perspective (The drawing has been started for you.).

11.5 An artistic drawing of a book is shown in two point perspective on **Worksheet 3.** Draw an artistic view of any simple object e.g. an eraser in two point perspective. Use all rendering techniques and colour to enhance the sketch.

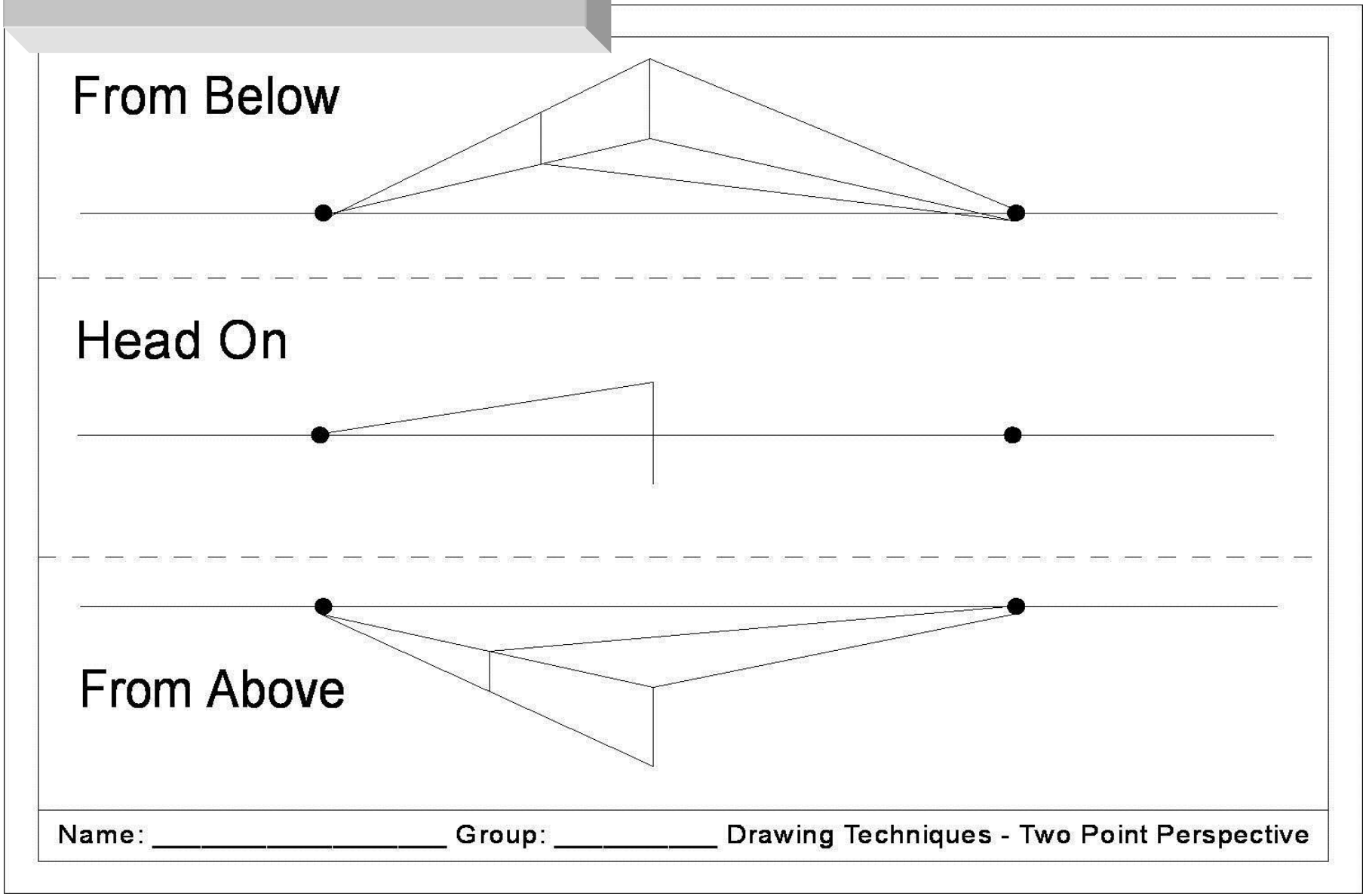
11.6 Complete the table below by indicating the grades and terms this skill is required in the Senior Phase. The delegates will require their CAPS policy document.

	Term 1	Term 2	Term 3	Term 4
Grade 7				
Grade 8				
Grade 9				

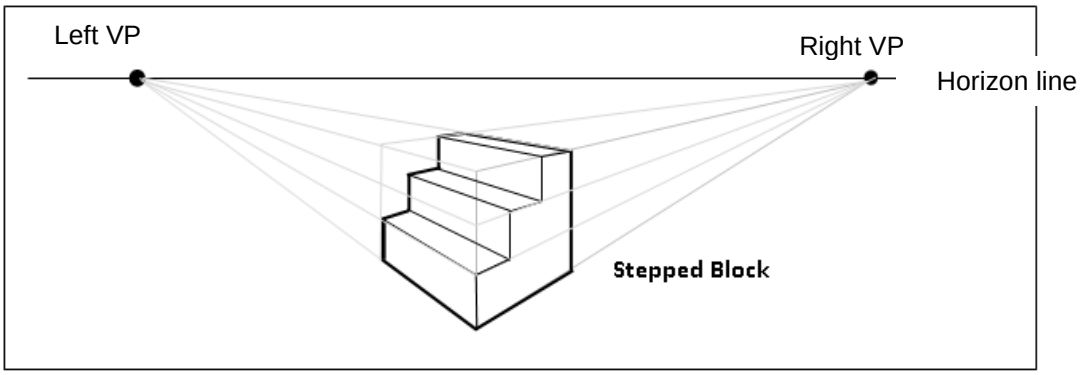
WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator** (Confirm the correctness of their findings)

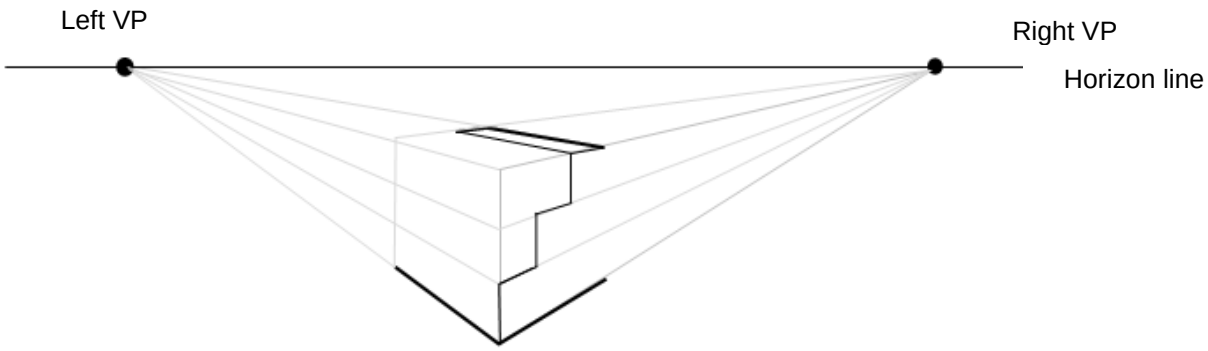
WORKSHEET 1: Two Point Perspective Activity 11.3



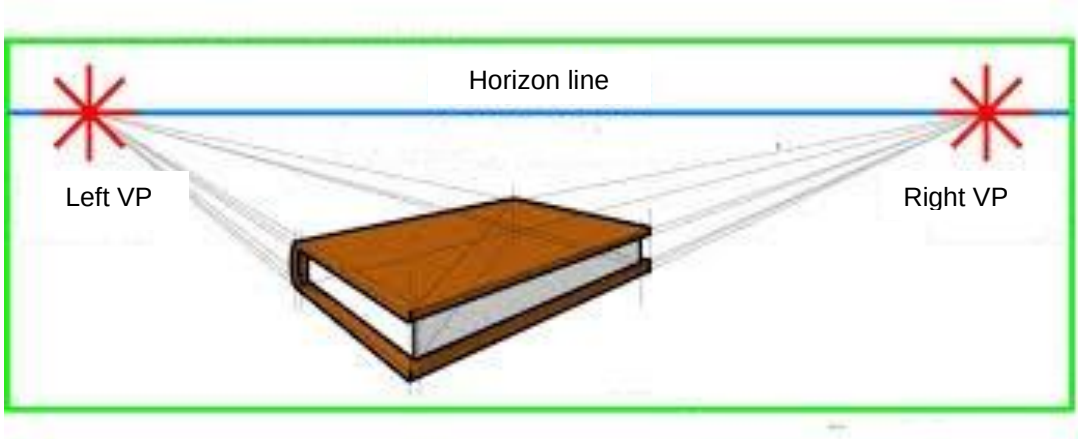
WORKSHEET 2: Two Point Perspective Activity 11.4
Stepped Block



Complete the Perspective drawing below



WORKSHEET 3: Two Point Perspective Activity 11.5
Artistic View



Graphic Communication Skills

ACTIVITY 12 Crating

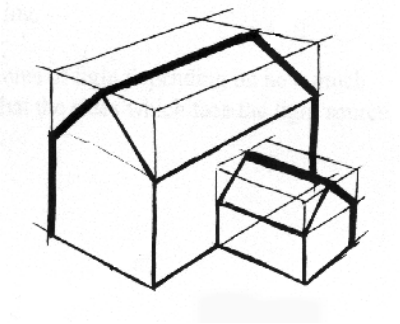
OUTCOME
At the end of this activity participants must be able to: demonstrate the drawing principles for crating.

METHOD Individually

INSTRUCTIONS

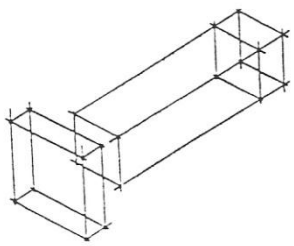
- Read the information below and study the illustrations provided.
- Complete activities 12.1, 12.2 and 12.3.

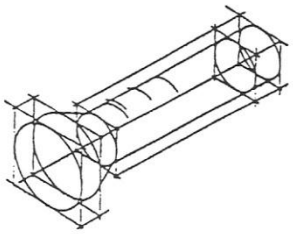
Most people are not able to immediately pick up a pencil and start producing design sketches that communicate everything about an idea. It is usually necessary to have someone show you a few of the basic rules about proportion, line and shape but 'simple crating' should allow you to make a really good start at sketching.

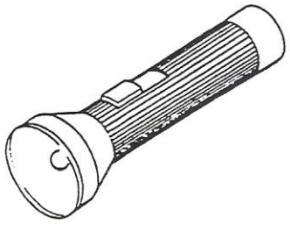


The starting point is to draw a simple outline of the shape or shapes of your idea. So, crating is a quick and effective way to sketch complicated 3D shapes.

Sketch of house showing the two boxes. The design is added using dark and light lines.



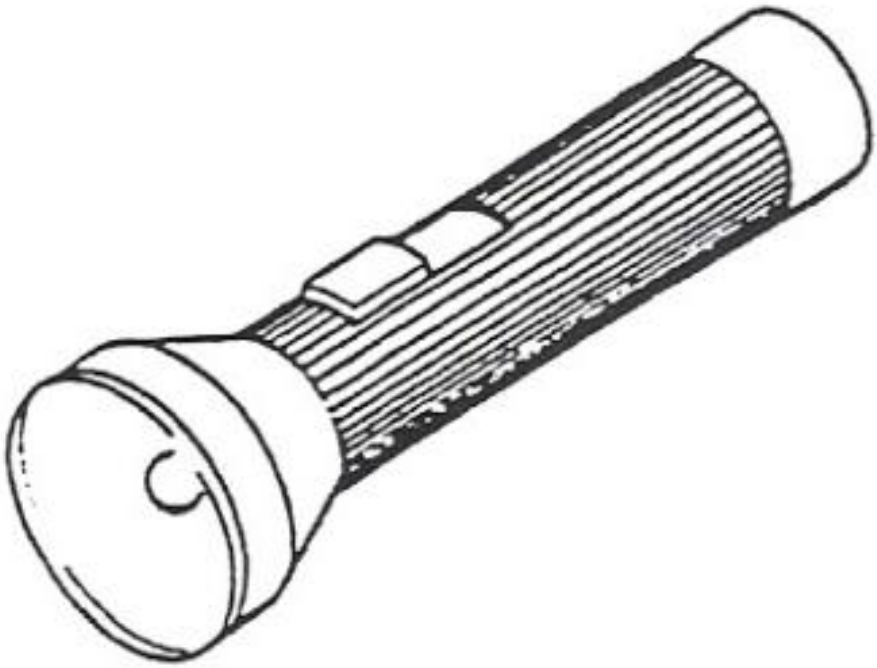




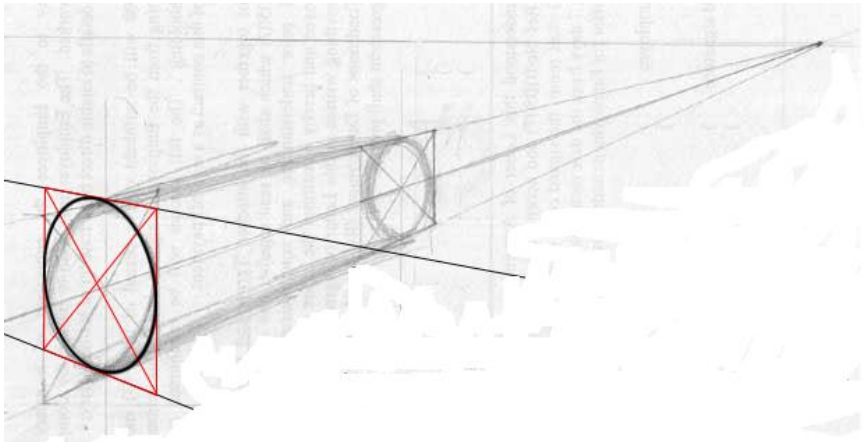
Step 1 Step 2 Step 3

Three steps when drawing a torch using the crating method.

12.1 Drawing the crating on the enlarged sketch of the torch indicated below.

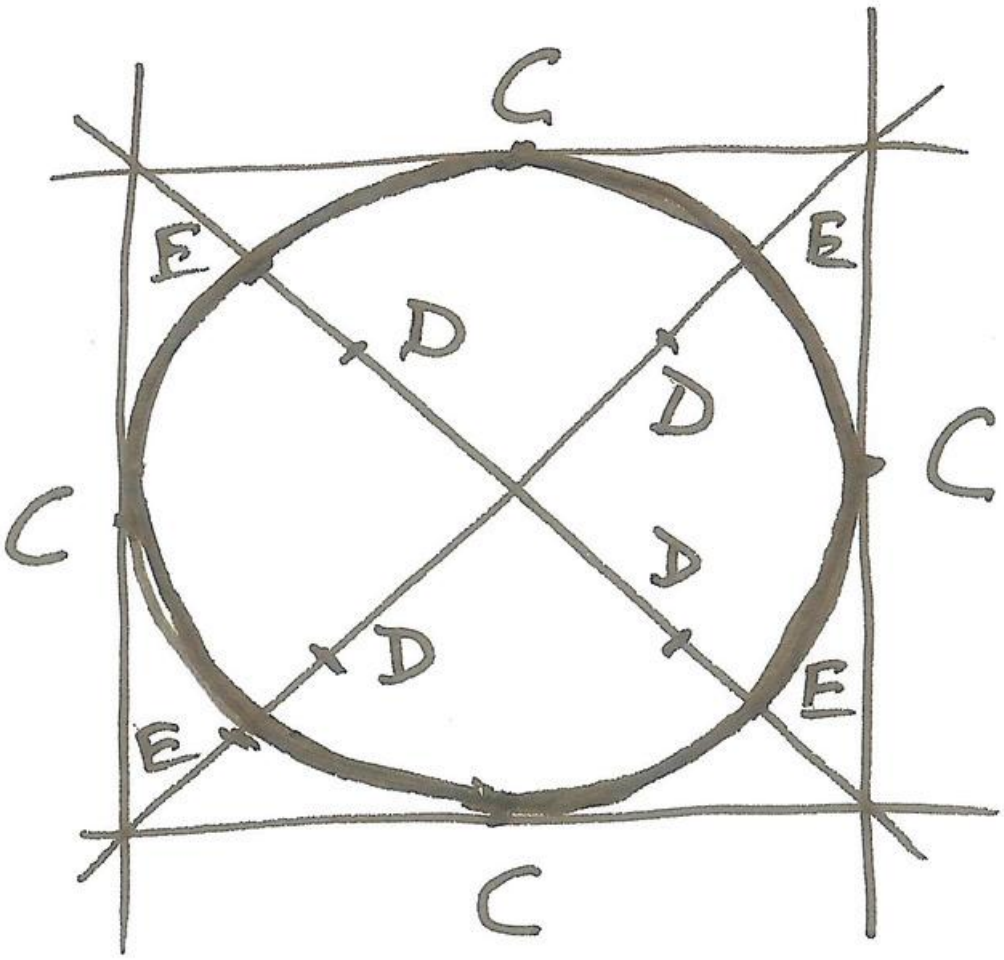


Crating can also be used to draw a circle accurately in an isometric drawing or in a perspective view as shown below.



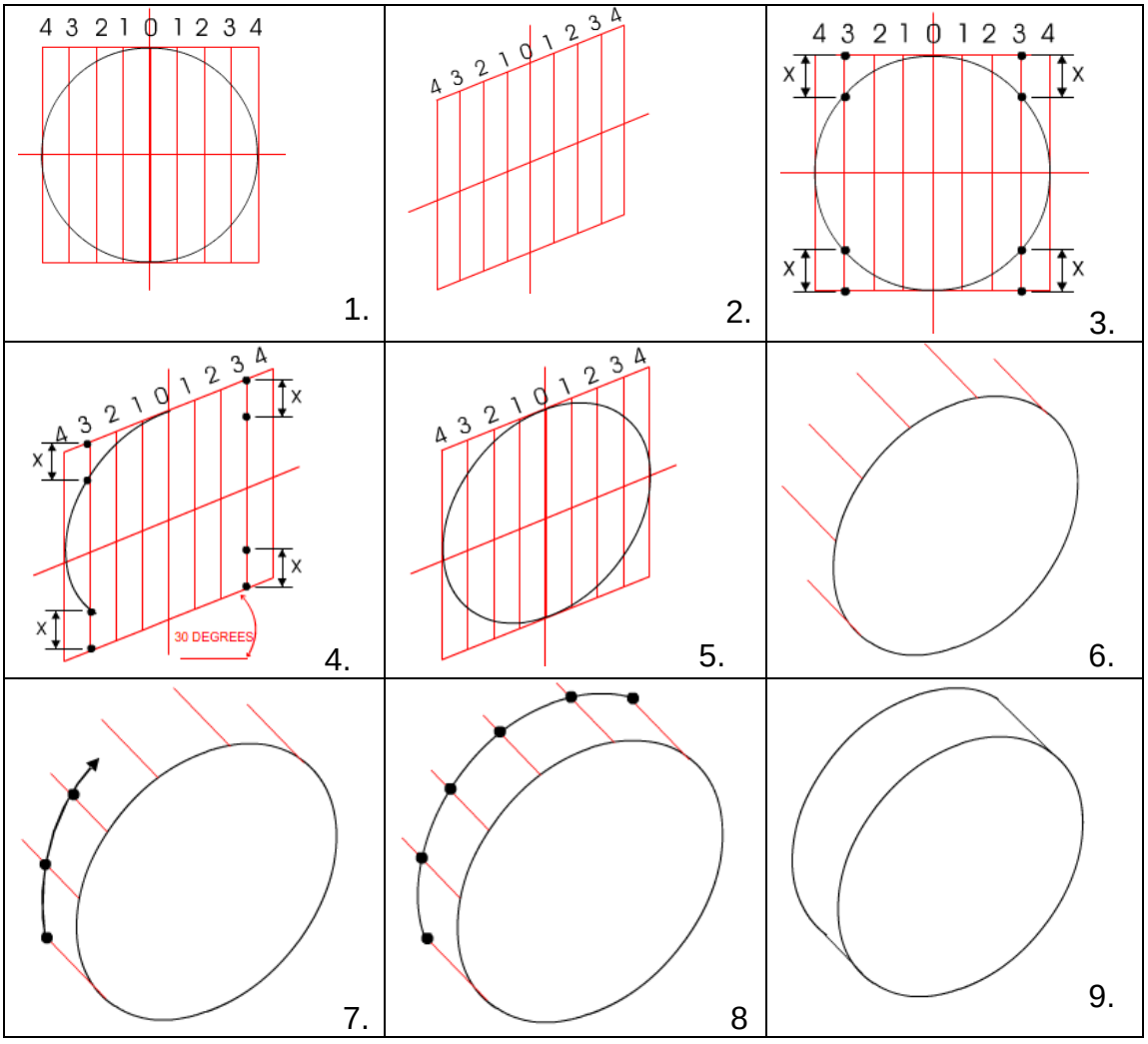
How to draw a circle freehand

- Sketch a square guide box. Do not use a ruler.
- Sketch lines from one diagonal corner to the other.
- Mark off the positions C of the centre of each side.
- Mark points D on the diagonals, halfway between the centre and each corner.
- Mark points E halfway between the Ds and the corners.
- Sketch a curved line to join up the C's and the E's; C-E-C-E-C-E-C-E.
- You have sketched a circle. Now make the circle's outline thicker.



How to draw a circle in Isometric

The following steps indicate the method used to draw a circle or any irregular shape in an isometric position.

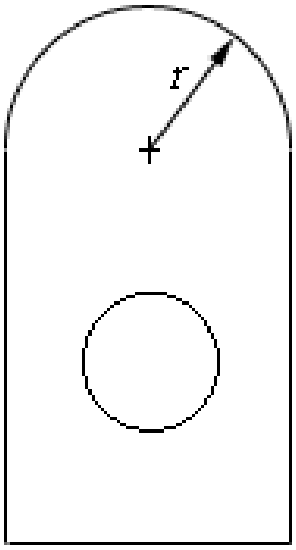


12.2 Describe the action you observe for each of the 9 steps above.

1.

12.3 Make a freehand sketch of the given irregular shape in any isometric plane.

- The thickness of the block of wood is 25mm.
- Use a scale of 1:1
- Show all constructions lines used to draw the arc and the circle.



Base line

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

refer to Annexure 1, 2 and 12 and discuss implication.

MODULE 5

Systems and Control: Electrical / Electronic

ACTIVITY 13 Teaching Electric / Electronic Circuits

OUTCOME

At the end of this activity participants must be able to build an electronic circuit, draw a circuit diagram and develop a lesson plan based on the 5Es for an electronic concept.

METHOD In pairs and in groups

INSTRUCTIONS

- Study the summary of the concepts to be taught in Grade 8 and 9.
- Complete the instructions 13.1, 13.2 and 13,3

Grade 8 Term 4	Grade 9 Term 3

Basic electrical circuit:
• Circuit diagrams, conventions and component symbols.
• Input devices, control devices, output devices.
• Circuit design (simple) and circuit interpretation.
• Circuits with more than one input or control device.
• Electrical energy sources (including illegal connections):
• Sources of direct current: electrochemical cells; photovoltaic cells.
• Sources of alternating current: generating (thermal and alternate).
• Distributing AC electricity: the national grid, transformers (an application of electromagnetism).
• **Ohm's Law:** *qualitative* treatment.
• **Logic conditions**:
  ○ **AND** logic (series); truth table.
  ○ **OR** logic (parallel); truth table.
	Electronic systems and control: how simple electronic circuits and devices are used to make an output respond to an input. Learners should be able to read a ***given*** electronic circuit diagram and assemble the components into a working circuit.
	• Input components: electrochemical cells, photovoltaic cells.
	• Storage components: electrochemical cells, capacitors.
	• Control components: switches, resistors, diodes, light emitting diodes (LED), transistors.
	• Sensor components: thermistors, light dependent resistors (LDR).
	• Output components: lamp, buzzer/bell, light emitting diodes (LED).
	• Resistor codes.
	• **Ohm's Law: *quantitative*** treatment with graphs and calculations.

Term 4 Assessment Mini-PAT (DM) **Task**: dual switch system like an alarm circuit with at least two panic buttons in different rooms, or similar concept using either AND or OR logic conditions	**Term 3** Assessment Mini-PAT (IDMEC) **Task**: identify a problem that can be solved by an electronic circuit. Assemble a given electronic circuit and design a device which can utilise the circuit to solve the problem.

13.1 In pairs select a Grade and build a suitable solution that will address a possible problem to be solved as a Mini-PAT.
Use the resources provided in the electricity / electronics kit.

13.2 Draw a circuit diagram of the circuit you have built.

13.3 Groups will be allocated one of the following concepts: **Logic Gates** or **Ohms law** to develop a lesson plan following the Instruction Method provided on the next page.

- In groups discuss the strategies of teaching these concepts in class using the headings below to guide your discussion.

Instructional model used to teach new concepts			
		What can you use?	What will you do?
1	ENGAGE	Capture learners' attention Get attention by engaging them on an activity / demonstration Ask a question Pose a problem	
2	EXPLORE	Resolve problem Use their experience Teacher provides background, information, materials Observe and listen	
3	EXPLAIN	Teacher directs learners to first two steps and asks for explanations Teacher puts the explanations into subject terminology and procedures	
4	ELABORATE	Teacher challenges with a new example or situation Encourages interaction with new sources Expand, enrich, extend concepts	
5	EVALUATE	Include formative assessment Summative assessment at the end of a concept Learners receive feedback Teachers report on outcomes	

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

MODULE 6

Managing Technology

ACTIVITY 14 Managing the Mini-PAT

OUTCOME

At the end of this activity participants must be able to explain the process to manage the implementation of the Mini PAT in a class.

METHOD In Pairs

INSTRUCTIONS

Resources

NCS CAPS SP Technology, any approved textbook and Annexure 4

- Read the note below and respond to instructions 14.1- 14.3

Note

Each term requires learners to complete a Mini – Practical Assessment Tasks (Mini-PAT) and a Test or Examination as part of their formal recorded School Based Assessment (SBA).

14.1 View the Annual Teaching Plan as set out in the NCS CAPS SP for Grades 8 and 9 Technology across terms 1-4.
(See Annexure 4 as an example for Grade 8 Term 2).

14.2 Select a grade and a term and use the template provided on the next page to note how the Mini PAT is structured to assist learners to develop relevant knowledge and skills.

14.3 The Enabling activities are meant to prepare learners to perform well in their Formal Assessment Tasks (Mini – PAT / Examination/test) conducted in each term. Refer to the CAPS in your selected grade and term and explain how these are presented in the planning tables.

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

Min-PAT Planning Table 14. 2

Grade 8/9	**Term:** 1, 2, 3, or 4
Context	
Content	
Expected Skills	
Time Allocation	
Resources required	

Managing Technology

ACTIVITY 15: Roles and Responsibilities of the Head of Department / Subject Head

OUTCOME

At the end of this activity participants must be able to list the key activity an HOD is responsible for to manage effective curriculum implementation.

METHOD In pairs

INSTRUCTIONS

Resources:

Annexure 5: Head of Department (HOD) roles and responsibilities, Annexure 6: Process Map for the Framework for Managing Quality Curriculum Implementation

- Study the Job Description of an HOD as presented in Annexure 5 and list the key responsibilities outlined in this policy that will assist an HOD with the effective management of his/her Department.

- Compare your list of key responsibilities with the aspects listed in the process Map for the Framework for Managing Quality Curriculum Implementation (Annexure 6) and explain your responsibility in support of the following:

The Teacher/s allocated to Teach the Subject:

The Teaching and Learning Pace:

Monitoring Learner Performance:

The Quality of the Assessments set by Teachers:

Recording of Assessment:

Provision of LTSM:

Provision of Consumable Resources:

WRAP UP

- **Feedback by participants**
- **Consolidation by facilitator**

Managing Technology

ACTIVITY 16 Monitoring Teaching, Learning and Assessment

OUTCOME

At the end of this activity participants must be able to explain the importance of monitoring curriculum implementation.

METHOD In pairs and in groups

INSTRUCTIONS

Resources: Annexure 7: Monitoring the Annual Teaching Plan; **Annexure 8:** HOD-Overview Monitoring Summary; **Annexure 9**: Technology Moderation Tool for Test / Examinations: **Annexure 10** Moderation Tool for the Mini-PAT; **Annexure 11**: District Support- School Visit Instrument.

- In pairs discuss briefly the use of templates to monitor and support teaching, learning and assessment in schools.

- List two benefits for the use of templates to monitor teaching, learning and assessment.

- The facilitator will allocate each group of four with two of the annexures listed above
- In your group discuss the two allocated annexures and present a SWOT analyses for each on a sheet of newsprint.

SWOT ANALYSES:

STRENGTHS	WEAKNESSES
OPPORTUNITIES	THREATS

WRAP UP

- **Feedback by participants** and share good practices.
- **Consolidation by facilitator**

THANK YOU FOR YOUR PARTICIPATION

Annexures

Annexure 1

Graphic Communication Skills (NCS CAPS Technology page 50)

Technology Drawing Sketches and Working Drawings	Grade 7	Free-hand sketching. 2D view of one face drawn to scale with correct line types and dimensions. 3D oblique technique: 45° cabinet projection to scale with correct line types and dimensions. Line types: outlines, construction lines, hidden detail.
	Grade 8	Free-hand sketching. 2D view of one face drawn to scale with correct line types and dimensions according to conventions. 3D isometric projection 30°: drawn using underlying grid to scale with correct line types and dimensions. Line types: outlines, construction lines, hidden detail lines, centre lines, wavy lines.
	Grade 9	Free-hand sketching. 2D working drawings in first angle orthographic projection: elementary use of instruments. 3D isometric projection: 30° drawn using underlying grid to scale, correct line types and dimensions. Line types: outlines, construction lines, hidden detail lines, centre lines, wavy lines. Dimensioning: conventions, arrows. **Drawing boards NOT required.**
Artistic Drawing Sketches and Presentation Graphics	Grade 7	Single vanishing point perspective; texture rendering; colour.
	Grade 8	Double vanishing point perspective; texture rendering; colour; shading.
	Grade 9	Single and double vanishing point perspective; texture rendering; shading; colour; shadows. The Grade 9 learner should demonstrate progress in skill levels relative to previous grades.

Annexure 2

2.1 Isometric Drawing: Marking Guidelines for the teacher:

Description	Marks allocated	Learner marks
Line work (consistency and corners)	**6**	
Neatness of the drawing (presentation)	**3**	
Isometric Correctness (interpretation 30°)	**4**	
Layout (use of space on the page/planning)	**2**	
Scale (writing and proportionality of the drawing)	**1**	
Title	**1**	
Name (Initial and Surname)	**1**	
Frame	**2**	
TOTAL	**20**	

2.2 Perspective Drawings: Marking Guidelines for the teacher:

Description	Marks allocated	Learner marks
Line work (consistency and corners)	**6**	
Neatness of the drawing (presentation)	**3**	
Perspective correctness (interpretation)	**2**	
Layout (use of space on the page/planning)	**2**	
Scale (writing and proportionality of the drawing)	**1**	
Projection Lines (consistency and sufficiency)	**4**	
Vanishing points and Horizon line	**2**	
TOTAL	**20**	

Annexure 3

Mechanical Systems

Mechanisms can help you to move things. To get an object to move, you need to push it or pull it. A push or pull is called a **force.** That force will make the object move over a **distance. Force and distance** are the two important things that are **changed by a mechanism.** Some mechanisms change a small input force over a large distance into a large output force over a small distance. **You can say that the mechanisms have a mechanical advantage,** but a **distance disadvantage.** You get a mechanical advantage when a machine makes it easier to lift or move something. Other mechanisms change a large input force over a small distance, into a small output force over a large distance. You can say that the mechanisms have a mechanical disadvantage, but a distance advantage. You get a **distance advantage when a machine makes something move further.**

Whenever you look to see how a mechanism works, try to understand what is happening to the **input force (driver mechanism) and the output force (driven mechanism).** Also try to understand what is happening to the **input distance and the output distance**. A distance advantage is often also a speed advantage, because if something moves further in the same time, it also moves faster.

Concept	Explanation	Formula
Speed ratio	When a small **pulley** is used to drive a large pulley, then the large pulley rotates more slowly than the smaller pulley (The ratio of the distance moved by the effort (input / driver) to the distance moved by the load (output / driven)	$SR = \frac{\text{Circumference of driven pulley}}{\text{Circumference of driver pulley}}$
Velocity ratio		$VR = \frac{\text{Diameter of driven pulley}}{\text{Diameter of driver pulley}}$
Gear ratio	When a small **gear** is used to drive a large gear, then the large gear rotates more slowly than the smaller gear (Same as velocity ratio	$GR = \frac{\text{Number of teeth on driven gear}}{\text{Number of teeth on driver gear}}$
		$GR = \frac{\text{Rotational speed of input axle}}{\text{Rotational speed of output axle}}$
		$GR = \frac{\text{Turning force on output axle}}{\text{Turning force on input axle}}$
Mechanical Advantage	This is a force advantage. It is calculated by dividing the effort force in Newtons into the load force in Newtons. It is expressed as a Unit. **(10 N force = 1 Kg)**	$MA = \frac{\text{Load / output}}{\text{Effort / input}}$

Note:

1. **Input** refers to the **Driver** mechanism; and **Output** refers to the **Driven** mechanism.
2. Rotational Speed is recorded in revolutions per minute (rpm)
3. Force is measured in Newtons (N)

Annexure 4

Grade 8 Term 2 Teaching Plan

Extract from the NCS CAPS Technology page 24

GRADE 8 TERM 2		
It is compulsory to cover the given scope in the term indicated. The sequence of the work within the term must be adhered to. Skills – investigating, drawing, designing, making and presenting should improve progressively from term to term.		
Hrs	**Focus**	**Content, concepts and skills** **Enabling Tasks**
2	**Impact of technology Processing** **Investigation skills** **Communication skills**	• **The positive impact of technology:** many natural materials have been replaced in modern times by new or improved materials. Some new materials are environmentally friendly by being bio-degradable. • **Case study 1:** investigate the impact of plastic shopping bags on the environment. • **Report**: learners write a report evaluating the effectiveness of using thicker, bio-degradable plastic shopping bags which shoppers must buy.
2	**Investigation skills**	• Case study 2: technology with a positive impact on society. - Investigate how waste paper and cardboard are recycled to produce new products for the packaging industry. • Development: draw a development of an opened container.
2	**Designing skills** **Making skills**	• Practical activity: a product requires packaging. Design and make packaging for a purpose. The nature of the product determines the design and properties of the packaging material. • Learners work safely to make and assemble the above packaging product.
FORMAL ASSESSMENT TASK 2: Mini-PAT **TOPIC: Impact of technology / Processing / Structures** **CONTEXT: Will be given by materials developers** **CONTENT: Counteracting effects of negative technology [70%]**		
2	**Impact of technology** **Investigating skills**	• **Case study 3**: technological products can have a negative impact. • Investigate a technological product that can have a negative impact on society. • **Class discussion**: facilitate a class discussion on possible solutions that can counteract or compensate for the negative impact of the technology identified.
2	**Structures** **Processing**	• **Revise:** forces that act on material – tension; compression; bending; torsion; shear. • Adapting materials to withstand forces – reinforcing concrete, plywood. • Selecting metal sections (I-beam, angle iron, T-bar, etc.) to withstand forces and to save material.
2	**Design skills** **Making skills**	• **Design**: learners adapt a material or design a product that will solve the problem or reduce the impact or negative effects of the technology identified. • **Design**: learners sketch free-hand sketches showing two possible solutions. • **Make:** learners draw their chosen solution in 3D using isometric projection. • **Make**: learners make the model/prototype/product they have designed safely.
2	**Making skills** **Evaluation skills**	• **Make (cont.)**: Learners make the model/prototype/product they have designed safely. • **Evaluate**: learners evaluate their solution in terms of its effectiveness in solving or reducing the negative impact of the technology identified. Their evaluation will be assessed in terms of its objectivity, fairness, accuracy and scope (depth).
2	**Communication skills**	• Communicate: Teams present their plans, model and evaluation.
1	**Formal Assessment Task:** **Term Test** **[30%]**	
Formal Assessment: Term 2: **Weighting: 10% of promotion mark** **Mini-PAT: [70%]** **Formal Term Test: [30%]** **Total: 100%**		

Annexure 5

Extract: PAM document

4.4 Head of Department

(a) JOB TITLE: Educator – public school
(b) RANK: Head of Department (subject, learning area or phase)
(c) POST LEVEL: 2
(d) THE AIM OF THE JOB:
To engage in class teaching, be responsible for the effective functioning of the department and organise relevant/related extra-curricular activities so as to ensure that the subject, learning area or phase and the education of the learners is promoted in a proper manner.

(e) CORE DUTIES AND RESPONSIBILITIES OF THE JOB:
The duties and responsibilities of the job are individual and varied, depending on the approaches and needs of the particular school, and include, but are not limited to, the following:

(i) TEACHING
- To engage in class teaching as per workload of the relevant post level and the needs of the school.
- To be a class teacher if required.
- To assess and to record the attainment of learners taught.

(ii) EXTRA- & CO-CURRICULAR
- To be in charge of a subject, learning area or phase.
- To jointly develop the policy for that department.
- To co-ordinate evaluation/assessment, homework, written assignments, etc. of all the subjects in that department.
- To provide and co-ordinate guidance:
  - on the latest ideas on approaches to the subject, method, techniques, evaluation, aids, etc. in their field, and effectively conveying these to the staff members concerned.
  - on syllabuses, schemes of work, homework, practical work

To control:
- the work of educators and learners in the department
- reports submitted to the Principal as required
- mark sheets
- test and examination papers as well as memoranda
- the administrative responsibilities of staff members

- To share in the responsibilities of organising and conducting of extra and co-curricular activities.

(iii) PERSONNEL
- To advise the Principal regarding the division of work among the staff in that department.
- To participate in agreed school/educator appraisal processes in order to regularly review their professional practice with the aim of improving teaching, learning and management.

(iv) GENERAL / ADMINISTRATIVE

- To assist with the planning and management of:
  - school stock, text books and equipment for the department
  - the budget for the department and
  - subject work schemes

- To perform or assist with one or more non-teaching administrative duties, such as:
  - secretary to general staff meeting and/or others
  - fire drill and first aid
  - timetabling
  - collection of fees and other monies
  - staff welfare
  - accidents

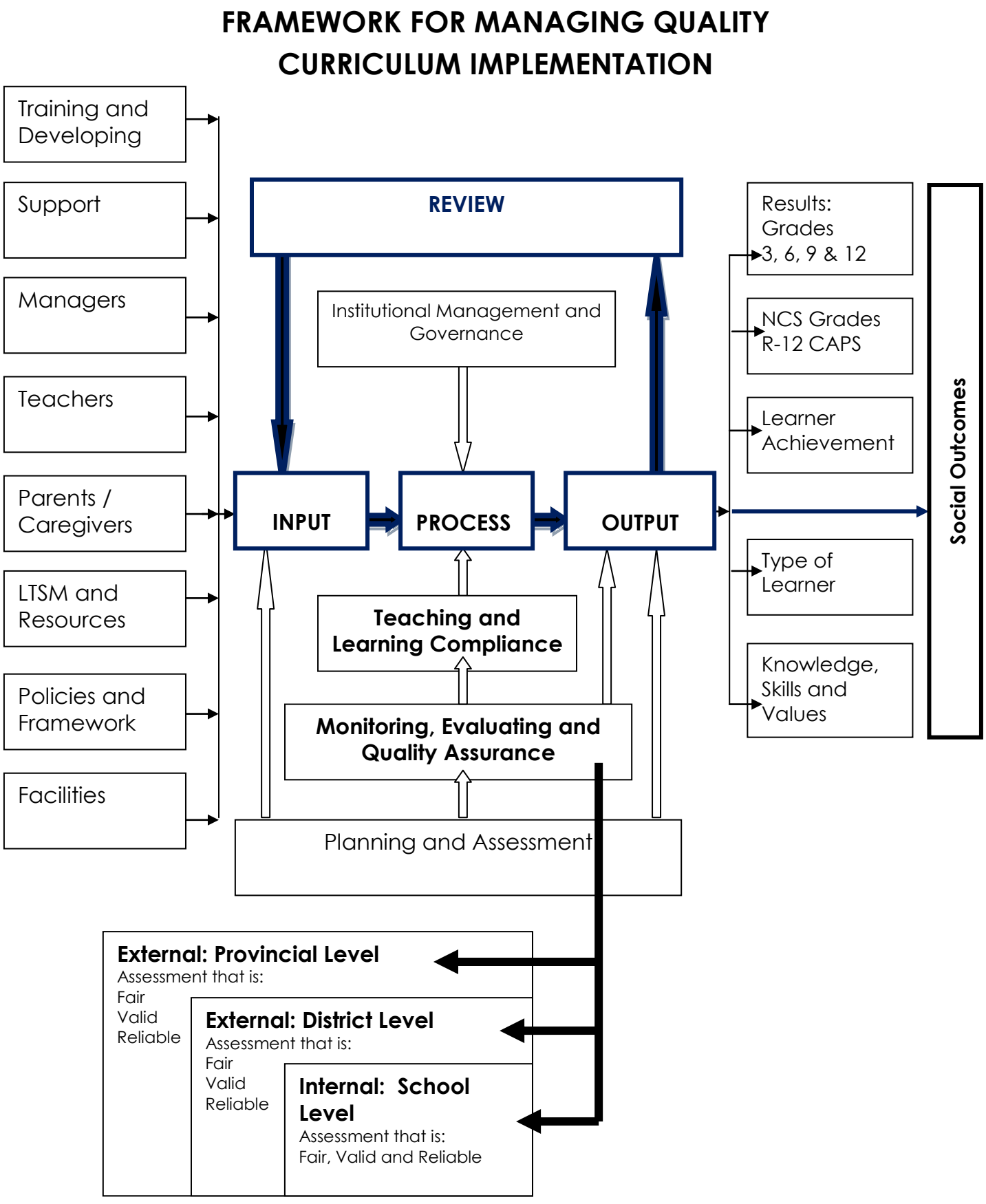
- To act on behalf of the Principal during her/his absence from school if the school does not qualify for a Deputy Principal or in the event both of them are absent.

(v) COMMUNICATION:

- To co-operate with colleagues in order to maintain a good teaching standard and progress among the learners and to foster administrative efficiency within the department and the school.
- To collaborate with educators of other schools in developing the department and conducting extra-curricular activities.
- To meet parents and discuss with them the progress and conduct of their children.
- To participate in departmental and professional committees, seminars and courses in order to contribute to and/or update one's professional views/standards.
- To co-operate with Further and Higher Education institutions in relation to learners' records and performance and career opportunities.
- To maintain contact with sporting, social, cultural and community organisations.
- To have contacts with the public on behalf of the Principal.

REF: *Employment of Educators Act 76 of 1998*

Annexure 6
Process Map



Annexure 7

7.1 MONITORING THE ANNUAL TEACHING PLAN: GRADE 8 TERM 1

	Week	Content and concepts	Hours	Syllabus completion (%)	Date completed	Notes / Comments
TERM 1	1	Frame structures Definition of *frame* structures Case study: Electrical pylons	**2**	**2.5**		
	2	Structures-Structural members	**2**	**5**		
	3	Communication Purpose of graphics, convention	**2**	**7.5**		
	4	Communication Working drawings and artistic drawings	**2**	**10**		
	5	Mechanical Systems and Control-Wedges wheels and axles, gears Investigation skills	**2**	**12.5**		
	6	Structures-design and make a structure utilizing required structural components and mechanisms to suit the context provided.	**2**	**15**		
	7	**Evaluate** examine information on several complex structures and list advantages and disadvantages in the designs	**2**	**17.5**		
	8	Design	**2**	**20**		
	9	Make a working drawing in 2D. Communicate a sketch in double VP Perspective	**2**	**25**		
	10	Formal Test	**1**			

Intervention and turnaround strategy (if the teacher has not completed the ATP):

7.2 MONITORING THE ANNUAL TEACHING PLAN: GRADE 8 TERM 2

	Week	Content and concepts	Hours	Syllabus completion (%)	Date completed	Notes / Comments
TERM 2	1	Impact of Technology Processing. Investigation Case Study 1 and Report	2	28.12		
	2	Communication Skills Case Study 2 Investigate waste paper. Draw Development of an opened container.	2	31.25		
	3	Design and make packaging for a purpose. Communication	2	34.37		
	4	Impact of Technology Investigating skills-Case Study 3. Investigate a technological product that can have a negative impact on society.	2	37.5		
	5	Structures processing. Revise forces that act on material. Adapt material to withstand forces. Select metal sections to withstand forces	2	40.62		
	6	Design Skills-Learners adapt a material or design a product to solve a problem Sketch free-hand sketches Making.-Learners draw their chosen solution in 3D. Learners make the model/prototype.	2	43.75		
	7	Making- Learners make the model/prototype. Evaluate-the solution.	2	46.87		
	8	Communication-Teams present their plans, model and evaluation.	2	50		
	9	Term Test	1			

Intervention and turnaround strategy (if the teacher has not completed the ATP):

7.3 MONITORING THE ANNUAL TEACHING PLAN: GRADE 8 TERM 3

	Weeks	Content and concepts	Hours	Syllabus completion	Date completed	Notes / Comments
Term 3	1	Mechanical Systems and Control-Revise Single levers and levers linked in pairs-Gear systems.	2	52.7		
	2	Mechanical Advantage calculations.-Calculate mechanical advantage for levers using ratios Mechanical advantage calculations for gears using ratios. Calculations using tooth ratios. Gear wheel diameters, velocity ratios.	2	55.4		
	3	Communication Skills-Represent gears graphically. Design-write a design brief. Draw an isometric projection.	2	58.1		
	4	Design-Sketches (2D) System analysis-Bicycle gear system. Investigation –Analyse a mechanical system-draw a systems diagram. Design-Plan a mechanical system for gear train with driven gear faster than the driver.	2	60.8		
	5	Investigating-Impact of technology-Impact on environment as result of acid mining OR dust pollution OR iron age technology OR indigenous mining of iron OR Gender bias in career choices.	2	63.5		
	6	Investigation Lifting mechanisms in South –African mines Design-Initial idea sketches to meet requirements in scenario. Design Brief with specifications and constraints.	2	66.4		
	7	Evaluation-Simulations teams form mechanical engineering companies. Evaluate sketches of individuals. Making-learners draw 3D Drawings for a shaft head-gear and 2D working drawings.	2	69.3		
	8	Design Skills-prepare a realistic budget. Making skills-Build their working model	2	72		
	9	Communicate-Teams present their tender proposal for the mine shaft headgear.	4	75		
	10	Formal Test	1			

Intervention and turnaround strategy (if the teacher has not completed the ATP):

7.4 MONITORING THE ANNUAL TEACHING PLAN: GRADE 8 TERM 4

	Weeks	Content and concepts	Hours	Syllabus completion (%)	Date completed	Notes / Comments
TERM 4	1	Electrical systems and control Design skills	2	78.57		
	2	Impact of/bias in technology Evaluation skills Bias in technology	2	82.14		
	3	Electrical systems and control Impact of Technology	2	85.71		
	4	Electrical systems and control Impact of Technology	2	89.28		
	5	Design skills Investigation skills	2	92.85		
	6	Investigation skills	2	96.42		
	7	Design skills Making skills Communication Skills	2	100		
	8	End of Year Exam				

Intervention and turnaround strategy (if the teacher has not completed the ATP):

7.5 MONITORING THE ANNUAL TEACHING PLAN: GRADE 9 TERM 1

	Week	Content and concepts	Hours	Syllabus completion (%)	Date completed	Notes / Comments
TERM 1	1	Design skills-First angle orthographic projection	2	2.5		
	2	Design skills-More Complex 3D objects drawn in Orthographic projection with instruments	2	5		
	3	Structures- Forces (Static or dynamic) Properties of construction materials.	2	7.5		
	4	Investigation skills-investigate the scenario given.	2	10		
	5	Design skills Sketch initial ideas – Evaluate and adapt. Design Brief and Flow chart	2	12.5		
	6	Making skills-Working Drawings Costing-budget.	2	15		
	7	Making skills- Model of a viable solution	2	17.5		
	8	Evaluation skills-Teams collaborate to produce an evaluation instrument.	2	20		
	9	Communication skills- Team presentations	2	25		
	10	Formal Test	1			

Intervention and turnaround strategy (if the teacher has not completed the ATP):

7.6 MONITORING THE ANNUAL TEACHING PLAN: GRADE 9 TERM 2

	Week	Content and concepts	Hours	Syllabus completion (%)	Date completed	Notes / Comments
TERM 2	1	Mechanical systems and control-Revise pneumatic and hydraulic systems Investigation skills-research Pascal's principles	2	28.125		
	2	Investigation skills-Investigate the hydraulic Jack.	2	31.25		
	3	Investigation skills- Single Wheel fixed and moveable pulleys. Ratchet and pawl	2	34.375		
	4	Mechanical systems and control-Revise different types of gears.	2	37.5		
	5	Evaluation skills Design skills Communication Skills-Examine different items using mechanisms. Draw a 3D wooden object in single VP perspective.	2	40.625		
	6	Investigation skills Design skills-Investigate the situation for an appropriate machine to be designed Write a design brief produce two sketches of possible designs	2	43.75		
	7	Making skills-Plan: Working drawings-Make prototype	2	46.875		
	8	Communication skills-Team Presentations	2	50		
	9	Formal Test				

Intervention and turnaround strategy (if the teacher has not completed the ATP):

7.7 MONITORING THE ANNUAL TEACHING PLAN: GRADE 9 TERM 3

	Week	Content and concepts	Hours	Syllabus completion (%)	Date completed	Notes / Comments
TERM 3	1	Electrical systems and control Cells and lamps in series Investigation skills-Ohms law quantitatively	2	52.7		
	2	Electrical systems and control-Resistor colour codes	2	55.4		
	3	Electronic systems and control-Switches, diodes, transistors	2	58.1		
	4	Electronic systems and control- sensors, capacitors	2	60.8		
	5	Electronic systems and control-Simple electronic circuits	2	63.5		
	6	Investigation skills Design skills-Design Brief and sketches	2	66.4		
	7	Making skills-Plans and working drawings and make prototype	2	72		
	8	Communication skills-Team presentations.	2	75		
	9	Formal Test	2	25		

Intervention and turnaround strategy (if the teacher has not completed the ATP):

7.8 MONITORING THE ANNUAL TEACHING PLAN: GRADE 9 TERM 4

	Week	Content and concepts	Hours	Syllabus completion (%)	Date completed	Notes / Comments
TERM 4	1	Processing Preserve metals,	2	78.57		
	2	Processing Indigenous technology preserve food	2	82.14		
	3	Processing Investigation skills plastics	2	85.71		
	4	Processing Investigation skills Case study	2	89.28		
	5	Investigation skills Case studies plastics on modern cars and around the home	2	92.85		
	6	Design skills-Sketch Making skills-Skills development	2	96.42		
	7	Making skills-work safely-assemble product Communication skills Learners compile records of work	2	100		
	8	Final examination	2			

Intervention and turnaround strategy (if the teacher has not completed the ATP):

Annexure 8

HOD – OVERVIEW MONITORING SUMMARY

Purpose of the tool:
To evaluate if monitoring systems are effective with reference to class visits, teachers' files, and learners' workbooks

Year: _____ Term:_____
Subject:_____

Name of teachers'	Dates the HOD check the teachers' file	Completed	Dates the HOD conducted class visits	Completed	Dates the HOD controlled learners' workbooks	Class

N.B.: *A copy of each teacher's class visit moderation and learners' workbook control report must be attached to this summative report. This report forms part of the HOD's report to the Deputy Principal and Principal for purposes of compiling a quarterly report for the District. Subject Advisers' may require it during their support and monitoring visits to the school.*

- **Areas of success within the department/phase/grade/subject with reference to the above areas:**

  _____
  _____
  _____

- **Problem areas or weaknesses within the department/phase/grade**:

  _____
  _____
  _____

- **Intervention:**

  _____
  _____
  _____

SIGNATURE OF HOD:
_____

Date:
_____

SCHOOL STAMP

Annexure 9

TECHNOLOGY MODERATION TOOL TESTS/EXAMINATION

Minimum evidence of 6 learners to be moderated per Grade – 2 above average, 2 average and 2 below average.		
NAMES OF LEARNERS WHOSE TASKS WERE MODERATED	**MARK/LEVEL ALLOCATED BY TEACHER**	**MARK/LEVEL ALLOCATED BY MODERATOR**
1.		
2.		
3.		
4.		
5.		
6.		

ASSESSMENT TASK	**YES**	**NO**	**COMMENT**
Does the task correspond with the **programme of assessment?**			
Is the task dated?			
Is the **duration** of the task indicated?			
Is there evidence that daily teaching and learning took place regarding the content of the formal activity?			
Does the task reflect the **topic** and **content** of the topic?			
Are the **instructions** clear?			
Does the task have a proper layout, free of spelling and grammatical errors, include clear and legible extracts/sketches?			
Is the language appropriate to the grade and subject?			
Does the task incorporate the different **cognitive levels e.g.** Blooms' Taxonomy?			
Is the **cognitive level grid** completed and submitted with the test/exam?			
ASSESSMENT TOOL			
Are the **assessment tools** e.g. rubric, memoranda, checklists, etc. for every assessment task included in the educator's file?			
Is the assessment tool appropriate to the task?			
Does the assessment tool make provision for various alternatives responses?			
MARKING			
Did the teacher sign and dated the task after marking?			
Did the educator include constructive feedback?			
Is **marking** done according to the assessment tool?			
RECORDING TOOL			
Is the mark sheet included in the file?			
Do the **learners' marks** corresponds with the mark sheet?			

Annexure 10

MODERATION TOOL FOR MINI-PAT: **Grade:** _____ **Term:** _____

	CRITERIA	**YES**	**NO**	**COMMENTS / RECOMMENDATIONS**
1.	Was the sequence of the activities followed as required by CAPS?			
2.	Full coverage of required content, concepts and skills			
3.	Were clear instructions given for each activity/task?			

	SKILLS *ADDRESSED (tick (✓) relevant skills)*					**SKILLS *<u>ASSESSED</u>* (tick (✓) relevant skills)**				
4.	Investigate	Design	Making	Evaluating	Communicating	Investigate	Design	Making	Evaluating	Communicating

5.	**MARKS ALLOCATED FOR DIFFERENT SKILLS**	__/__	__/__	__/__	__/__	__/__
	TOTAL NUMBER OF LEARNERS PER GRADE	Grade 7: _____		Grade 8: _____		Grade 9: _____
	NUMBER OF MINI-PATS MODERATED	Grade 7: _____		Grade 8: _____		Grade 9: _____
	TOTAL MARK FOR MINI-PAT	_____				

	CRITERIA	YES	NO	COMMENTS / RECOMMENDATIONS
6.	Does the mark allocation meet the 70% CAPS requirement for the term?			
7.	Does the practical work cover 40 marks out of the possible 70 marks (57% of total – CAPS page 41)			
8.	Is the assessment tool available and correct (in case of memorandums)			
9.	Was an analytical rubric used to assess the skills?			
10.	Were the models / prototypes available in order to verify the mark allocation?			
11.	Was the assessment fair and transparent?			
12.	Do the marks of the group / learner correlate with recording sheet?			
13.	**GENERAL REMARKS:**			
	Date of moderation:	**Signature of HOD:**		**Signature of teacher:**
14.	**IN CASE OF RESUBMISSION:**	**Date of resubmission:** _____		

Annexure 11
SENIOR PHASE: TECHNOLOGY

District Support

School visit Instrument

School:	Name of teacher:	Subject : *Technology* Grade:	Topic:
Description of School Context / Challenges:			

		COMPONENT	What the teacher does well	Areas for develop-ment
Preparation of Lesson	**1**	CAPS Aligned		
	2	Skill building activities identified		
	3	Relevant terminology Identified		
	4	Organised and structured		
	5	Resources identified		
	6	Textbook / workbook		
Teaching	**1**	Motivation		
	2	Presentation / Explanation		
	3	Opportunities for Consolidation / Review (notebook, prac. etc)		
	4	Learners' response: expressing ideas using terminology		
	5	Learners write in full sentences		
	6	Teacher audible		
	7	Teacher models good language		
	8	Code switching as intervention		
Teaching & learning materials	**1**	Suitable & Adequate		
	2	Relevant		
	3	Effectiveness		
	4	Quality of technical skills		
	5	Word wall appropriate & utilised		
Classroom Management	**1**	Control & discipline		
	2	Classroom Climate		
	3	Time management		
	4	Learner attention & participation		
	5	Learner Rapport and interaction		
	6	Eye contact and individual attention		
Chalk / White board management	**1**	Clear and explicit		
	2	Writing and spelling		
	3	Spacing & neatness		
	4	Lettering and drawing		
	5	Cleaning		
Notebook and /or workbook	**1**	Each learner has a notebook / workbook		
	2	Written Work in line with teaching activities		
	3	Writing in full sentences where appropriate		
	4	Formal assessment instruction and Assessment instrument		
	5	Marked, signed and constructive feedback		

Comment on what the teacher does well:

Recommendations:

Follow up:

Signature: Teacher: …… **Subject Head / HOD**……..

Signature: **Subject Adviser**: ……

Date:…….

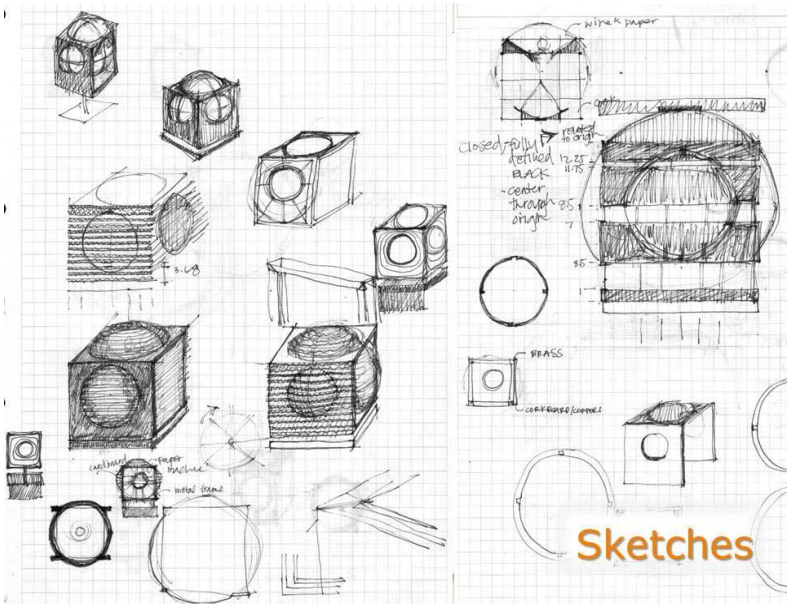
Annexure 12

THE VISION

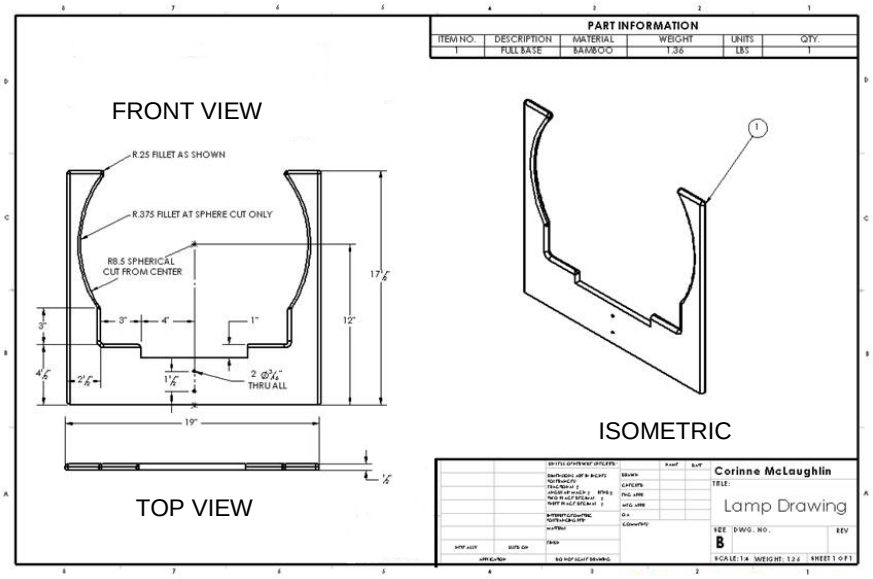
http://www.designsojourn.com/do-i-have-to-be-able-to-draw-well-to-be-a-good-designer/

THE PROCESS:

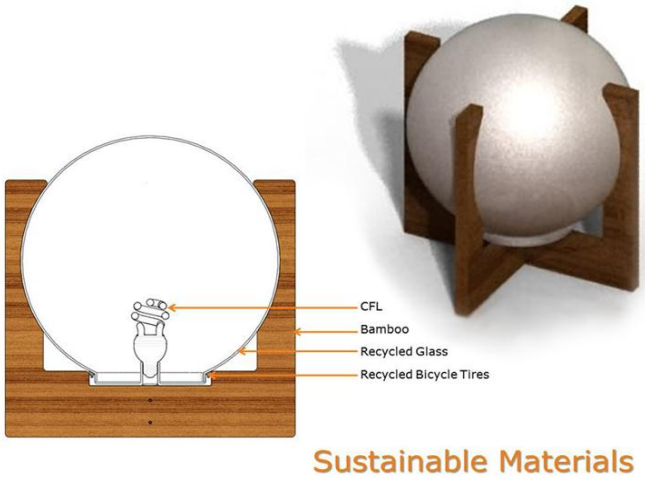
DESIGN SKETCHES



FORMAL DRAWINGS



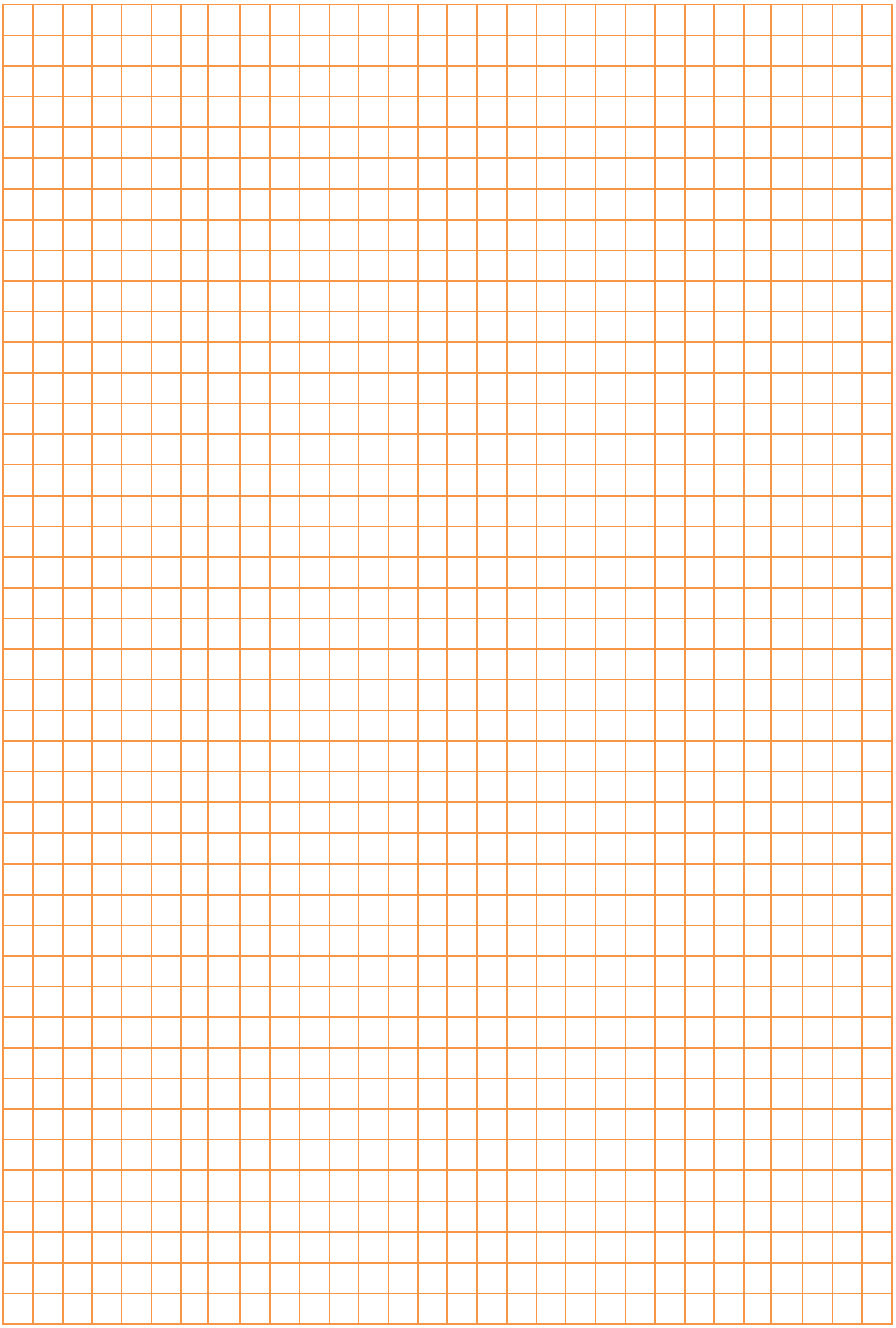
PRODUCT



Annexure 13

Annexure 14

Annexure 15



Annexure 16