ECZ COMPETENCE-BASED ASSESSMENT

DESIGN AND TECHNOLOGY (8015)

Component 1: School Based Assessment

Competence-Based Assessment Tasks, Marking Guides and Project Rubrics

Level: Certificate of Secondary Education, Ordinary Level (Forms 2 and 3)

Basis: ECZ ECSEOL Assessment Schemes, Chapter 19 (Design and Technology – 8015); Design and Technology Syllabus, Forms 1–4 (CDC, 2024)

Contents: 6 summative tests (Form 2 and Form 3, three per Form, 15 marks each) with marking guides; research project (portfolio and artefact) brief and rubrics; marks record sheet

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1. Overview of the SBA

The ECZ Assessment Scheme for Design and Technology sets Component 1 (School Based Assessment) from Form 2 to Form 3. It is set, administered and marked by the subject teacher. The SBA has two parts: summative tests written in Form 2 and Form 3, and a two-year research project made of a portfolio (Part 1) and an artefact (Part 2).

1.1 Structure and marks

Task	Form	Number of tasks	Marks
Summative tests	Form 2	3 tests (one per term), 10 items in total	45
Summative tests	Form 3	3 tests (one per term), 13 items in total	45
Research project – Part 1: Portfolio	Form 2 to 3	1 theme (set by ECZ)	79
Research project – Part 2: Artefact	Form 2 to 3	1 artefact	31
Total			**200**

Note on weighting. The ECZ scheme is not consistent on the SBA total and weighting (it shows 200 marks in the test-design table, 300 marks and 50% in the text, and 30% in the summary table). This pack follows the detailed test-design table. Confirm the marks and weighting in the ECZ School Based Assessment Guidelines before converting learners' marks for submission.

1.2 Test framework

Every test uses realistic Zambian scenarios followed by tasks. There are no multiple choice questions. The tests are drawn from all four Elements of Construct (EoC):

- **EoC 1** – Utilises various materials and techniques to produce items while adhering to safety procedures
- **EoC 2** – Generates and develops graphical representations and models
- **EoC 3** – Designs and constructs innovative systems
- **EoC 4** – Develops and implements a business idea

Test	Term	Content focus	Items	Marks by EoC	Marks
Form 2 Test 1	Term 1	Manufacturing processes; Graphic communication (plane geometry)	3	1: 9; 2: 6	15
Form 2 Test 2	Term 2	Environmental management; Pictorial drawing and surface development; Electrical circuits	3	1: 4; 2: 6; 3: 5	15
Form 2 Test 3	Term 3	Structural forces; Pulleys and belts; Design process; Budgeting and business records	4	2: 5; 3: 6; 4: 4	15

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Test	Term	Content focus	Items	Marks by EoC	Marks
Form 3 Test 1	Term 1	Hardware and manufacturing; Logos and computer aided design	4	1: 8; 2: 7	15
Form 3 Test 2	Term 2	Plane geometry (special curves, loci); Solid geometry; Surface development	4	2: 15	15
Form 3 Test 3	Term 3	Energy conservation; Cells and batteries; Structures; Gears; Winding up a business	5	3: 12; 4: 3	15

Cognitive levels (revised Bloom's): RE = remembering, UN = understanding, APP = applying, AN = analysing, EV = evaluating, CR = creating. Each test carries a mix of levels; the tasks that follow the scenario ask learners to apply, analyse or create, not only to recall. The key competences assessed are analytical thinking, creativity and innovation, critical thinking, problem solving and communication, together with financial education, entrepreneurship, environmental sustainability and digital literacy.

1.3 Elements of Construct and specific competences assessed

The table shows the Element of Construct (EoC) and the specific competences (syllabus references) assessed in the tests. The item-by-item detail is in each test's specification.

Syllabus ref.	Specific competence (learner can…)	Assessed in
EoC 1: Utilises various materials and techniques to produce items while adhering to safety procedures		
2.1.1.1	Cut screw threads	F2T1 Item 2
2.1.1.2	Apply heat treatment processes on metals	F2T1 Item 1
2.1.2.1	Manage waste	F2T2 Item 1
3.1.1.1	Join materials using fasteners	F3T1 Item 1
3.1.2.1	Mount fittings	F3T1 Item 1
3.2.1.1	Produce components by casting	F3T1 Item 2
EoC 2: Generates and develops graphical representations and models		
2.2.2.1	Construct circles from given data	F2T1 Item 3
2.2.2.2	Construct tangents and arcs from given data	F2T1 Item 3
2.2.3.1	Produce pictorial drawings	F2T2 Item 2
2.2.4.1	Produce surface development of solids	F2T2 Item 2
2.7.1.1	Apply the design process stages to problem solving	F2T3 Item 3
3.3.1.1	Produce logos	F3T1 Item 3
3.3.3.1	Produce Computer Aided Designs in 3-Dimension	F3T1 Item 4
3.3.4.1	Construct special curves	F3T2 Item 1
3.3.4.2	Plot the locus of a point on link mechanisms	F3T2 Item 2

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Syllabus ref.	Specific competence (learner can…)	Assessed in
3.3.5.1	Produce pictorial drawings incorporating circles and arcs	F3T2 Item 3
3.3.5.2	Draw exploded views	F3T2 Item 3
3.3.6.1	Draw surface developments of solids	F3T2 Item 4
EoC 3: Designs and constructs innovative systems		
2.3.1.1	Construct electrical circuits	F2T2 Item 3
2.4.1.1	Analyse the effects of forces on structures	F2T3 Item 1
2.5.1.1	Apply pulleys and belts in problem solving	F2T3 Item 2
3.4.1.1	Apply ways of conserving energy	F3T3 Item 1
3.4.2.1	Utilise cells and batteries in problem solving	F3T3 Item 2
3.5.1.1	Construct structures	F3T3 Item 4
3.6.1.1	Apply gears in problem solving	F3T3 Item 3
EoC 4: Develops and implements a business idea		
2.8.1.2	Prepare a budget for a business	F2T3 Item 4
2.9.1.1	Manage business records	F2T3 Item 4
3.8.1.1	Winding-up a business venture	F3T3 Item 5

1.4 Notes for the teacher

- Give each test as a timed class test in the term shown (suggested time: 30 minutes). Learners need drawing instruments (compass, set squares, rule, pencils) and A4 drawing paper for the drawing tasks.
- All measurements are in millimetres. Construction lines must remain visible; do not award construction marks for a traced or freehand answer.
- Marking guides show the expected response and where each mark is awarded. Accept any correct alternative answer that meets the task. Where "any one/two" is shown, award only the number required.
- Award follow-through marks where a later answer is correct from an earlier wrong value.
- You may change names, places and figures to suit your school, keeping the same level of demand and mark allocation. Keep marked scripts and drawings as evidence for verification by standards officers and ECZ.
- Learners with special educational needs may be given extra time or ancillary aids (see ECZ Chapter 29 on access arrangements).

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Form 2 – Test 1 (Term 1)

DESIGN AND TECHNOLOGY 8015/1 – SBA

Name:		**Class:**	
Date:		**Time allowed:**	30 minutes
Teacher:		**Total marks:**	15

Instructions

- Answer **all** items. The marks for each task are shown in brackets [ ] at the end of the task.
- Use drawing instruments for constructions unless "freehand" or "sketch" is stated. All dimensions are in millimetres. Do not rub out construction lines.

Item 1 [6 marks]

The Design and Technology club at Mansa Day Secondary School forged a cold chisel from a piece of discarded high-carbon steel (an old car leaf spring) for use in the school workshop. When the club tested the chisel on a mild steel bar, its cutting edge became blunt after only a few blows.

Task

(i) Name the heat treatment process that would make the cutting edge of the chisel harder and describe how it is carried out. **[3]**

(ii) After the process in (i), the chisel is very hard but brittle. State the process used to reduce the brittleness and explain how the club would know when the correct temperature has been reached. **[2]**

(iii) State one safety precaution the club must observe during the heat treatment. **[1]**

Item 2 [3 marks]

The club is making a stand for a bench vice. A 10 mm hole has been drilled in a mild steel plate and a bolt must screw directly into it. A mild steel rod also needs an external thread so that a nut can be fitted.

Task

(i) Name the tool used to cut the internal thread in the hole and the tool used to cut the external thread on the rod. **[2]**

(ii) Explain why cutting oil should be applied when cutting the threads. **[1]**

Item 3 [6 marks]

The school garden club wants a template for the badge of its plant nursery. The design is made of two separate circles joined by a straight line that touches both circles.

Task

(i) Using drawing instruments, draw two circles of diameter 40 mm and 60 mm with their centres 75 mm apart. **[2]**

(ii) Construct one external common tangent to the two circles. **[3]**

(iii) State one real-life product in which a tangent between two circles is applied. **[1]**

END OF TEST

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Form 2 – Test 1: Test Specification and Marking Guide

For the teacher only.

Test specification

Item	Element of Construct (EoC)	Specific competence(s) assessed	Levels	Key competences	Marks
1	**EoC 1:** Utilises various materials and techniques to produce items while adhering to safety procedures	2.1.1.2 Apply heat treatment processes on metals	UN, APP	Analytical thinking; Problem solving	6
2	**EoC 1:** Utilises various materials and techniques to produce items while adhering to safety procedures	2.1.1.1 Cut screw threads	RE, UN	Problem solving; Communication	3
3	**EoC 2:** Generates and develops graphical representations and models	2.2.2.1 Construct circles from given data 2.2.2.2 Construct tangents and arcs from given data	APP, UN	Creativity and innovation; Communication	6
				Total	**15**

Marking guide

Task	Expected response and mark allocation	Marks
Item 1 – total 6 marks **EoC assessed:** EoC 1 – Utilises various materials and techniques to produce items while adhering to safety procedures **Specific competence(s):** 2.1.1.2 Apply heat treatment processes on metals		
(i)	• Hardening [1] • Heat the steel slowly to a bright/cherry red colour (about 760–800 °C) [1] • Quench (cool rapidly) in water or oil [1]	**3**
(ii)	• Tempering [1] • Clean/polish the edge, reheat gently and watch the oxide colour; when the pale straw/light yellow colour appears, quench again [1]	**2**
(iii)	• Any one: wear goggles, gloves and an apron; hold hot metal with tongs; avoid splashing when quenching; work away from flammable materials; keep the work area clear [1]	**1**
Item 2 – total 3 marks **EoC assessed:** EoC 1 – Utilises various materials and techniques to produce items while adhering to safety procedures **Specific competence(s):** 2.1.1.1 Cut screw threads		
(i)	• Internal thread: tap (held in a tap wrench) [1] • External thread: die (held in a die stock) [1]	**2**
(ii)	• Lubricates and cools the tool / reduces friction and heat / gives a smoother thread / prevents the tool from breaking or jamming [1]	**1**

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Task	Expected response and mark allocation	Marks
Item 3 – total 6 marks **EoC assessed:** EoC 2 – Generates and develops graphical representations and models **Specific competence(s):** 2.2.2.1 Construct circles from given data; 2.2.2.2 Construct tangents and arcs from given data		
(i)	• Circles of correct diameters (40 mm and 60 mm) [1] • Centres 75 mm apart (±1 mm) [1]	**2**
(ii)	• Auxiliary circle of radius 10 mm (60/2 − 40/2 = 10) drawn from the centre of the larger circle [1] • Tangent drawn from the centre of the smaller circle to the auxiliary circle (semicircle on the line of centres used to locate the point of contact) [1] • Tangent line offset/projected so that it touches both circles accurately, with construction lines visible [1]	**3**
(iii)	• Any one: belt drive around two pulleys; chain and sprockets; conveyor belt; rounded profile of a badge or logo [1]	**1**

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Form 2 – Test 2 (Term 2)

DESIGN AND TECHNOLOGY 8015/1 – SBA

Name:		**Class:**	
Date:		**Time allowed:**	30 minutes
Teacher:		**Total marks:**	15

Instructions

- Answer **all** items. The marks for each task are shown in brackets [ ] at the end of the task.
- Use drawing instruments for constructions unless "freehand" or "sketch" is stated. All dimensions are in millimetres. Do not rub out construction lines.

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SBA Marks Record Sheet

Class: _____ Year: _____ Teacher: _____

Learner name	F2 T1	F2 T2	F2 T3	F3 T1	F3 T2	F3 T3	Tests /90	Portfolio /79	Artefact /31	Total /200

Each test is marked out of 15. Tests total = sum of six tests (90). Project total = portfolio + artefact (110).

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