

G12 ECZ DESIGN & TECHNOLOGY P2 2016 SPECIMEN SOLUTIONS

Design and Technology Paper 2 Specimen, 2016 (6045/2)

2 hours 30 minutes | Section A [30 marks, Q1-3 all] + Section B [70 marks, Q6 + 3 others]

Candidate Name _____

Centre Number				Candidate Number									

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Design and Technology

6045/2

Paper 2 (Theory & Design)

Additional Information:

Time 2 hours 30 minutes

Instructions to Candidates

Write your name, centre number and candidate number in the spaces at the top of this page and on the separate Answer Booklet provided.

There are **two** sections in this paper.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

If working is needed for any question, it must be shown in the space below that question.

Section B

Answer **any six** questions.

Write your answers in the Answer Booklet provided.

The **first** question is **compulsory** and then answer any other **three**.

All answers should be written in words or sentences and not symbols or formulae unless specified.

Where a diagram is required, it must be drawn to half full size with good lifework.

At the end of the examination:

- 1 fasten the Answer Booklet used securely to the question paper,
- 2 enter the numbers of the Section B questions you have answered in the grid under the bottom right side corner, "For **candidate use**"

Information for candidates

The number of marks is given in brackets [] at the end of each question or part of question.

All dimensions are in millimetres.

Cell phones are not allowed in the examination room.

For Candidate use	For Examiner's use
Section A	
Section B	
Total	

Section A [30 marks]

Answer all the question in the spaces provided on the question paper.

- 1 (a) **Figure 1** shows **two** types of joints a Grade 9 pupil made on two of his artifacts.

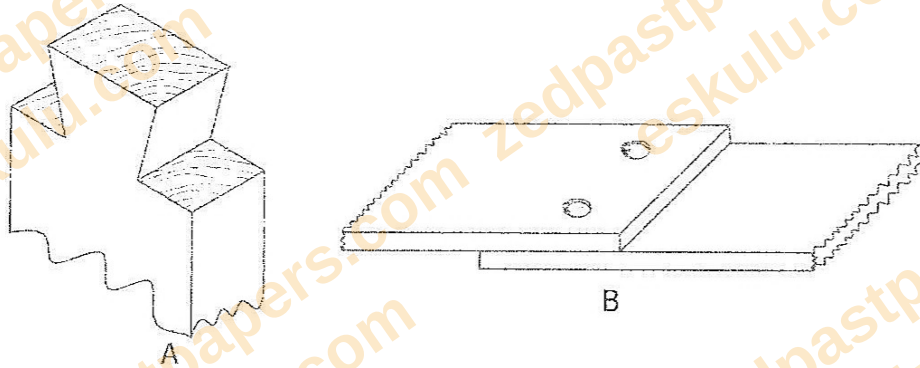


Figure 1

- (i) What tools (one on each) did he use?
- A** [1]
- B** [1]
- (ii) State where these joints can be applied (one on each).
- A** [1]
- B** [1]
- (iii) State the safety precaution you would consider when using the tools used for making joints **A** and **B**.
- A** [1]
- B** [1]

- (b) What would be the suitable material for making the tag in **figure 2**.

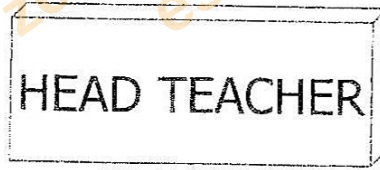


Figure 2

(i) [1]

(ii) State **two** reasons for your choice

(a) [1]

(b) [1]

(iii) Write **three** factors you need to take into consideration when buying screws.

(a) [1]

(b) [1]

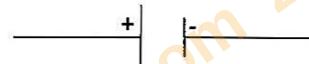
(c) [1]

Total 12 marks

2 **Figure 3** shows different symbols used in electrical and electronics drawings.

(a) State the function of each as used in the circuits.

(i)  [1]

(ii)  [1]

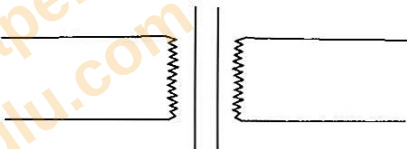
(iii)  [1]

Figure 3

- (b) Your classmate has been electrocuted in the workshop as you are working. What would be your first reaction?

.....
 [1]

- (c) (i) When bulbs are connected in series, the last bulb (s) will usually be dim. Give one reason for this

.....
 [1]

- (ii) What would you propose to be the solution to the dimming of the bulbs in (i).

.....
 [1]

Total 6 marks

- 3 One of the factors to consider when designing an artifact is how materials would be joined. The table below shows some joining situations.

- (a) Complete the table by adding the missing information

Joining situation	Joining medium to be used	Reasons for use
Veneer to block board		
Butt		
Tin plate to tin plate		
Brass to pine		

[Total: 12 marks]

Section B [70 marks]

Question 6 is compulsory. Answer any 3 other questions.

- 6** Study the figure below and refer to it as you answer the questions that follow:

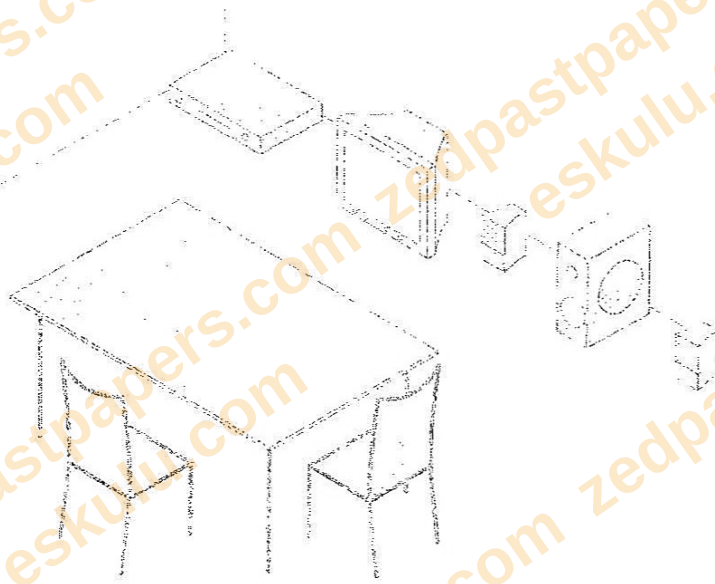


Figure 4

The situation in figure 4 is obtaining in your TV room at home.

- (a) (i) In your own words, write down the situation above. [1]
 (ii) What is the problem in the above situation? [1]
- (b) (i) Define design brief. [2]
 (ii) Write down the design brief leading to your solution. [2]
 (iii) Using annotated sketches, draw **one** possible solution for the situation above. [10]
- (c) One of the important factors to consider in the design of the suggested solution is the material(s).
 (i) List any **four** other specifications you have to consider when coming up with a design solution. [4]
- (d) (i) Suggest **one** suitable material for your solution. [1]
 (ii) Give **two** reasons for:
 - accepting the material in **d (i)** [2]
 - rejecting the material in **d (i)** [2]

Total 25 marks

- 7 **Figure 5** shows a circuit with resistors as shown.

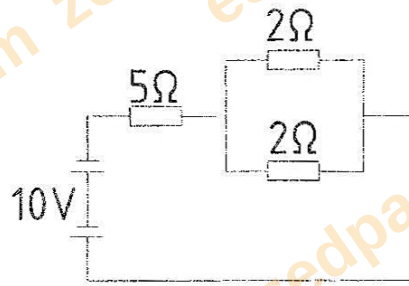


Figure 5

- (a) Calculate the resistance of the two resistors connected in parallel. [4]
- (b) Calculate the total resistance in the circuit assuming that there is no internal resistance in the voltage source. [4]
- (c) What is the total current in the circuit? [3]
- (d) What is the advantage of connecting load resistance in parallel? [1]
- (e) If your television set stopped working, what is the first thing you would check? [1]
- (f) When welding artefacts like door frames, what two safety precautions would you observe? [2]

Total 15 marks

- 8
- (a) Give **three** reasons why timber should be seasoned before use. [3]
 - (b)
 - (i) List **two** appropriate finishes for railed steel if it is to be used outdoors. [2]
 - (ii) Make a sketch and name the tool you would use to mark on railed steel. [4]
 - (c) Make a neat sketch of a try square and state one use. [5]
 - (d) What safety precaution would you observe when cutting plastic on a circular saw. [1]

Total 15 marks

- 9 **Figure 6** shows a food container made from expanded polystyrene.

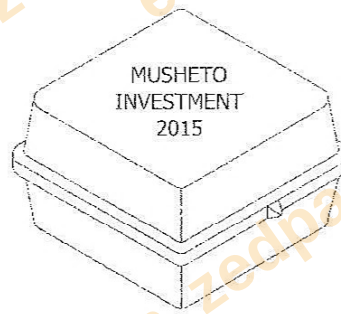


Figure 6

- (a) (i) Suggest **two** reasons why expanded polystyrene has been used to make this product. [2]
- (ii) Name two other items made out of expanded polystyrene. [2]
- (b) List **two** advantages that thermoplastics have over thermosetting plastics. [2]
- (c) Classify the following types of plastics according to their groups. [5]
- Polyester resin, acrylic, urea formaldehyde, rigid polystyrene, epoxy resin.
- (d) Mention **two** methods of joining plastic to metal. [2]
- (e) What are the two safety measures one needs to take into consideration when working with hot plastic? [2]

Total 15 marks

10 You have just been employed as a foreman of a construction company.

- (a) (i) What do you understand by the term aggregate. [1]
- (ii) What constitutes the aggregate for a slab? [3]
- (iii) Working with cement can be hazardous. Give **one** safety precaution you would take when working with cement. [1]

(b) A poor approach to safety can cause problems in the workshops.

Figure 7 shows some of the tools commonly used in the school workshops.

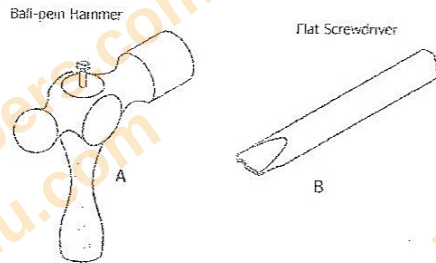


Figure 7

- (i) Identify **one** problem in each of the situations above. [2]
- (ii) Explain how each of the problems in (i) could be dangerous. [2]
- (iii) With the aid of annotated sketches, explain how each of these dangers could be solved in order to make the tools safe.. [6]

Total 15 marks

11 (a) As an entrepreneur, you decide to start up an enterprise.

- (i) What is an enterprise? [2]
 - (ii) List **two** skills of a good entrepreneur. [2]
- (b) You have formed the enterprise. Give the name of your enterprise. [1]
- (c) (i) Design the logo for you enterprise. [2]
 - (ii) What material would you used for your logo? [1]
 - (iii) Give **two** reasons for the choice for your material. [2]

(d) You are the managing director of your enterprise and you have four workers, two directly under your supervision and two under one of your subordinates.

- (i) Draw up an organisational chart to suit the illustration above. [5]

Total 15 marks

Question SECTION A, Q1 (12 marks). Figure 1 shows two joints (A, B) made by a Grade 9 pupil; Figure 2 shows a wooden name tag reading 'HEAD TEACHER'.

Answer: (a)(i) Tools used: Joint A (an interlocking comb/finger joint) -- a tenon saw; Joint B (an overlapped, screw-fixed joint) -- a hand drill or bradawl (to drill the screw holes).

Answer: (ii) Where applied: Joint A -- corner joints in box/drawer construction (wood); Joint B -- joining flat panels or sheet material edge-to-edge (e.g. cabinet sides, casings).

Answer: (iii) Safety precautions: Joint A -- keep fingers well clear of the saw blade and cut away from the body; Joint B -- secure the workpiece in a vice/clamp before drilling, and wear eye protection.

Answer: (b)(i) Suitable material for the 'HEAD TEACHER' tag: wood (e.g. plywood) or acrylic/perspex plastic.

Answer: (ii) Two reasons for the choice: (1) it is durable enough for regular office/door use; (2) it takes a good finish, allowing the lettering to be neatly painted or engraved.

Answer: (iii) Three factors to consider when buying screws: (1) the length and gauge/diameter suited to the material thickness; (2) the head type (countersunk, round, pan) suited to the job and finish; (3) the material/finish of the screw (steel, brass, stainless) suited to resist corrosion in its working environment.

Question SECTION A, Q2 (6 marks). Figure 3 shows electrical/electronic circuit symbols.

Answer: (a)(i) Rectangle symbol -- Resistor: restricts/controls the flow of current in a circuit.

Answer: (ii) Battery symbol (long and short parallel lines, +/-) -- Cell: supplies electrical energy (voltage) to the circuit.

Answer: (iii) Two-coil symbol -- Transformer: steps up or steps down an AC voltage.

Answer: (b) If a classmate is electrocuted in the workshop, your first reaction should be to switch off the power supply at the mains/isolate the electricity immediately -- never touch the person directly while the circuit is still live.

Answer: (c)(i) In a series circuit, the last bulb(s) are dim because the same current flows through every bulb, but the supply voltage is shared/divided among all of them, so each bulb only receives a small fraction of the voltage.

Answer: (ii) Solution: connect the bulbs in parallel instead of series, so each bulb receives the full supply voltage and shines at equal, full brightness.

Question SECTION A, Q3 (12 marks). Complete the joining-situation table.

Answer: Veneer to block board -- joining medium: adhesive/glue (e.g. contact adhesive or PVA); reason: veneer is thin and delicate, and glue gives a strong, even, flat bond without damaging it.

Answer: Butt (wood-to-wood) joint -- joining medium: glue and nails/screws (e.g. PVA plus panel pins); reason: quick and adequate for simple, lightly-stressed square-edge joints.

Answer: Tin plate to tin plate -- joining medium: soft soldering; reason: tin plate is thin sheet metal that solders easily at low temperature, giving a neat, leak-proof joint.

Answer: Brass to pine (metal to wood) -- joining medium: screws (e.g. brass screws); reason: screws securely and removably fix a metal fitting to wood without needing heat or glue.

Question SECTION B, Q6 (compulsory, 25 marks). Figure 4 shows an exploded TV-room scene (table, chairs, TV and accessories with no proper stand). Analyse, brief, sketch and justify a solution.

Answer: (a)(i) The situation in Figure 4: a TV room has a dining table and chairs, but the television and its accessories are shown scattered separately with no proper unit to hold and display them together.

Answer: (ii) The problem: there is no suitable stand/cabinet to hold the television and its accessories neatly in the room.

Answer: (b)(i) A design brief is a short, clear statement describing the need or problem a design must solve, without prescribing the exact form of the solution.

Answer: (ii) Design brief for this situation: 'To design and make a stand/cabinet that will safely and neatly hold a television and its accessories in the TV room.'

(iii) [SKETCH REQUIRED -- cannot be reproduced in text] A possible solution: an annotated isometric sketch of a simple TV stand with a lower shelf for accessories and a flat top sized to hold the television, labelled with key dimensions and materials.

Answer: (c)(i) Four other specifications: (1) size -- must fit the television and available room space; (2) strength/stability -- must safely support the television's weight without toppling; (3) cost -- must be affordable to build; (4) appearance/finish -- must look attractive and match the room's other furniture.

Answer: (d)(i) Suitable material: wood (e.g. blockboard or chipboard).

Answer: (ii) Reasons: accepting wood -- it is strong enough to support the television's weight and easy to work with hand tools; rejecting an alternative such as glass -- glass would be more costly and riskier, since it could shatter and injure users, making it less suitable despite a more modern look.

Question SECTION B, Q7 (15 marks). Figure 5: a 5-ohm resistor in series with two 2-ohm resistors in parallel, supplied by 10V.

(a) The two 2-ohm resistors in parallel: $1/R = 1/2 + 1/2 = 1$, so $R = 1$ ohm.

(b) Total circuit resistance = 5 ohm (series) + 1 ohm (parallel combination) = 6 ohm.

(c) Total current = $V / R = 10V / 6 \text{ ohm} = 1.67A$ (5/3 A).

Answer: (d) Advantage of connecting load resistors in parallel: if one branch/load fails or is disconnected, the others keep working independently, and every parallel branch still receives the full supply voltage.

Answer: (e) If the television stopped working, the first thing to check would be the power supply/plug, switch and fuse -- confirming it is properly connected to a working power source.

Answer: (f) Two safety precautions when welding door frames: (1) wear a welding helmet/mask with a dark visor to protect the eyes from arc flash; (2) wear protective gloves and clothing to guard the skin from sparks, heat and UV radiation.

Question SECTION B, Q8 (15 marks). Timber seasoning, steel finishes, marking tools, try square, and cutting plastic.

Answer: (a) Three reasons timber should be seasoned before use: (1) to reduce moisture content so it does not shrink, warp or split later; (2) to increase its strength and durability; (3) to make it lighter, easier to work, and more resistant to fungal/insect attack.

Answer: (b)(i) Two appropriate finishes for railed/mild steel used outdoors: galvanising (a zinc coating) and painting with an anti-rust/oil-based paint.

(ii) [SKETCH REQUIRED] Tool used to mark on railed steel: a scribe -- a pointed steel tool used to score fine, accurate lines on metal.

(c) [SKETCH REQUIRED] Try square; one use: to mark and check right angles (90 degrees) on the edge of a workpiece.

Answer: (d) Safety precaution when cutting plastic on a circular saw: wear eye protection and ensure the blade guard is in place, since plastic can shatter or fling hot chips; feed the material slowly and steadily to avoid it grabbing or kicking back.

Question SECTION B, Q9 (15 marks). Figure 6: an expanded-polystyrene food container; plastics classification.

Answer: (a)(i) Two reasons expanded polystyrene is used for the food container: (1) it is a good heat insulator, keeping food hot or cold for longer; (2) it is lightweight and cheap to produce, making disposable packaging economical.

Answer: (ii) Two other items made from expanded polystyrene: protective packaging for electronics/appliances, and disposable cups/plates (also acceptable: ceiling tiles).

Answer: (b) Two advantages of thermoplastics over thermosetting plastics: (1) thermoplastics can be reheated, reshaped and recycled, while thermosetting plastics cannot; (2) thermoplastics are generally easier and cheaper to mould using heat alone, whereas thermosetting plastics require a curing/chemical-setting process.

Answer: (c) Classification: Polyester resin -- thermosetting; Acrylic -- thermoplastic; Urea formaldehyde -- thermosetting; Rigid polystyrene -- thermoplastic; Epoxy resin -- thermosetting.

Answer: (d) Two methods of joining plastic to metal: (1) adhesive/epoxy glue; (2) self-tapping screws or rivets.

Answer: (e) Two safety measures when working with hot plastic: (1) wear heat-resistant gloves to avoid burns; (2) work in a well-ventilated area to avoid inhaling harmful fumes.

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