

G12 ECZ DESIGN & TECHNOLOGY P2 2015 SOLUTIONS

Design and Technology Paper 2, 2015 (608/2)

2 hours 30 minutes | 100 marks: Section A (30 MCQ) + Section B (structured) + Section C (Q32 + 1 other)



EXAMINATIONS COUNCIL OF ZAMBIA
JUNIOR SECONDARY SCHOOL LEAVING EXAMINATION (GRADE 9) – 2015

Design and Technology 608/2
Paper 2

(INTERNAL AND EXTERNAL CANDIDATES)

Time: 2 hours 30 Minutes

Marks: 100

Instructions to candidates

- 1 Pull out the Answer Booklet from the question paper.
- 2 Write your Name, Examination Number, School/Centre name and Code at the top of the first page on the Answer Booklet.
- 3 There are **three (3)** sections in this question paper, Section **A**, **B** and **C**.
- 4 Answer all questions from Section **A** and Section **B**, and choose any **two (2)** questions from Section **C**.
- 5 In sections **A**, **B** and **C** answer all questions on the Answer Booklet provided.
- 6 In Section **A** answer all questions on the answer sheet provided. Choose the best answer from A, B, C or D. Mark the letter of the answer that you have chosen with a cross (X)
- 7 In Section **B**, write your answers in the spaces provided in the Answer Booklet provided.
- 8 In Section **C**, write all your answers on the blank pages provided at the end of the Answer Booklet.

Information for candidates

Cell phones are not allowed in the examination room.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Multiple choice questions

Answer all questions from this section. Write all your answers in the Answer Booklet provided. Cross out the best answer from the four (4) choices that are given A, B, C, and D with the letter X.

- 1 Which one of the following is **not** a safety precaution when using hand tools?
 - A Do not use tools which are blunt.
 - B File handles must be secured.
 - C Never use a hammer that has a loose head.
 - D Use a chisel with a mushroom head.
- 2 Which of the following is **not** found in a First Aid Box?
 - A Cotton wool
 - B Gauze
 - C Salt
 - D Soap
- 3 If a Chisel is used without a Mallet, the action is referred to as ...
 - A chopping.
 - B grooving.
 - C morticing.
 - D paring.
- 4 **Figure 1** shows a regular Polygon.

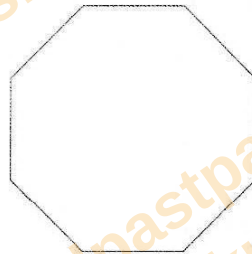


Figure 1

Name it.

- A Heptagon
 - B Nonagon
 - C Octagon
 - D Pentagon
- 5 On the drawing of the circle, the symbol $\varnothing$ put before a figure represents ...
 - A circumference.
 - B diameter.
 - C size.
 - D radius.

- 6 Colours can also be used to communicate. From the options given, choose a colour that communicates danger.

A Blue
B Green
C Red
D Yellow

- 7 The drawing in **figure 2** shows a Dice drawn in isometric projection.

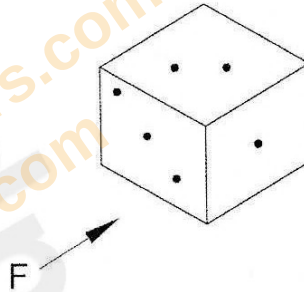


Figure 2

Which one of the views represents the end elevation of the Dice?



A 1
B 2
C 3
D 4

- 8 What is the use of a Hacksaw in the workshop? For ...

A cleaning metal.
B cutting metal.
C drawing parallel lines on metal.
D drilling holes in metal.

- 9 Copper is ductile. This means that it can ...

A be hammered and rolled without breaking.
B be drawn into fine wire.
C become a liquid when heated.
D resist fracture.

- 10 Name the hole shown in **figure 3**.

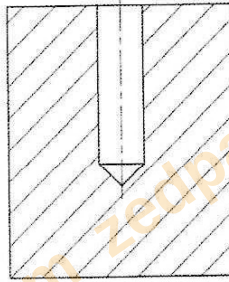


Figure 3

- A** Blind hole
B Counter hole
C Countersunk
D Through hole
- 11 A cutting list or parts list is a list of ...
A all materials needed with the dimensions indicated.
B all the joints to be constructed.
C the cuts to be made.
D the required operations in construction.
- 12 Which of the following statements qualifies to be a design brief?
A Design a test rack to hold test tubes.
B Design and make a rack to hold test tubes.
C Design and make an artefact to hold test tubes.
D Make a rack to hold test tubes.
- 13 The steps given below show the process of fixing the countersunk screw.
1 Drill the pilot hole.
2 Countersunk for the screw head.
3 Drive in the screw.
4 Drill the clearance hole.
A 1 4 2 3
B 1 4 3 2
C 2 3 1 4
D 4 3 2 1
- 14 Jane is a new Grade 8 learner in your school and would like to make a straight cut through a piece of thin sheet metal. Which one of the following tools would you advise her to use?
A Marking knife
B Pliers
C Scissors
D Tin snips

15 Which class of levers has the load in the middle?

- A** 1st Class
- B** 2nd Class
- C** 3rd Class
- D** 4th Class

For questions 16 and 17 refer to figure 4.

16 Identify the tool.

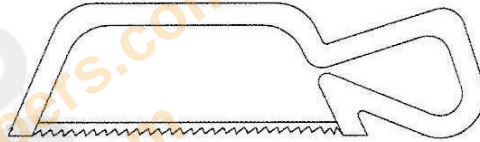


Figure 4

- A** Junior hacksaw
- B** Panel saw
- C** Piercing saw
- D** Standard hacksaw

17 What is the use of the tool? For ...

- A** cleaning out slots.
- B** cutting joints.
- C** cutting wide slots.
- D** small light works.

18 When an electric iron is switched on, what energy changes take place?

- A** Electrical energy to heat.
- B** Heat to electrical energy.
- C** Kinetic to heat.
- D** Mechanical to electrical energy.

19 **Figure 5** shows part of a type of Chisel used on wood.

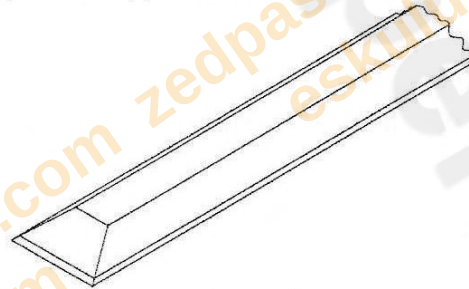


Figure 5

Name the Chisel.

- A** Bevel edged
- B** Firmer chisel
- C** Mortice chisel
- D** Square edged

- 20** A group of entrepreneurs bought materials at K200.00 and realised K2 050.00 after selling chopping boards. Transport costs amounted to K350.00, airtime K50.00 and council levy K20.00. How much profit did they make?

A K620.00
B K 1430.00
C K1 850.00
D K2 050.00

- 21** Figure 6 shows a simple circuit.

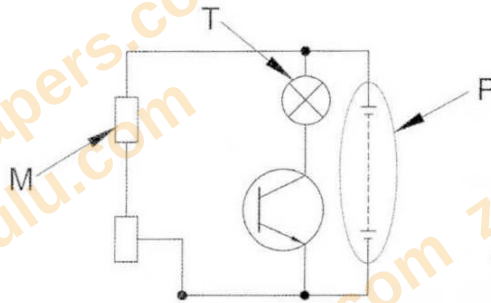


Figure 6

Name the part labelled 'P'.

A Battery
B Current
C Electronics
D Resistor

- 22** Name the part labelled 'T'.

A Battery
B Bulb
C Resistor
D Transistor

- 23** Figure 7 shows a Resistor. What is the use of this electronic component?



Figure 7

A Acts as a booster.
B Increases the brightness of the bulb.
C Serves as a storage for electrical energy.
D To restrict the flow of electricity.

24 Which Saw can be used for cutting curves in Wood and Plastic?

- A Back saw
- B Bow saw
- C Coping saw
- D Cross cut saw

25 What is the most effective method of removing the metal (waste) in **figure 8**?

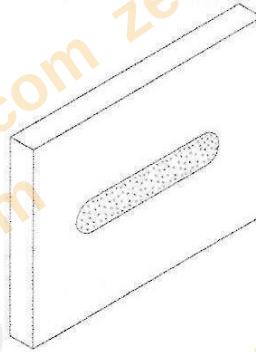


Figure 8

- A Chain drilling
- B Counter sinking
- C Cutting
- D Grinding

26 Which shape in **figure 9** represents an irregular Quadrilateral?

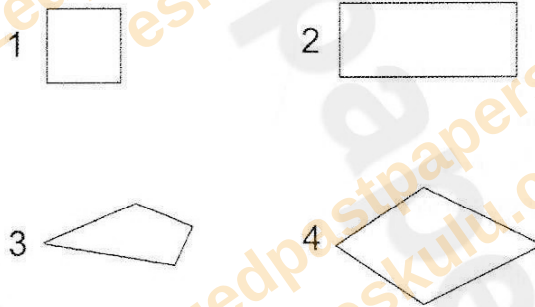


Figure 9

- A 1
- B 2
- C 3
- D 4

27 Sometimes the Stock of the Marking Gauge has brass strips to ...

- A make the gauge accurate.
- B make the gauge heavy.
- C make the gauge look beautiful.
- D reduce wear on the stock.

28 When you reheat a Thermoplastic, it returns to its original shape. This is referred to as plastic ...

- A** deformation.
- B** elasticity.
- C** formation.
- D** memory.

29 Flat head rivet shown in **figure 10** is used for ...

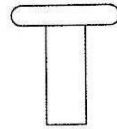


Figure 10

- A** general purpose where a flush surface is needed.
- B** general purpose where finish is not important.
- C** joining soft materials whenever necessary.
- D** joining thin plates which cannot be countersunk.

30 At what stage should a designer ask these questions in the design process?

- What size should it be?
- Who will use it?
- What materials should be used?
- How will it function?
- Where will it be used?
- What finish should it have?

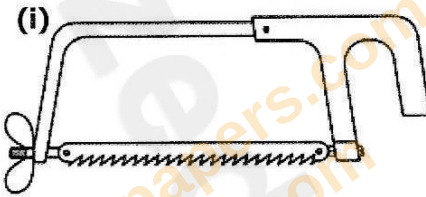
- A** Evaluation stage
- B** Specification stage
- C** Testing stage
- D** Working procedure stage

[Total 30 marks]

SECTION B**Attempt all questions**

Write your answers in the spaces provided in the **Answer Booklet**.

- 31 (a)** **Figure 11** below shows some tools used in a Design and Technology workshop. Name each of them.



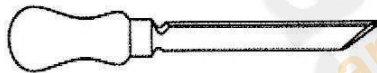
..... [1]

(ii)



..... [1]

(iii)



..... [1]

(iv)



..... [1]

Figure 11

- (b) (i) Annealing is the heat treatment process of [1]
- (ii) Which Tap is used for cutting threads in a Blind hole? [1]
- (iii) Sawing, planing, drilling, filing and shaping are methods of ... [1]
- (c) (i) Write down the electronic device used for reducing current. [1]
- [1]
- (ii) A device that allows current to flow in one direction is called [1]
- [1]

- (iii) Study the diagrams in **Figure 12**.

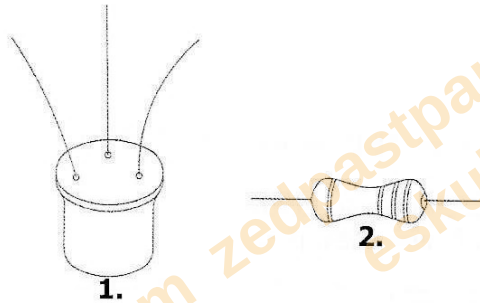


Figure 12

Draw the symbols of the electronic components above.

..... (1 mark) (1 mark)

- (d) Classify the following situation:

(i) the ability to perform work [1]

- (e) What movements do the following produce?

(i) Windscreen wipers: [1]

(ii) Bicycle wheels: [1]

(iii) Train moving from one town to another: [1]

- (f) From the list of tools given below, classify them according to their appropriate trade groups. (Write **one** tool in each group)
Pliers, Cold Chisel, Steel Square, Jack plane, Drilling Machine.

- (i) Bricklaying and Plastering

Tool: [1]

- (ii) Electrical Engineering

Tool: [1]

- (iii) Carpentry and Joinery

Tool: [1]

- (iv) Metal Fabrication and Welding

Tool: [1]

- (g) In Bricklaying, the tool which is used to pick up mortar and spread it evenly before setting Bricks or Blocks is called ...

[1]

- (h) The list of **plane figures** is given below. Arrange them according to their number of sides.

Scalene, Circle, Rhombus, Pentagon, Ellipse.

3 sides	4 sides	5 or more sides
(i)..... (1 mark)	(ii) (1 mark)	(iii) (1 mark)

- (i) The short statement of what is to be designed is called ... [1]
- (j) **Figure 13** shows a Square. Using a pencil draw a line diagonally across the square.



Figure 13

- (k) Name **two** main groups of plastics. [1]
- (l) As an Entrepreneur the first stage of establishing a business enterprise is the ... [1]
- (m) What do you call a set of rules to prevent accidents in the workshop?
- (n) What does the symbol mean in Design and Technology?
(i) R20 [1]

SECTION C

Answer question 32 as a compulsory question and any other one from questions 33, 34 and 35.

- 32 The following situation is obtaining in the school science laboratory.
Test tubes are lying all over the bench and on the floor.

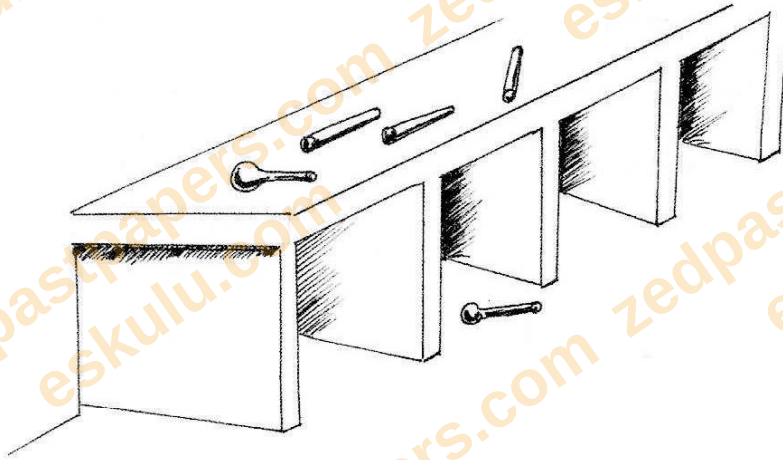


Figure 14

- (a) (i) Suggest a problem from the given situation. [2]
(ii) From the problem suggested in (a) above, write a design brief [3]
- (b) One of the specifications to the possible solution is material to be used.
 - (i) Write any other **two** specifications to be considered. [4]
 - (ii) Sketch a possible solution in isometric projection. You may consider the following:
Interpretation, Proportion, Rendering, Quality and Neatness. [5]
- (c) (i) Suggest **one** type of material you would use on your possible solution. [2]
(ii) Give **two** reasons for your choice of material. [4]

- 33 (a) (i) Sketch and label **two** parts of a Try Square. [6]
 (ii) Sketch a 300mm steel rule and give a reason why it has a hole. [6]
 (b) Write **two** safety precautions to be observed when using the Try Square and Steel rule. [4]
 (c) **Figure 15** shows a Nail in a piece of wood.

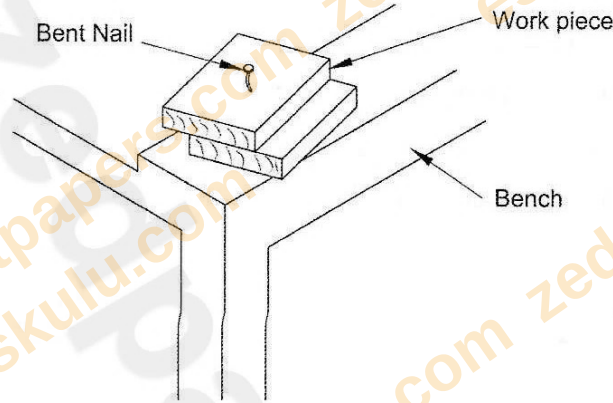


Figure 15

- (i) Name the tool that can be used to remove the Nail. [2]
 (ii) Why would you need a waste piece when removing the Nail? [2]
- 34 (a) **Figure 16** shows a Building Trowel.
- (i) label parts **A, B, C** and **D**. [8]

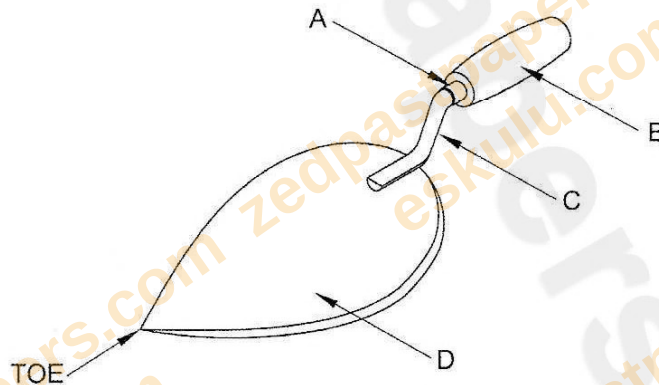


Figure 16

- (i) What is the use of the tool? [2]
 (ii) Explain **two** ways you can care for the tool. [4]
 (b) Mention any **three** other tools used in building. [6]

- 35 (a) **Figure 17** shows an incomplete table of electrical components. Fill in the missing details. [18]

S/N	Component	Symbol	Use
(i)	Switch		
(ii)			
(iii)	Cell or Battery		
(iv)	Speaker		
(v)			Restrict the flow of electricity

Figure 17

- (b) Explain why you should avoid touching naked electrical wires with bare hands. [2]



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Question SECTION A: Q1-30 (multiple choice). Answer all 30 multiple-choice questions.

Answer: 1. D -- using a chisel with a mushroom head is NOT a safety precaution: a mushroomed chisel head is unsafe (it can shed sharp splinters when struck) and should be ground off before use.

Answer: 2. C (Salt) -- cotton wool, gauze and soap are standard first aid box contents; salt is not.

Answer: 3. D (paring) -- driving a chisel by hand pressure alone, without a mallet, is called paring.

Answer: 4. C (Octagon) -- the regular polygon shown has 8 sides, so it is an octagon.

Answer: 5. B (diameter) -- the symbol phi (a circle with a diagonal line) placed before a figure represents diameter.

Answer: 6. C (Red) -- red is the standard colour used to communicate danger/stop.

Answer: 7. B (option 2, one dot) -- reading the pip layout on the isometric dice: the top face shows 2 pips, the face F points to (the front face) shows 3 pips, so by the sum-to-7 rule the hidden faces are bottom=5 and back=4; the remaining visible face (front-right, adjacent to the F face) shows 1 pip. The End Elevation is the view looking at that adjacent side face (90 degrees round from the front/F view), so it shows a single pip -- matching option 2.

Answer: 8. B (cutting metal) -- a hacksaw is used for cutting metal.

Answer: 9. B (be drawn into fine wire) -- ductility is the property that allows a metal to be drawn out into wire without breaking.

Answer: 10. C (Countersunk) -- figure 3 shows a conical recess at the top of the hole, which is the countersunk shape that lets a countersunk screw head sit flush.

Answer: 11. A (all materials needed with the dimensions indicated) -- a cutting list/parts list specifies every material required and its dimensions.

Answer: 12. C (Design and make an artefact to hold test tubes) -- a good design brief states the need in general terms without presupposing the exact solution; 'artefact' leaves the actual form of the solution open, unlike naming a specific pre-decided object such as 'a rack'.

Answer: 13. A (1, 4, 2, 3) -- the textbook order for fixing a countersunk screw: drill the pilot hole (1), drill the clearance hole (4), countersink for the screw head (2), then drive in the screw (3).

Answer: 14. D (Tin snips) -- tin snips are the correct tool for making a straight cut through thin sheet metal.

Answer: 15. B (2nd Class) -- a lever with the load positioned in the middle, between the effort and the fulcrum, is a 2nd class lever (e.g. a wheelbarrow).

Answer: 16. A (Junior hacksaw) -- figure 4 shows a small saw with a thin curved frame/spine and pistol-grip handle, characteristic of a junior hacksaw.

Answer: 17. D (small light works) -- a junior hacksaw is used for small, light cutting work (thin materials, small sections).

Answer: 18. A (Electrical energy to heat) -- an electric iron converts electrical energy into heat energy.

Answer: 19. B (Firmer chisel) -- figure 5 shows a chisel with a plain flat (rectangular) cross-section rather than angled/bevelled sides, characteristic of a firmer chisel.

Answer: 20. B (K1430.00) -- income K2 050 minus total costs (materials K200 + transport K350 + airtime K50 + council levy K20 = K620) gives a profit of K2 050 - K620 = K1 430.00.

Answer: 21. A (Battery) -- of the four symbols in figure 6, 'M' is the resistor (rectangular box) and 'T' is the bulb (circle with a cross), so the remaining oval/parallel-line symbol at 'P' represents the battery (cell), the circuit's power source.

Answer: 22. B (Bulb) -- 'T' is drawn as a circle containing a cross, the standard lamp/bulb symbol.

Answer: 23. D (To restrict the flow of electricity) -- a resistor's function is to restrict/limit current flow in a circuit.

Answer: 24. C (Coping saw) -- a coping saw has a thin, replaceable blade suited to cutting curves in wood and plastic.

Answer: 25. A (Chain drilling) -- the most effective way to remove an elongated slot of waste metal is to drill a series of adjoining holes along the slot (chain drilling), then clean up the edges with a file.

Answer: 26. C (shape 3) -- an irregular quadrilateral has no equal sides or angles; shape 3 (an uneven, scalene-sided four-sided figure) fits this, whereas shape 4 (a rhombus/kite) still has a symmetric, equal-sided form.

Answer: 27. D (reduce wear on the stock) -- brass strips let into the stock of a marking gauge resist the wear caused by repeated sliding contact against the workpiece edge.

Answer: 28. D (memory) -- a thermoplastic that returns to its original shape on reheating is displaying plastic memory.

Answer: 29. B (general purpose where finish is not important) -- a flat head rivet gives a plain, general-purpose fixing where a flush surface is not required (unlike a countersunk rivet).

Answer: 30. B (Specification stage) -- asking about size, user, materials, function, location and finish are all part of drawing up the design specification.

Question SECTION B: Q31 (structured, short answer). Answer all parts.

Answer: 31.(a) Tools shown in Figure 11: (i) junior hacksaw; (ii) round (rat-tail) file; (iii) marking/trimming knife; (iv) flat file.

Answer: (b)(i) Annealing is the heat-treatment process of heating a metal and then cooling it slowly, to soften it, relieve internal stresses and make it easier to work.

Answer: (b)(ii) The plug (bottoming) tap is used to cut threads to the very bottom of a blind hole, after the taper tap has started the thread.

Answer: (b)(iii) Sawing, planing, drilling, filing and shaping are all methods of wasting (removing material to shape a workpiece).

Answer: (c)(i) The electronic device used for reducing current is the resistor.

Answer: (c)(ii) A device that allows current to flow in one direction only is called a diode.

Answer: (iii) [Figure 12] Component symbols: 1 = cell/battery (drawn as one long and one short parallel line, the terminals); 2 = resistor (drawn as a rectangle, or a zig-zag line).

Answer: (d)(i) 'The ability to perform work' classifies as Energy.

Answer: (e) Movements produced: (i) windscreen wipers -- reciprocating (oscillating) motion; (ii) bicycle wheels -- rotary motion; (iii) a train moving from one town to another -- linear (translatory) motion.

Answer: (f) Tool per trade group: (i) Bricklaying and Plastering -- Cold Chisel; (ii) Electrical Engineering -- Pliers; (iii) Carpentry and Joinery -- Jack plane; (iv) Metal Fabrication and Welding -- Drilling Machine. (Steel Square is the unused distractor.)

Answer: (g) The tool used in bricklaying to pick up mortar and spread it evenly is the trowel.

Answer: (h) Plane figures by number of sides: 3 sides -- Scalene (triangle); 4 sides -- Rhombus; 5 or more sides -- Pentagon. (Circle and Ellipse are curved figures, not counted by straight sides.)

Answer: (i) A short statement of what is to be designed is called the design brief.

Answer: (j) [Figure 13] Drawing task -- a straight pencil line drawn corner-to-corner across the square, dividing it into two equal right-angled triangles. (Drawing task, described here rather than reproduced.)

Answer: (k) Two main groups of plastics: thermoplastics and thermosetting plastics.

Answer: (l) The first stage of establishing a business enterprise is idea generation -- identifying a viable business opportunity or need.

Answer: (m) A set of rules to prevent accidents in the workshop is called workshop safety rules (a safety code).

Answer: (n)(i) The symbol R20 in Design and Technology means a radius of 20 millimetres.

Question SECTION C, Q32 (compulsory). A school science laboratory has test tubes scattered untidily over the bench and floor (Figure 14). Analyse the problem, write a design brief, propose and sketch a solution, and justify your material choice.

Answer: (a)(i) Problem: test tubes are left scattered across the bench and on the floor, creating breakage and injury hazards and general disorganisation, because there is no dedicated storage for them.

Answer: (a)(ii) Design brief: 'To design and make a rack/stand that will safely store and organise test tubes on the laboratory bench.'

Answer: (b)(i) Two other specifications to consider: (1) size/dimensions -- the rack must fit the number of test tubes and the available bench space; (2) strength/stability -- it must securely hold the tubes upright without tipping or breaking.

(b)(ii) [SKETCH REQUIRED -- cannot be reproduced in text] A possible solution: a simple isometric sketch of a test-tube rack/stand with a flat base and rows of drilled holes sized to hold the tubes upright, drawn with clean, proportionate lines and appropriate rendering.

Answer: (c)(i) Suitable material: wood (e.g. softwood board).

Answer: (c)(ii) Two reasons: (1) wood is easy to cut, drill and shape using basic workshop tools; (2) wood is durable, inexpensive and readily available in the school workshop.

Question SECTION C, Q33. Try square, steel rule and a bent-nail removal scenario.

(a)(i) [SKETCH REQUIRED] Two parts of a Try Square: the STOCK (the thicker handle held against the workpiece edge) and the BLADE (the thin steel strip set at 90 degrees to the stock, used to mark/check right angles).

(a)(ii) [SKETCH REQUIRED] A 300mm steel rule; the hole near one end is for hanging the rule on a hook/nail for safe, tidy storage.

Answer: (b) Two safety precautions for the Try Square and Steel rule: (1) never use them to lever, prise or hammer anything, as this will bend or distort them; (2) store them properly (hung up or laid flat) after use, since their edges are sharp and they can be easily damaged or cause injury if left lying around.

Answer: (c)(i) [Figure 15] The tool used to remove the bent nail is a pair of pincers.

Answer: (c)(ii) A waste piece (packing block) is needed under the pincers when removing the nail to protect the surface of the workpiece/bench from being dented, and to give the pincers better leverage.

Question SECTION C, Q34. Building trowel (Figure 16) and other building tools.

Answer: (a)(i) Parts of the building trowel: A = Handle; B = Ferrule/Bolster (the metal collar joining the handle to the blade); C = Neck (the bent shank connecting the blade to the handle); D = Heel (the wide back edge of the blade, opposite the toe).

Answer: (i) Use of the tool: to spread, shape and smooth mortar or plaster/concrete during bricklaying and plastering.

Answer: (ii) Two ways to care for the tool: (1) clean off wet mortar/plaster immediately after use, before it dries and hardens on the blade; (2) store it in a dry place and lightly oil the blade to prevent rusting.

Answer: (b) Three other tools used in building: spirit level, builder's square, and plumb bob (also acceptable: pointing trowel, tape measure, mason's line).

Question SECTION C, Q35. Table of electrical components; electrical safety.

Answer: (a)(i) Switch -- symbol: a break in the circuit line with a lever touching one contact; use: to open and close (make or break) an electrical circuit.

Answer: (ii) Bulb/Lamp (filling the blank row) -- symbol: a circle with a cross inside; use: converts electrical energy into light.

Answer: (iii) Cell or Battery -- symbol: two parallel lines, one long and one short, repeated for a battery; use: supplies/stores electrical energy (provides voltage) to drive the circuit.

Answer: (iv) Speaker -- symbol: a small circle with a triangular cone attached; use: converts electrical energy into sound.

Answer: (v) Resistor (its use, 'restrict the flow of electricity', is already given) -- symbol: a rectangle (or a zig-zag line).

Answer: (b) You should avoid touching naked electrical wires with bare hands because the human body conducts electricity; touching a live bare wire can cause an electric shock, resulting in burns, muscle injury, or even death (electrocution).

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