2 HOURS ALLOWED

Materials required for this examination:
- normal writing and drawing instruments
- a calculator
- a protractor.

Instructions to candidates:
- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer all questions.
- You must answer the questions in the spaces provided. Do not write on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

Information
- The marks for questions are displayed.
- The maximum mark for this paper is 130.
- There are 22 marks for Section A, 37 marks for Section B and 71 marks for Section C.

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CORE TECHNICAL PRINCIPLES - SECTION A

The questions to follow are multiple choice. Tick one answer for each question.

1. Which one of the following manufacturers, initially concentrated on designing and manufacturing ‘metal’ kitchenware?

A. Apple
B. Alessi
C. Raleigh
D. Tesla

2. Which type of mechanism does the diagram opposite represent?

A. Cam
B. Spring
C. Treadle
D. Worm Gear

3. Linear Motion is:

A. Movement in a straight line and in one direction.
B. Movement following a circular path, around a fixed point
C. When an object swings left and then right (or vise-versa), from a fixed point.
D. A repetitive movement left to right OR up and down.
4. Identify the material that is a thin sheet/layer of natural wood

A. Flexiply
B. MDF
C. Veneer  
D. Plywood

5. Which of the following designers, designed the London Underground Map?

A. Philippe Starck
B. Marcel Breuer
C. Jorn Utzon
D. Harry Beck

6. Which of the following statements describing ‘POLYESTER’ is FALSE?

A. It is also called ‘polyethylene terephthalate’.
B. It is a thermoplastic polymer.
C. It cannot be manufactured as a fibre / textile material.  
D. It is 100% recyclable.

7. Which of the statements about Graphene is FALSE?

A. Graphene is a nonmetal.
B. Graphene has high resistance to the flow of electricity.
C. Graphene has the potential to radically change our consumer world.
D. Graphene exhibits amazing potential, especially in the electrical and electronics industries.
8. Which of the following statements about nano materials is TRUE?

A. Nanos are used by the Food Processing industry, to add flavour and taste.  
B. Nano materials are widely used in the construction industry, because of their resistance to corrosion.  
C. A single particle of a nanomaterial, has an average size between 1 to 100 nanometres (nm), which is extremely small.  
D. Nano materials are derived from natural wood.  

C. A single particle of a nanomaterial, has an average size between 1 to 100 nanometres (nm), which is extremely small.  

9. Which of the statements below is accurate regarding ‘wood turning’?

A. Is a method of bending thin layers of wood, forming complicated shapes.  
B. Is a technique whereby wood is turned around, during the seasoning process.  
C. A process that creates a ‘reflective’ coating on a range of woods.  
D. Wood is ‘turned’ on a woodworking lathe, producing items such as lamps, table legs and bowls.  

D. Wood is ‘turned’ on a woodworking lathe, producing items such as lamps, table legs and bowls.  

10. What is the name of the area of the circle labelled ‘A’, seen below?

A. Segment  
B. Chord  
C. Tangent  
D. Aspect  

A. Segment
11. Describe two ways, in which sustainable forests can contribute to the local economy. 2 marks

1: Follow the link for possible answers. 1 mark per correct answer.

2: Employment, careers, leisure industry etc.....

12. The logo shown opposite, is sometimes printed on timber and packaging. Explain the meaning of this logo. 2 marks

Follow the link for the answer.

1 mark for basic answer.
2 marks for more detail.
Use teacher discretion.

13. A number of Power Stations, produce electricity from coal. Give two reasons why some people are against this method of energy production. 2 marks

Reason 1: Follow the link for possible answers. 1 mark per correct answer.

Reason 2:
14. Give two reasons why some people are in favour of electricity produced by coal fuelled power stations. 2 marks

Reason 1:

Follow the link for possible answers.
1 mark per correct answer.

Reason 2:

15. What is the area of the triangle seen in the diagram.

You will gain marks for each stage of the calculation, written in the space below.

4 marks

**CALCULATION:**

A triangle has a base of 60mm and a height of 80mm

\[
\text{AREA} = \frac{1}{2} \times \text{BASE} \times \text{HEIGHT}
\]

\[
\text{AREA} = \frac{60 \times 80}{2} = \frac{4800}{2} = 2400 \text{mm}^2
\]

**FORMULA**

\[
\text{AREA} = \frac{1}{2} b \times h
\]

\[
\text{AREA} = \frac{b \times h}{2}
\]
SECTION B - Specialist Technical Principles

16. Nylon is one of the most useful of all plastics

Describe the manufacture of nylon. Include notes and a labelled sketch(s)

8 marks

TO HELP YOU ANSWER THIS QUESTION

http://www.technologystudent.com/joints_flsh/nylon2.html

Up to 4 marks for the quality and clarity of the diagram / diagrams.
1 mark simple / basic diagram(s)
2-3 marks for increased detail.
4 marks for good quality diagram(s)

Up to 4 marks for the written detail.
1 mark simple / basic explanation.
2-3 marks for increased detail.
4 marks for excellent detail and clarity.
17a. List two properties of nylon?  

2 marks

Follow the link for potential answers.  
1 mark awarded per correct answer

17b. Name two products manufactured from nylon?  

2 marks

1 mark for each correctly identified product.

18. Name a product manufactured from kevlar® and explain why this is a suitable material for its production.  

4 marks

TO HELP YOU ANSWER THIS QUESTION

http://www.technologystudent.com/joints/flsh/nylon1.html

PRODUCT: ____________________________

REASONS 1:

1 mark for correctly identified kevlar product.

1 mark awarded for each correct reason (up to 3 marks)
19. Steel is a very important material, found all around us in buildings, bridges, cars and many other products. Iron is ‘converted’ into steel. In the space below, name and describe the process of conversion, using notes and diagrams. 5 marks

TO HELP YOU ANSWER THIS QUESTION

http://www.technologystudent.com/joints/iron5.html

PROCESS NAME: __________________________________________

1 mark for the correct process name (follow link for answer)

1 further mark for a basic diagram.
2 marks for additional detail.
3-4 marks for a detailed answer.

Use teacher discretion.
20a. Some products are manufactured through a process called 'compression moulding'. Using notes and a diagram(s), explain this process. 4 marks

TO HELP YOU ANSWER THIS QUESTION

Follow the links below.

Follow the link for the answer.

Up to 2 marks for detailed notes.

Up to 2 further marks for a diagram(s)

20b. List four products manufactured through compression moulding. 4 marks

TO HELP YOU ANSWER THIS QUESTION

Follow the links below.
https://www.youtube.com/watch?v=-FxiWMnY4aQ&t=7s

1 mark for each correctly identified product. Total of 4 marks.
21a. The toy glider shown below, is ‘batch’ manufactured, through a process called dye cutting. It arrives to the customer on a flat sheet of polystyrene and the three parts are pressed out of the sheet, to form the lightweight glider.

In the space below, explain the process, using notes and a diagram(s). 

8 marks

Follow the link for potential answers.

Up to 4 marks for detailed notes / explanation.
1 mark for basic notes.
2-3 marks for increased detail.
4 marks for full/complete explanation.

Up to 4 further marks, depending on the quality of the diagram(s).
1 marks for simple/basic diagram
2-3 marks for increased detail.
4 marks for a detailed diagram(s)
This picnic table, has been designed to fold away to a compact form and to be transported with ease.
22a. Why is High Density Polyethylene (HDPE), a suitable material for the table top?  

*Follow the link for potential answer.*

1 mark awarded per suitable reason.

22c. Describe the stages of manufacturing the table top? Use notes and diagrams  


Up to 3 marks for the diagram(s)
1 mark for a basic / simple diagram
2-3 marks for increased detail

Up to 3 marks awarded for notes/explanation
1 mark for a basic explanation
2-3 marks for more detail.
23a. The International Standard ISO 216 (International Organization for Standardization), sets out the common paper sizes used around the world? Mark the following paper sizes on the diagram below, in the correct positions. A2, A3, A4, A5

4 marks

1 mark per correct answer.

23b. What is the meaning of the symbol shown below? 4 marks

Follow the link for potential answer.

1 mark per fact - up to 4 marks.
24a. Laminated card packs such as Tetra Paks, are often used to store liquids. Briefly, describe the process of manufacture, of this type of pack.  

*Follow the link to a detailed explanation*

1 mark awarded per correctly identified fact / statement/ stage.

24b. There are different forms of corrugated card. These include: Single Face, Single Wall and Double Wall. Draw a simple diagram representing each of the forms listed.  

*Follow the link for all three diagrams.*

1 mark per correct diagram.
25a. These questions are related to key business terms / phrases (6 marks in total)

What is crowd funding? 2 marks

Follow the link at the top of the page for the answers.

1 mark awarded for a basic answer.
2 marks for additional detail.

25b. What is the Fair Trade system? 2 marks

Follow the link at the top of the page for the answers.

1 mark awarded for a basic answer.
2 marks for additional detail.

25c. What are cooperatives? 2 marks

Follow the link at the top of the page for the answers.

1 mark awarded for a basic answer.
2 marks for additional detail.
Designers need an understanding of the role ICT, in designing and developing ideas.

26a. What role does ICT play in modelling and developing ideas?  

Follow the link for potential answer.  
1 mark per correct statement.  
Use teacher discretion.

26b. What is the meaning of CNC? Include an explanation of the role of coordinates in your answer.  

Follow the link for potential answer.  
1 mark per reasoned statement  
Please note reference to the use of ‘coordinates’ must be made in order to gain 3 or more marks.
AREA OF A SQUARE - EXAMINATION QUESTION

27. An acrylic window for a school project seen below, is composed of two pieces, accurately cut to size on a laser cutter. They fit perfectly together. 2 x 3 marks (6 marks in total)

a. Calculate the area of piece A

b. Calculate the area of piece B

First, calculate the entire area of 'A', without the centre piece being removed, by treating it as a square 400mm x 400mm.

\[
\text{AREA} = \text{LENGTH OF \, SIDE} \times \text{LENGTH OF \, SIDE} \\
\text{AREA} = 400 \times 400 \\
\text{AREA} = 160000 \text{mm}^2
\]

Now, calculate the area of the smaller piece ‘B’, which is also the size of the piece to be removed from ‘A’.

\[
\text{AREA} = \text{LENGTH \, OF \, SIDE} \times \text{LENGTH \, OF \, SIDE} \\
\text{AREA} = 200 \times 200 \\
\text{AREA} = 40000 \text{mm}^2
\]

Now subtract the smaller area ‘B’ from the area of ‘A’. The answer will be the area of ‘A’ with it’s central window of material removed.

\[
160000 - 40000 = 120000 \text{mm}^2
\]

AREA OF FINAL SHAPED PIECE ‘A’ WITHOUT CENTRAL PIECE IS 120000mm²
AREA OF PIECE ‘B’ IS 40000mm²
28a. In general terms, what is a PIC microcontroller? What does it do?  

2 marks

Follow the link for potential answer.

Award 1 mark per correct statement - maximum of 2 marks

28b. Name a piece of programming software, used to program PIC Microcontrollers and to design circuits.  

1 mark

1 mark for a correctly identified software name.

28c. The diagram below shows all the necessary equipment for operating a PIC microcontroller. Label the equipment and explain how it works together, to enable the programming of the microcontroller.  

5 marks

Follow the link at the top of the page for a detailed explanation.

1 mark for a correct statement only.

2-3 marks for a basic answer

4-5 marks for a detailed answer.

Teacher discretion required.
29a. When gears mesh together, what are they called?  1 mark

1 mark for Spur Gear.

29b. What is a gear train?   1 mark

1 mark for a description of the animations seen when following the link.

29c. Write a simple description of a rack and pinion gear system. Include a diagram.   4 marks

Up to 2 marks for the diagram. 1 mark for a basic diagram.

Up to 2 marks for a detailed answer. 1 mark for a basic description.

29d. What is the main purpose of a bevel gear? Include an example of a practical application.   2 marks

1 mark for a correct description and 1 further mark for a practical application.
30. This is a simple pencil sharpener.

A two point perspective drawing of the sharpener has been started below.

Complete the outline of the sharpener.  
**3 marks**

Add appropriate pencil shading, to enhance the final finish.  **3 marks**

1 mark for a basic drawing.
2 - 3 depending on accuracy and detail.

1 mark for basic shade.
2 - 3 marks for greater realism of shade.