Sample assessment task	
Year level	10
Learning area	Technologies
Subject	Design and Technologies: Engineering principles and systems and Materials and technologies specialisations
Title of task	Automatons
Task details	
Description of task	Students are required to study and understand the fundamentals of the process of materials being combined with force, motion and energy to create, while understanding combinations of a range of characteristics and properties of materials, systems, components, tools and equipment, a designed mechanical device. Students design solutions within a range of technologies specialisations, using combined technologies and components and materials available in a studio or workshop.
Type of assessment	Formative
Purpose of assessment	To assess students' knowledge and understanding of the topics of motion, force and energy, and characteristics of materials and students' understanding of the design process and technology process in developing a design solution.
Assessment strategy	Students complete research and presentation of reports on topics of engineering and materials, and develop a design folio within a suitable time frame.
Evidence to be collected	• Series of worksheets and progressive developed stages of a design folio • Completed product and evaluation sheet
Suggested time	One semester, approximately 18 weeks
Content description	
Content from the Western Australian Curriculum	**Technologies and society** Social, ethical and sustainability considerations that impact on designed solutions, complexity of design, and production processes involved Impact of emerging technologies on design decisions, and/or economic, environmental and social sustainability **Engineering principles and systems** The process of materials being combined with force, motion and energy to create solutions **Materials and technologies specialisations** The combination of a range of characteristics and properties of materials, systems, components, tools and equipment to create designed solutions Designed solutions within a range of technologies specialisations, using combined technologies **Investigating and defining** Identify the needs of the client/stakeholder to determine the basis for a solution Create and critique briefs to solutions Investigate components/resources to develop increasingly sophisticated solutions, identifying and considering associated constraints **Designing**

	Apply design thinking, creativity, enterprise skills and innovation to develop, modify and communicate design ideas of increasing sophistication Design possible solutions, analysing designs against criteria, including functionality, accessibility, usability and aesthetics, using appropriate technical terms and technology **Producing and implementing** Select, justify, and safely implement and test appropriate technologies and processes, to make solutions **Evaluating** Analyse design processes and solutions against student-developed criteria **Collaborating and managing** Work independently, and collaboratively to manage projects, using digital technology and an iterative and collaborative approach. Considers time, cost, risk, safety, production processes, sustainability and legal responsibilities
Task preparation	
Prior learning	Students will have an understanding of the design process, motion, force and energy, and have fundamental hand and machine skills of production in materials and ICT skills.
Assessment differentiation	Teachers should differentiate their teaching and assessment to meet the specific learning needs of their students, based on their level of readiness to learn and their need to be challenged. Where appropriate, teachers may either scaffold or extend the scope of the assessment tasks.
Assessment task	
Assessment conditions	Individually complete worksheets and a design folio and the construction of the product and evaluation sheet
Resources	• Theory worksheets • Design task template for folio • Relevant theory and skill demonstrations • Selection of available materials, components, tools and equipment

Instructions for teacher

Task one: Engineering principles and systems knowledge worksheet

1. Follow up from prior student knowledge on the use of motion, force and energy to manipulate and control electromechanical and mechanical systems.

2. Demonstrate the different, common mechanisms and the types of input required, process created and output generated by these mechanisms:
   - use arrangements of gears, pulleys, cams and followers to explain the operating principles of the following motion conversion and control systems:
     - axles and shafts
     - pulleys and belts
     - linkages
     - cranks and slider
     - rack and pinion
     - worm and wheel
     - cams and followers
     - ratchets
     - gears
     - bevel gears
     - chains and sprockets
     - bearings and bushes
   - teach and demonstrate:
     - varying gear ratios to vary speed and/or forces
     - calculating changes of speed and force
     - using common formula for velocity ratios, mechanical advantage and work
   - and the following:
     - force is measured in newtons [N]
     - rigidity, strength and resilience in simple static structures
     - common engineering calculations and units of measurement.

3. All mechanisms are designed to create some type of mechanical advantage. This mechanical advantage (MA) is usually calculated by the ratio between the input force and the resultant output force through the components of the mechanical device.
   Simple calculations can use the following formulas (the symbol Ø is diameter, and n^{o} is the number of)
   - pulley belt ratio = $\frac{\text{Ø follower pulley}}{\text{Ø driver pulley}}$ = input revolutions:1 output revolution
   - chain and sprocket ratio = $\frac{\text{n}^{o}\text{ teeth follower gear}}{\text{n}^{o}\text{ teeth driver gear}}$ = input revolutions:1 output revolution
   - gear ratio = $\frac{\text{n}^{o}\text{ teeth follower gear}}{\text{n}^{o}\text{ teeth driver gear}}$ = input revolutions:1 output revolution
     - pinion gear
     - idler gear
   - rack and pinion calculate the distance moved = $\frac{\text{n}^{o}\text{ teeth pinion} \times \text{n}^{o}\text{ revolutions}}{\text{n}^{o}\text{ teeth per metre of rack}}$

4. Below is an instruction sheet that requires students to research fundamental changes in motion, mechanisms and ratio changes of input to output force, including examples of mechanical advantage and velocity.

5. With teacher supervision and guidance, students can investigate given websites to find correct definitions, explanations and examples of mechanisms.
   - In addition, instruct students to research, using available research tools, and collect images of machines that represent the types of motion and mechanisms.
6. This knowledge will be applied to designing and producing a mechanical device.

Task two: Materials and technologies specialisations

1. Follow up from prior student knowledge of the characteristics and properties of materials, systems, components, tools and equipment used to create designed solutions.
2. Provide examples of, and discuss the different common timbers, metals and polymers, and associated, systems, components, tools and equipment:
   - demonstrate the differences and define the engineering material properties of hardness, strength and working characteristics for the following materials:
     - timbers
     - manufactured board
     - brass
     - mild steel
     - stainless steel
     - aluminium
     - polyethylene
     - acrylics.
3. Explain and discuss the characteristics, properties and sizes of available common timbers, manufactured boards, metals and polymers in the workshop.
   - Focus on the materials that students can use to design and build a mechanical device.
   - Additional materials can be discussed, if the teacher plans to include special materials not currently present in the workshop.
4. Below is an instruction sheet that requires the student class to:
   - observe and record the names of the available workshop materials
   - research the fundamental characteristics, properties and sizes of available common timbers, manufactured boards, metals and polymers in the workshop
   - prepare group chart and/or report that illustrates these differences in characteristics, properties and sizes.
5. With teacher supervision and guidance, students can investigate given websites to find correct definitions, explanations and examples of the fundamental characteristics, properties and sizes of available common timbers, manufactured boards, metals and polymers in the workshop.
6. This knowledge will be applied to designing and producing a mechanical device.

Task Three: research and design a mechanical device; an automaton

Students will research and design an automaton mechanical device.

1. Provide or have students prepare a design folio; start with discussing and writing a design brief.
2. Review and discuss the students' understanding of the design process.
3. With teacher guidance, have students:
   - identify the needs of the client/stakeholder to determine the basis for a solution
   - create and critique briefs to solutions.
4. Discuss preparing statements that explain the design problem, limitations and requirements for the design brief:
   - prepare a design brief.
5. Investigating and defining; direct students to:
   - collect examples/ideas/evidence from manuals, texts, and on-line resources of possible solutions
   - evaluate these examples/ideas/evidence, then select, note and draw possible combinations of these ideas.
6. Designing. Teach students some sketching techniques to get them to design, sketch and write notes on ideas and possible solutions:
   - sketches and notes should show a sequence of developing ideas and concepts
   - add measurements to the sketches

- finish with a detailed sketch that could be used to build the solution
- list of colours, additional materials and printed logos to add to the housing or stand
- working drawings may be created, depending on the complexity of the solution.

7. Designing; demonstrate techniques to:
   - draw together ideas, noting and explaining the shape and arrangement of components, mechanics and the transition of motion through the collected ideas
     - experiment with a series of sketches to produce some redesigned possibilities
   - develop concepts of at least three possible solutions, using annotated drawings and explanations to develop and justify a final solution
     - each new design sketch should be an improvement on the previous sketch
     - annotations should explain progress, and subsequent improvements of concepts towards a possible solution to the key design issues
     - seek feedback from teacher and class members.
8. Designing; using:
   - technical knowledge and understanding of ratios of the input and output forces of components of devices
   - possible solutions, analysing designs against criteria, including functionality, accessibility, usability and aesthetics, using appropriate technical terms and technology
9. Using the students' understanding of input, transition and output components, and design limitations, direct students to develop a mechanical device.
10. Discuss methods of power input:
    - hand operation, or
    - electrical motor supply, with batteries or low voltage power supply.
11. Demonstrate the methods of calculating and testing ratios, and the forces through the input, process and output mechanisms:
    - use common formula for velocity ratios, mechanical advantage and work.
12. Explain rigidity, strength and resilience in simple static structures.
13. Discuss the design and making of a stand or housing:
    - materials for a stand or housing the device formed from
      - pieces of clear or coloured acrylic plastic
      - light metals or timber
      - other materials considered suitable for parts of the model
    - develop an appropriate rigid, or open, housing to incorporate the mechanism and allow the workings to be seen
    - determining the materials required and calculating quantities.
14. Decide and justify a final possible solution against the design brief by completing a well-drawn annotated concept drawing/s:
    - the housing may be painted, or decorated with signage or logos.
15. Teacher demonstration of some fundamental building skills
16. Discuss with the class the types of workshop skills that could be used to build the design:
    - available general and specialist tools and equipment
    - discuss different methods of cutting, fitting, joining and finishing of selected materials
    - teacher directed and demonstrated
      - materials marking, cutting and shaping, and finishing
      - general and specialist workshop tools such as plastics bandsaw, drill, buffing machine, heat strip bender
      - identifying components parts, and construction/assembly of any electronic components.

17. Students should observe, discuss and list the steps required to build the solution.
18. Teach the applications of the fundamentals of production planning; to assist students in the selecting, justifying, and safely implementing and testing appropriate technologies and processes, to make solutions:
    - general safety awareness in the workshop
    - selecting and safely operating machinery.

Task Four: produce the designed mechanical device; an automaton

Students will construct and test the designed automaton mechanical device.

1. Supervise and assist students to follow their production plan:
    - encourage students to:
        - work independently, and collaboratively, to manage projects
        - use digital technology to record the progress of production
        - apply both iterative and collaborative approaches
        - consider time, cost, risk, safety, production processes, sustainability and legal responsibilities.
2. Students carefully follow their planned steps of production to collaboratively and safely use tools and equipment in the workshop to produce and test their solution.
3. Advise students to partly assemble the device in stages and test each part assembly
4. Complete the assembly of the device and test.
5. Complete installing the device into the housing or stand:
    - test the operation of the device, and adjust, where necessary.
6. instruct students to photograph their finished solution
    - create images that show
        - overall front and side views
        - internal mechanical operations
        - specific features that reference to the design brief.

Task Five – evaluate the designed finished mechanical device; an automaton

Students will present, operate and evaluate the designed automaton mechanical device.

1. Instruct students to present the finished device, and demonstrate the operation of the working device.
2. Evaluation: analyse design processes and solutions against student-developed criteria.
   Direct students in how to develop a student evaluation criteria based on the design brief (teacher may provide focus questions on a worksheet).
   Students write a 50 word reflection about how the device worked out and satisfied the design problem. Focus on the finished, working product. Explain how it works, and discuss its success at meeting the design brief, as well as the areas that could be improved or changed.

Student worksheet

Name: _____ Group: _____

TASK 1: Mechanisms investigation **(25 marks)**

Identify and explain different mechanical motion, and the functional differences between changes of motion. Prepare a chart of mechanisms and list their operational change of motion.

Suggested time management

One or two periods per week from the first three weeks of Term 1 (three weeks' recommended allocation of time to complete this task, which should include class lessons with some out of class time).

What you need to do

1. With direction from your teacher, investigate different mechanisms and the types of input required, process created and output generated by these mechanisms.

2. Chart the information and include an explanation of:
   - motion input
   - mechanism process
   - changes of motion
   - mechanical advantage and velocity ratio
   - changes in ratios of motion — increase, same or reduction
   - changes in resultant output
   - different methods of calculating differences in input forces and output forces
     - provide examples of calculating, using ratios and correct units of measurement, the changes from input to output forces
     - examples of mechanical advantage and velocity ratio.

All references and sources of information should be included in the presentation.
Discuss with your teacher, the method of presentation. It may be submitted in a digital or hard copy form and should include a bibliography of all references used.

You are encouraged to gather information from various sources (internet, written text and your environment) to complement your work.

Illustrations and charts can be designed and presented according to agreed methods available.

Progress through the assignment should be in stages, and your teacher may direct you to present and discuss researched information in the early stages of your study, with other sessions to discuss draft investigation notes and methods of setting out the report.

What needs to be submitted for assessment: Display chart/s and report
Due date: End of Week 3

Sample marking key

Task one

Description	Marks
Engineering principles and specialisations Knowledge of mechanisms and changes of motion	
Accurate detailed information on each type of mechanism and motion supported by collection of relevant notes and clear images.	4–5
Collection of main broad points about the motion/mechanisms, with little or no use of collected notes or images.	2–3
Varied collection of information, but majority of statements copied directly from source or single reference.	1
Subtotal	**5**

Description	Marks
Engineering principles and specialisations Descriptions of different mechanisms: input – process – output changes	
Accurate, complete explanations of different mechanisms with detailed information about input, process and output changes.	4–5
Correct titles/name/s combined with general descriptions.	2–3
List of mechanical names, followed by brief descriptions, but with small errors and/or some detail missing.	1
Subtotal	**5**

Description	Marks
Engineering principles and specialisations Descriptions of different methods of calculating differences in input forces and output forces	
Accurate, complete explanations and calculation examples of different methods of calculating, using ratios and correct units of measurement about changes from input to output, showing correct examples of mechanical advantage and velocity ratio.	8–10
Explanations of different methods of calculating, recording the differences from input to output forces, showing correct examples of mechanical advantage and velocity ratio.	5–7
Satisfactory explanations, with listed ratios and formulas, but with errors in calculations of examples of mechanical advantage and velocity ratio.	3–4
Some brief explanations, list of ratios, but few correct calculations, with errors and/or some detail missing.	1–2
Subtotal	**10**

Description	Marks
Investigating and defining - clarity and presentation of information in chart/s and/or report	
Clear correct terminology, using uncluttered images in a well-set-out presentation format.	3
Correct use of terminology, with relevant images in a satisfactory presentation format.	2
Errors in terminology and presentation incomplete.	1
Subtotal	**3**

Description	Marks
Investigating and defining – recorded sources of information and/or bibliography	
Accurate, complete bibliography or reference list.	2
Partial or incomplete bibliography or reference list.	1
Subtotal	**2**

Total	**25**

Teacher's comment:

_____

_____

Teacher's signature: _____ Date: _____

TASK 2: Materials and Technologies specialisations - Differences in materials (20 marks)

Identifying the differences in the properties and characteristics of commonly available materials in the workshop.

Suggested time management

One or two periods per week from the first four weeks of Term 1 two weeks recommended allocation of time to complete this task, which should include class lessons with some out of class time).

What you need to do

1. With assistance from your teacher, the class group will investigate the available materials within the workshop.
2. Record the names and specific information of the materials your teacher identifies in the workshop.
3. With assistance from the teacher, the class group will investigate, identify and record the differences in the properties and characteristics of available materials in the workshop.
4. The class group will produce a chart that lists the different types and functional differences, including available sizes of:
   - timbers and manufactured boards
   - mild steel and stainless steel
   - non-ferrous metals
   - polymers and acrylics
5. With assistance from the teacher, add to the chart a list of the:
   - differences in hardness and strength of each material
   - samples of different uses and products of each materials
6. The class should then discuss with your teacher, the method of presenting this information. It may be submitted in a digital or hard-copy chart and should include sources and acknowledgments of all materials information.
7. Illustrations and charts can be designed and presented according to agreed layout or format.

You are encouraged to gather information from various sources (internet, written text and your environment) to complement your work.

Progress through the assignment should be in stages, and the teacher may direct you to present and discuss researched information in the early stages of your study, with other sessions to discuss draft investigation notes and methods of setting out the report.

What needs to be submitted for assessment: Collected information as a display chart/s and report
Due date: End of Week 5

Sample marking key

Task two

Description	Marks
Materials and technologies specialisations - knowledge of materials and differences in materials properties	
Provides accurate, complete explanations and examples of all materials, and the different properties of materials, presenting correct examples of suitable images of the materials.	8–10
Provides explanations of the differences and examples of available materials, and the different properties of materials, presenting suitable examples of some images of the materials.	5–7
Satisfactory explanations of the differences of available materials, with suitable images of some materials.	3–4
Some brief explanations, but few correct names, a brief list of differences, with errors and/or some detail missing.	1–2
Subtotal	**10**
Description	**Marks**
Investigating and defining. Collaborating and managing - Clarity and presentation of information for class group chart/s and/or report	
Works independently, and collaboratively, to gather relevant data and information, using digital technology and an iterative and collaborative approach. Contributed clear, relevant information to the group with consistent, correct use of terminology and with relevant images. Presents an accurate, complete bibliography or reference list.	8–10
Works co-operatively to gather information, using digital technology and collaborative approach. Contributed clear, relevant information to the group, with correct terminology and suitable images in a satisfactory presentation format. Presents a satisfactory bibliography or reference list.	5–7
Contributes some relevant information to the group, using appropriate terminology in a satisfactory presentation format.	3–4
Contributes little relevant data or information to the group and uses simple or incorrect terminology.	1–2
Subtotal	
Total	**20**

Teacher's comment:

_____

_____

Teacher's signature: _____ Date: _____

Student worksheet for design process

TASK 3: Research and design a mechanical toy or desk character - an automaton (40 marks)

Investigating and defining

Identify the needs of the client/stakeholder to determine the basis for a solution
Create and critique briefs to solutions
Investigate components/resources to develop increasingly sophisticated solutions, identifying and considering associated constraints

Designing

Apply design thinking, creativity, enterprise skills and innovation to develop, modify and communicate design ideas of increasing sophistication
Design possible solutions, analysing designs against criteria, including functionality, accessibility, usability and aesthetics, using appropriate technical terms and technology

Suggested time management Five weeks

What you need to do

Using your design folio/journal, complete the following:

Design Brief: In this section, write down your design problem

_____

_____

_____

_____

_____

_____

Investigating and defining

Investigate existing mechanical devices from selected websites

- collect examples/ideas/evidence from manuals, texts, and on-line resources of possible solutions
- evaluate these examples/ideas/evidence, then select, note possible solutions or combinations of these ideas.

Some suggested website references and sources of information:

Automata and mechanical theatre http://www.flying-pig.co.uk/
http://cabaret.co.uk/

Designing paper animation mechanism models https://www.robives.com/

Clear illustrations on mechanisms with other links
http://camillasenior3.homestead.com/mechanicalefficiency.html

Topics set out in chapters from levers to hydraulics http://www.tpub.com/machines/
http://www.smartown.com/sp2000/machines2000/main.htm

Simple machines with musical introduction http://www.design-technology.info/home.htm

Materials http://www.technologystudent.com/joints/joindex.htm
http://www.notesandsketches.co.uk/Index.html

Engineering calculations http://www.technologystudent.com/despro_flsh/new_maths1.html
http://www.design-technology.info/home.htm

Collection space for ideas and concepts (add notes to images collected)

(This blank page can be duplicated, if more space is required)

Statement of intent

Write a clear description of the project you are going to design and make.

1. Write and describe each of the following:
   - input – power type or source
   - motion and movement - changes
   - mechanisms – what is it expected to do
   - ratios – slow down or speed up
   - output – figure/object.
2. Make statements that are clear, with full sentences, and detailed in their meaning.
3. Include the likely components you think are needed for this device to function.
4. Include images, if they add to the description.

Designing

Design possible solutions, analysing designs against criteria, including functionality, accessibility, usability and aesthetics, using appropriate technical terms and technology.

Drawing template for ideas and concepts (add notes to drawn concepts)

Drawing template for developing ideas and concepts (add notes to drawn concepts)

Drawing template for consolidating ideas and concepts (add notes to drawn concepts)

Additional note on ideas, colours and logos for device

Designing

Design possible solutions, analysing designs against criteria, including functionality, accessibility, usability and aesthetics, using appropriate technical terms and technology

Consolidate ideas

1. Decide on the most likely final concept through the drawing/s and notes you have gathered.
2. Produce a series of notes/graphs/charts, using appropriate mathematical formulae to explain, illustrate and justify the different changes to forces, speed, distance and time within the mechanism.
3. Prepare a set of detailed working drawings:
   - this would be the drawing/s that you will work off when you began construction
   - the working drawing/s should be drawn orthogonally and include views showing all detail, with appropriately scaled dimensions
   - drawings to include notes on materials and assembly.
4. Determine and calculate the required materials for the housing or stand to support the mechanical device:
   - decide on materials, shape and size
   - calculate lengths or area of materials, and total amounts.
5. Calculate a costing for the components and materials
6. Produce a list of the required components and their details for the production of the device.

Component description and/or material	Number of	Sizes	Cost

7. Develop a plan for the production procedure
    - this is the estimated order of operations within an approximate timeline, required to build the project.

Notes from Teacher production skills demonstration

Take notes on:

Materials, components, cutting and shaping tools and machines, assembly of components, and finishing procedures, testing, forces and powering up.

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

Planning production

List the steps in the process, tools and equipment, and an approximate period of time you need to follow to produce your design.

Process	Tools/equipment	Estimated time

Sample marking key

Task 3

Description	Marks
Investigating and defining: Provides a design brief	
That includes detailed statements about required function, limitations and effect of other design considerations.	4–5
That includes statements about the major design considerations.	2–3
That uses poorly worded or very general terms to only partially cover the broad areas of the design problem.	1
Subtotal	**5**
Description	**Marks**
Investigating and defining: Provides evidence of investigating, selecting and explaining different types of mechanisms by including	
Detailed comparisons, using the design considerations and engineering fundamentals, between a carefully selected number of different mechanisms, with examples and descriptions of changes of motion.	9–10
Clear statements, using the design considerations and engineering fundamentals, comparing selected, different mechanisms, with descriptions of changes of motion.	7–8
A number of different mechanisms, with notes comparing their motion with occasional reference to design considerations.	5–6
A selection of images and brief comments on the function and motion of each mechanism.	3–4
A varied selection of different mechanisms with limited, general comments on personal likes and dislikes.	1–2
Subtotal	**10**
Investigating and defining total	**15**
Description	**Marks**
Designing: Design development of concepts from collection of images or ideas, showing annotations, justifications, progress in design	
Detailed progress of design concepts from collected images, with notes referring to design brief, valid justification and clear progress of design. Considers a wide range of components/resources to develop solutions, describing likely constraints.	9–10
Relevant connections of design concepts to collected images and design brief, some comments supporting design progress. Considers available components/resources to develop solutions, identifying constraints.	7–8
Adopted ideas from some images and likes/dislikes, with notes developing single design concepts. Presents relevant information on suitable components/resources to develop a solution.	5–6
Some adoption of collected images and ideas, limited to copying existing solutions. Presents limited information on common components/resources, may not be relevant in developing solutions.	3–4
Limited adoption or development of ideas. Presents incomplete information on a limited range of component/resources/devices.	1–2
Subtotal	**10**
Description	**Marks**
Designing: Clarity of ideas through concept design sketches	

At least three different, well-drawn sketches, well proportioned, good detail and clearly annotated.	7–8
Three well-detailed sketches, with relevant annotations, but minor errors in size and proportion.	5–6
Three satisfactory sketches, with suitable annotations, but with errors in size, angle and proportion.	3–4
Incomplete sketches, poor representation of ideas in size, angle and proportion.	1–2
Subtotal	**8**

Description	Marks
Designing: Explanation of proposed mechanism, calculations of force and changes in motion	
Detailed and logical statements about function and operation of mechanisms, with correct calculations of force, and changes in motion.	7–8
Logical comments about function and operation of mechanisms, with calculations of force, and changes in motion.	5–6
Clear, but brief, general explanation of mechanisms and changes in motion.	3–4
Incomplete explanation and/or comments taken from others.	1–2
Subtotal	**8**
Description	**Marks**
Designing: Working drawing/s	
Well-drawn, correctly labelled views with clear, accurate dimensioning and annotations for materials, joining, fittings and design features.	7–8
Well-drawn view/s with majority of correct dimensions and some notes for materials, joining and fittings.	5–6
Three views with majority of correct dimensions, but some errors or corrections in sizes and notes.	3–4
Near complete drawing with limited dimensions and few notes about production.	1–2
Subtotal	**8**
Description	**Marks**
Designing: Completed list of materials, components and costs & Proposed steps for manufacturing	
Complete and correct list of chosen materials and components, costed correctly. Logical list of preferred methods of production, together with correct tools and correct procedures, including a proposed timeline.	5–6
Complete and correct list of suggested parts, costing attempted. List of correct procedures and tools, some timeline estimates.	3–4
Incomplete list of parts, and partial list of tools or poor outline of procedures.	1–2
Subtotal	**6**
Designing total	**40**

Task Four - Producing and implementing & collaborating and managing (45 marks)

Select, justify, and safely implement and test appropriate technologies and processes, to make solutions

What you need to do

Using developed drawings and proposed manufacturing plan, construct the project:

1. follow all OSH (Occupational Safety and Health) requirements
2. keep a record of each production step. You could take photographs
3. select appropriate materials from available materials as per component list
4. measure, cut and shape and form all components for the mechanism
   - apply ongoing evaluation at different stages of the production, using conventions and functional tolerances
5. fit, fix and fasten components together by stages
   - partly assemble the device in stages and test how parts work together
   - test for the functional tolerances between components
6. build a suitable housing for the mechanism, and install the mechanism within the housing
7. test operation and movement of the assembled components within the housing
   - test for the functional tolerances between components and support surfaces of the housing
   - adjust, where necessary
8. present the working project for assessment.

Sample marking key

Task 4

Description	Marks
Producing and implementing: Accuracy of marking, cutting and shaping of the parts for the project	
All parts are marked accurately, and safely cut to size, then shaped correctly.	17–20
All parts are marked accurately, and safely cut to size, some assistance needed to achieve correct shape.	13–16
All parts marked correctly; assistance needed when cutting or shaping to size.	9–12
Most parts marked correctly; assistance needed when cutting and shaping to correct size.	5–8
Most parts incorrectly marked and cut, and required re-marking and/or parts replaced with additional materials.	1–4
Subtotal	**20**
Description	**Marks**
Producing and implementing: Accuracy of joins and how they fit, with success in assembling the various parts	
All parts are fitted accurately, and combine to move smoothly, as designed.	17–20
All parts assembled well and hold together, as designed.	13–16
All parts fit, joins require some adjustment, majority of parts hold together, as designed.	9–12
Most parts fit, but requires assistance to better fit some joins, assembled parts fit together, but not as designed.	5–8
Some parts fit, others require re-cutting/shaping, assembled parts do not fit together without additional materials.	1–4
Subtotal	**20**
Producing and implementing total	**40**
Description	**Marks**
Collaborating and managing: Work independently, or collaboratively when required, considering resources and safety, to plan, develop and communicate ideas and information for solutions	
Demonstrates consistent management skills and processes. Works independently and co-operatively to develop ideas and plan production. Works collaboratively when required to assist others to produce designed devices.	5
Demonstrates developing management skills. Works co-operatively to develop ideas and plan production. Works collaboratively when required to produce designed device.	4
Works co-operatively to develop ideas and plan production. Works collaboratively when required to produce designed device.	3
Works co-operatively on most occasions to produce a solution.	2
Demonstrates little collaboration, and requires assistance to work towards an end product.	1
Collaborating and managing total	**5**

Task 5 - Evaluating **(15 marks)**

Analyse design processes and solutions against student-developed criteria

Test the performance of the finished project against the design requirements, providing a demonstration to the class group.

1. Prepare an explanation of the operation of the project, providing:
   - A title for your project
   - explanation of the materials used and reasons for material selected
     - materials used to make the components
     - materials used to make the housing, and methods used to make the housing rigid and support the mechanism
   - an explanation of:
     - movement, in terms of the interaction between the parts changes of motion
     - use technical language to explain the dynamics of the mechanism, speed, distance, rpm and time
     - summarise the system in terms of input-process–output.
2. Demonstrate the operation of the project.

Photographs of the finished device

(Expand this area to fit all images)

My evaluation report on the completed working device

Name of device: _____

Evaluation: Write a 50 word reflection about how you think your device worked out. Focus on the finished, working product. Explain how it works, and discuss its success as well as the areas that could be improved or changed.

Trigger questions

- *Did your design satisfy the design brief and statement of intent? If not, what changes did you make and why?*
- *Did your design turn out as you planned it would? Explain why or why not? (Consider your sketch and comment on the size, shape, colour, added materials etc.)*
- *Did your design work mechanically, as planned? Explain why or why not?*
- *Did your production process use the tools and equipment listed? If not, what changes did you make and why?*

Sample marking key

Task 5	
Description	**Marks**
Evaluating: Overall appearance and performance of assembled working project	
Assembled project clearly resembles drawings in every detail and functions as per design.	5
Assembled project clearly resembles drawings and functions as per design.	4
Assembled project resembles drawings and appears to function as per design.	3
Assembled parts correct, but appearance not to design, and with intermittent functions.	2
Parts irregular and poorly shaped, poor fit, no function.	1
Subtotal	**5**
Description	**Marks**
Evaluating: Analyse design processes and solutions against student-developed criteria Evaluation comments with regards to the design brief and design considerations Explanation of finished project overall function input, process and output, and operation of the mechanism and support housing	
Comprehensively acknowledges that the initial design needs to match the end outcome and accurately explains any alterations made, justifying why they were made. Clear explanation using correct terminology for the function and processes, justifying assembly of individual components with reference to specific components and/or materials.	9–10
Understands that the device must match the design any can clarify and changes made and give reasons for the changes. Appropriate reporting and/or comments on assembly and function with some general logical evaluation of operations and reference to parts.	7–8
Follows design accurately and understands the end program should match the initial design, but lists basic changes made, and only provides brief explanatory comments with few references to materials or parts.	5–6
Comments linked to statement of intent expressing personal likes and dislikes about finished project. Limited explanation as to why end product may not match design. Attempts to give basic reasons for changes.	3–4
End product does not match the design and no explanation is given for why the project is incomplete, or the explanation is not relevant to the task.	1–2
Subtotal	**10**
Evaluating total	**15**