Grade 8 Technology: Mini-PAT

Design a Headgear System to Lift a Load in a Mine

Innovation Underground!

Term 3

Total Marks: 70 **Due Date: 31 August 2025 by 5pm**

Teacher: Ms Lombard

Instructions:

1. Answer **all** questions in this project.
2. Number your answers correctly according to the numbering system used.
3. Write neatly and legibly.
4. The mark allocation guides you on how much to write.
5. Leave a line after each answer.

Good Luck!

TOTAL MARKS: 70

HONESTY DECLARATION

Before starting with your exam, please complete the HONESTY DECLARATION on your first page

Declaration by [add your name and surname here]

I hereby confirm that all information in this document is my own original work

I understand that plagiarism, the use of AI-generated content, and any other form of dishonesty are serious offences and will result in the loss of marks and/or disciplinary action

[signature] **[date]**

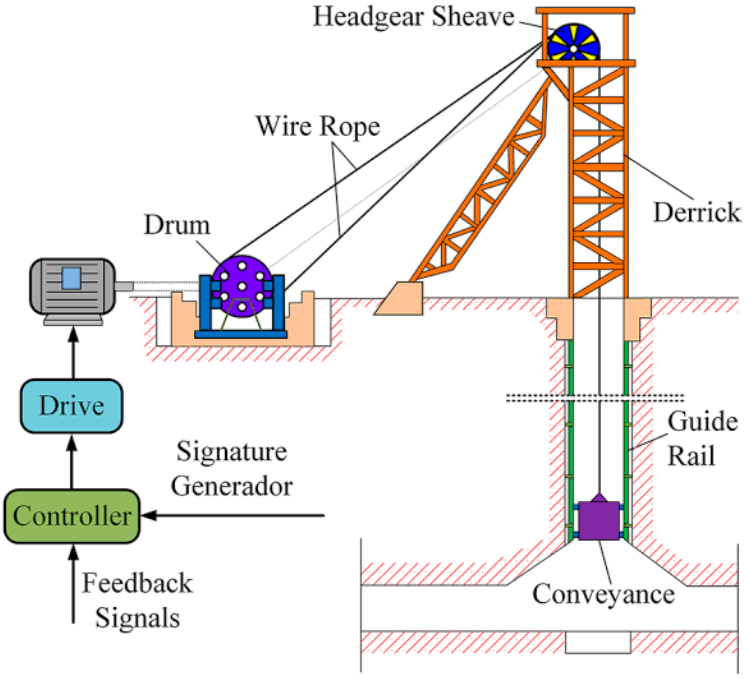
Scenario

You are a young engineer working for a company that builds mine headgear systems to help miners go underground and bring valuable minerals to the surface. South Africa's rich mining industry needs your help to design a safe, strong, and smart structure that includes a lifting mechanism.

Are you up for the challenge?

Mine headgear systems, also known as headframes, are structures built above mine shafts to support the hoisting equipment used to raise and lower materials and personnel in and out of the mine. They are essential for safe and efficient mine operations, facilitating the movement of ore, equipment, and workers.





PART A – INVESTIGATE (30 Marks)

1. What is the main job of the headgear at a mine? (3)

2. What important task is done inside the winding house? (3)

3. What is a sheave wheel and how does it help in the lifting process? (3)

4. What is a head frame, and why is it crucial in mining operations? (2)

5. Why are the legs of the head frame sloped toward the winch? (3)

6. The lift that goes down the mine has two parts:

6.1 What are they called? (2)

6.2 What does each part do? (4)

7. Do you think I-beams are a good choice for the head frame supports? Why? (3)

8. Where is triangulation used in this structure? How does it strengthen the headgear? (3)

9. What helps to keep the headgear stable and stop it from being pulled over by the winch? (1)

10. Is the sheave wheel placed in the centre of the upright column? (1)

10.1 Why must it be placed precisely in the right position?

PART B – DESIGN (40 Marks)

11. Draw a neat **2D sketch of a headgear system** including a sheave wheel, with all the parts clearly labelled. Use colour if you wish. (10)

12. **Design Brief and Planning** Imagine you're presenting your design to a real mining company. Complete the following:

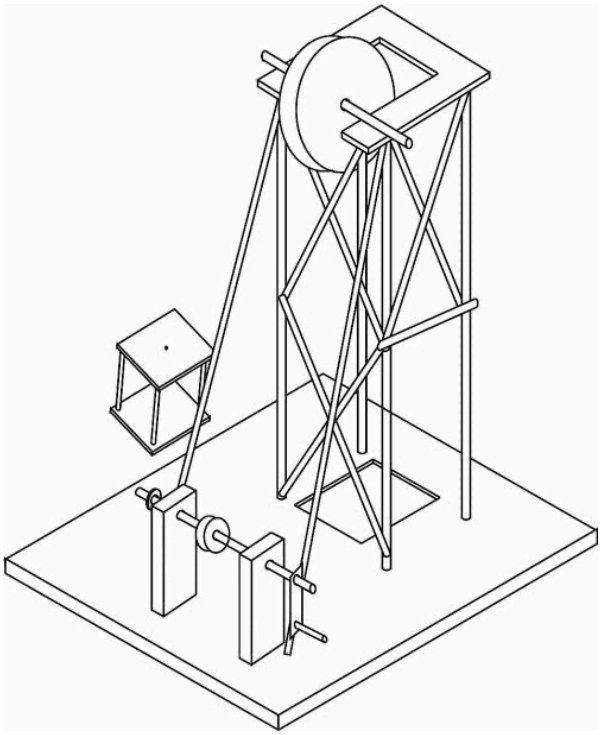
12.1 What opportunity are you designing for? (2)
12.2 What steps must you take to submit your design successfully? (2)
12.3 Write a design brief for your project. Include:

- The **materials** you used (4)
- The **tools** you needed (4)
- Any **difficulties** you experienced while making it (2)
- What part **you enjoyed** most (2)

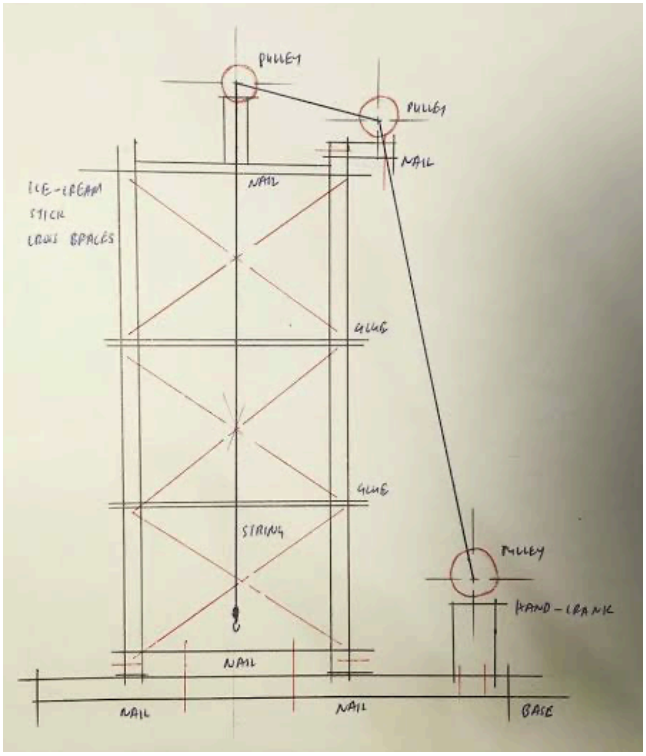
12.4 How does your winch mechanism help the mine workers? (2)
12.5 What is the purpose of the headgear? (2)
12.6 How does the headgear work? (2)
12.7 Name two safety features your design includes. (2)
12.8 What is one important factor when designing something like a headgear?
12.9 How can your design benefit the local community? (2)

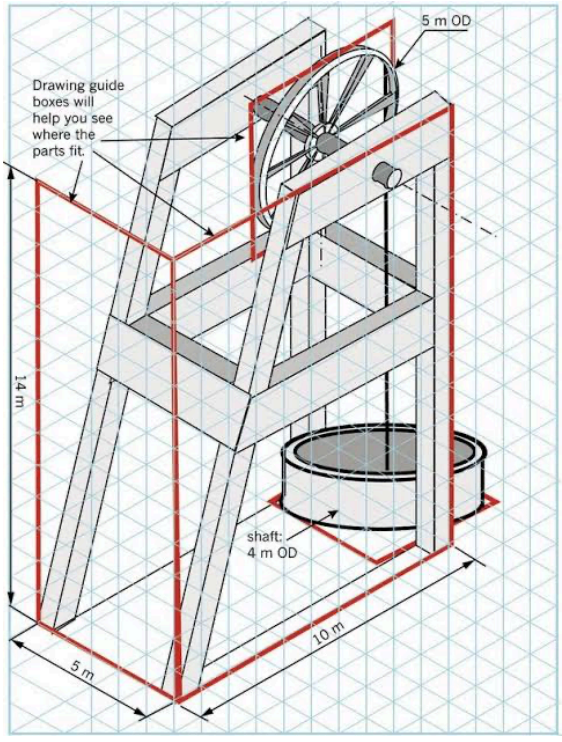
12.10 Would you rather design something cheap and simple, expensive and high quality, or something balanced in between? Explain why. (2)

PROJECT EXAMPLE:









MARKS BREAKDOWN:

- Investigation: 30 marks
- Design & Drawing: 40 marks