TECHNOLOGY

GRADE 8 MINI PAT PROJECT

TERM 3

2020

MARKS: 70

INSTRUCTIONS:

1. Units of measurement MUST be indicated, where applicable.

2. Diagrams are NOT necessarily drawn to scale unless otherwise indicated.

3. Write neatly and legibly.

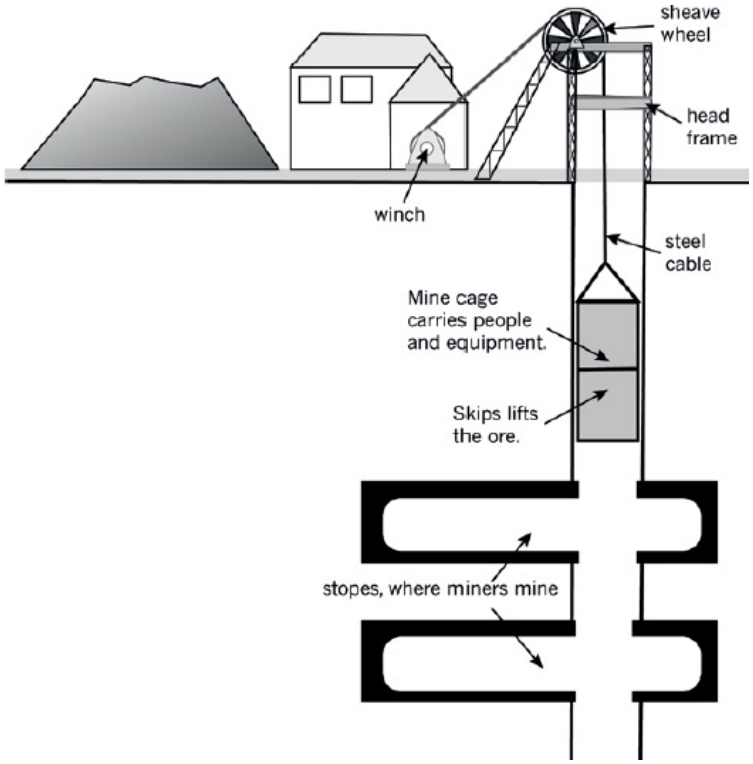
4. The length of the Project is left to the teacher's discretion.

An opportunity to tender for a mining contract

Your engineering company wants to submit a tender for the construction of the shaft headgear. The headgear must be able to transport miners and equipment 500 m underground. It must also be able to lift platinum ore that weighs 10 tons back up to the surface.

INVESTIGATE:

1. Use the picture in Figure 3 and your own information to answer the questions below:



1.1 What does the headgear of a mine do ?

_____

_____(1)

1.2 What happens in the winding house of a mine ?

_____

_____(1)

1.3 Explain what a sheave wheel is and what it does.

_____

_____(2)

1.4 What does a head frame do?

_____

_____(1)

1.5 Why do the legs on a head frame always slope towards the winch ?

_____

_____(1)

1.6 What do you call the two parts of the lift that goes down a mine ?

_____

_____(1)

1.7 What do these two parts of the lift do ?

_____

_____(1)

Look at the photographs and then answer the questions below. You will have to use your knowledge of frame structures.

1.8 Do you think I- beams are a good thing to use for head frame supports? Why?

_____

_____(2)

1.9 Where do you see triangulation used on this structure? Explain how triangulation

_____

_____(2)

1.10 What has been used to stop the head frame from being pulled over by the winch

_____

_____(2)

1.11 Look at the sheave wheel. Has it been placed in the middle of the upright column? Why do you think it is important to place the sheave wheel in exactly the right place on the head frame?

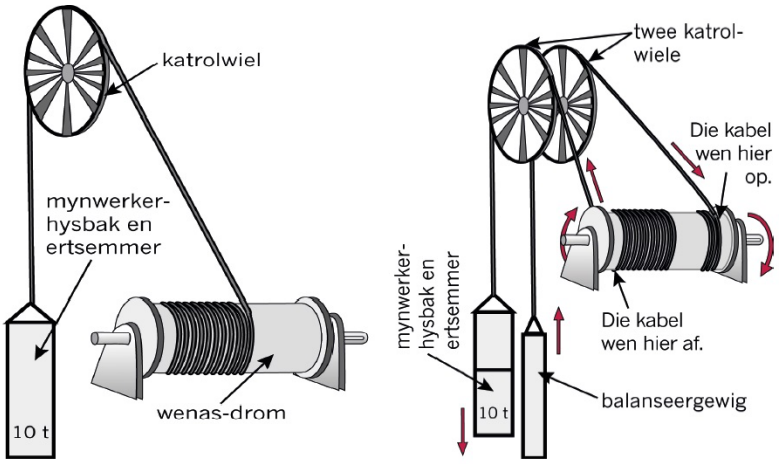
_____

_____(1)

[15]

Investigate: Mine- winches

The pictures show two different types of mining hoists. The first one has one sheave wheel, while the second has two sheave wheels. Use these pictures to help you answer the questions below:



Figuur 4

1.12 What are the differences between the two mine winches shown here?

_____

_____

_____(3)

1.13 What do you think a counterweight does for a mine winding system? Imagine winding the winch by hand.

_____

_____(1)

1.14 If the mine winch drum diameter is 6 m, calculate how far the cage will drop for each single rotation of the drum.

_____

_____

_____(3)

1.15 If the mine winch drum diameter is 6 m, calculate how far the counterweight will lift for each single rotation of the drum.

_____

_____(2)

1.16 Calculate how many turns of cable you will need on the drum for your cage and skip to move up and down by 500 m.

_____

_____(1)

1.17 Which of the two systems in Figure 4 do you think will need the largest motor? Explain your answer.

_____

_____(2)

1.18 Which system will be safer? Explain your answer.

_____

_____

_____(3)

[15]

2 **DESIGN:** Design brief, specifications and constraints.

2.1 Write the design brief in the space below:

_____

_____(3)

2.2 Specifications:

_____

_____

_____

_____(4)

2.3 Constraints:

_____

_____

_____(3)

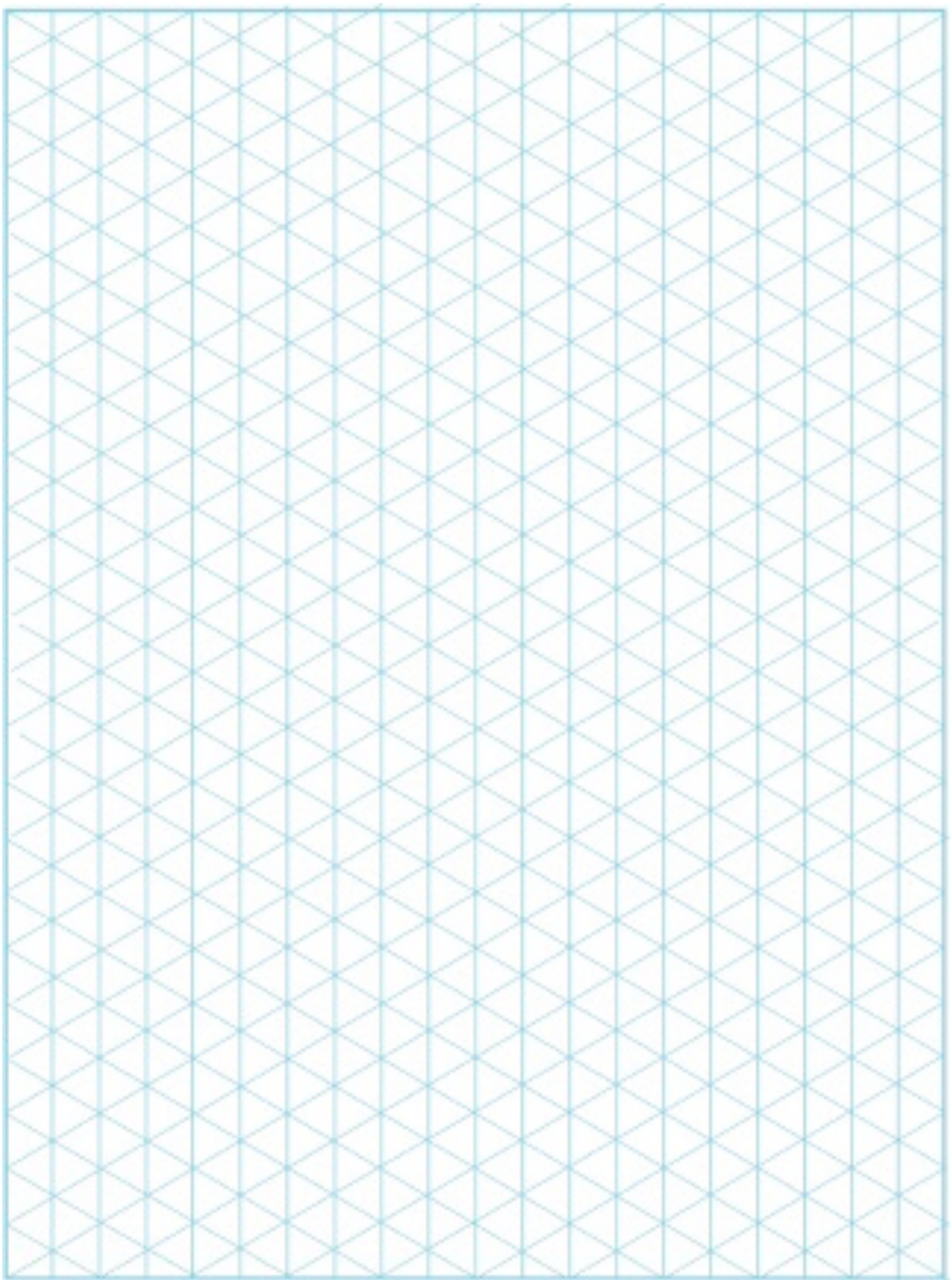
[10]

2.4 Make a 2D scale drawing:

Now use a ruler and a drawing triangle to get a more accurate version of your company's shaft tower design. Use the space below.

[15]

2.5 Make a 3D drawing of your own shaft tower design in the isometric pane below. **[15]**



[40]

Total: /70/

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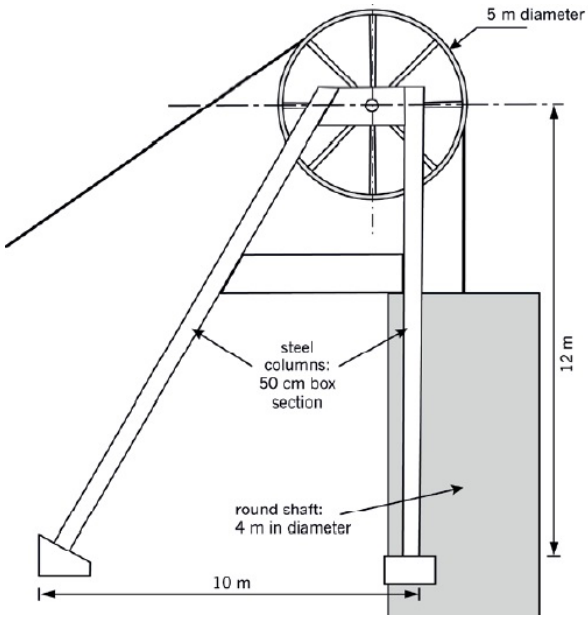
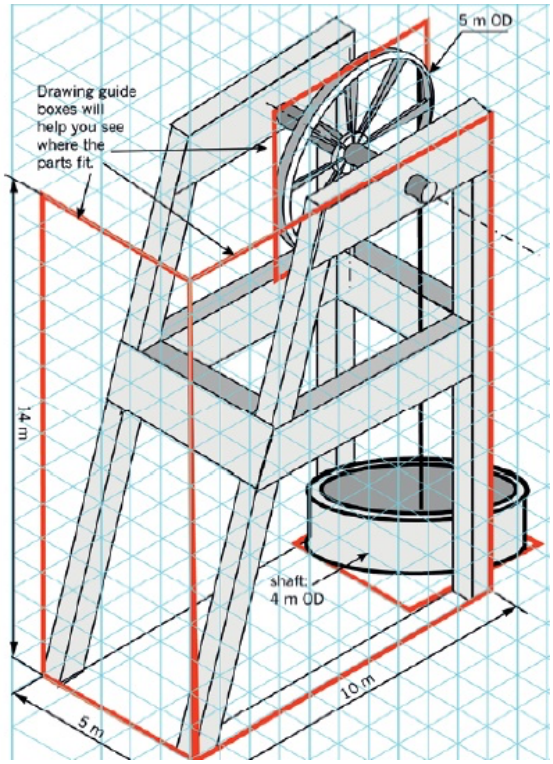
MARKING GUIDELINES

No	Solution	Explanation	Marks
1.1	The headgear of a mine is the lifting system that takes miners up and down to the working areas under= ground, and brings ore to the surface.	Answ = 1	(1)
1.2	The winding house contains the winch and cable that lifts the mine cage and skip.	Answ = 1	(1)
1.3	The sheave wheel is a pulley. It is located above the mine shaft, and the cable from the winch passes over it and is attached to the cage.	Answ= 2	(2)
1.4	The head frame is a strong structure that supports the sheave wheel.	Answ = 1	(1)
1.5	It is braced to prevent the structure from falling towards the pull of the winch.	Answ= 1	(1)
1.6	The cage and the skip.	Answ= 1	(1)
1.7	The cage is for the miners and equipment; the skip is to bring the ore out of the mine.	Answ= 1	(1)
1.8	I-beams are stronger than single plates of steel, Because the I–structure reinforces the beam against bending.	Answ= 2	(2)
1.9	There is triangulation throughout on the head frame. Triangulation strengthens the structure through cross-bracing the uprights. It works the same as triangu= lation on a roof truss.	Answ = 2	(2)
1.10	There are legs that slope from the winding house to the top of the head frame. These also act as triangulation, acting against the force of the cable pulling on the sheave wheel.	Answ = 2	(2)
1.11	The pull on the wheel should be in the center of the upright column. If the wheel is placed in front or behind, the same pressure will occur. The weight of the lift should be directly over the upright beam.	Any 1 =1	(1)
			[15]
1.12	The winch on the right has two sheave wheels working off the same drum. The one sheave wheel is for the cable that lowers the mine cage and skip. The other sheave wheel is for the cable that lifts the counterweight.	Answ = 3	(3)
1.13	It acts as a hoisting system by pulling down the drum and thus placing less stress on the winch shaft.	Answ = 1	(1)

1.14	C = 2 πr = 2 x 3.142 x 3 = 18,84 m	Formula = 1 Method = 1 Answ = 1 = 3	(3)
1.15	C = 2πr = 2 x 3.142 x 3 = 18,84 m	Formula = 1 Method = 1 Answ = 1 = 3	(3)
1.16	$\frac{500}{18,84}$ = 26,54	Answ = 1	(1)
1.17	The system on the left will need a stronger motor. The counter weight reduces the load on the motor on the right-hand example.	Answers = 2	(2)
1.18	The system on the right will be safer. If the motor fails on the left-hand-system, the cage and skip would fall. With a counterweight, the two weights will be more-or-less balanced, and a cable brake could more easily stop or slow the fall.	Answers = 3	(3)
			[15]
2.1	Design and build a mine shaft tower for the Platinum Stars platinum mine that can lift and sink at least 10 tons with a depth of 500 m. It must be strong, safe and able to keep working for as long as the mine is in operation.	Answers = 3	(3)
2.2.	• The mine shaft tower must be secure. • Must lift at least 10 tons of ore from the mine. • It must be fast and efficient to lower the miners. • There must be an emergency escape route. • The mine shaft tower must be built according to safety standards • Costs must be determined by considering strong materials. • The structure must be simple but safe.	Any 4 = 4	(4)
2.3	• The mine shaft tower should not relocate local community. • It must be built with the minimum of disruption. • It must not cause any pollution. • It must have a winch that works with a counterweight.	Any 3 = 3	(3)

			[10]
2.4		The shaft tower should look like the one on the left. Correctness = 7 marks Accuracy = 2 marks Neatness = 2 marks Labels = 4 marks	**[15]**
2.5	3D – Sample sketch 	The learner's sketch must be drawn with drawing tools. = 2 marks. Neatness = 2 marks Correctness = 5 marks Labels = 3 marks Dimensions = 3 marks Total: 15	**[15]**
			[40]
		Total: /70/	

Cognitive Level Summary:

Question	Lower order	Middle order	Higher order
1.1.		1	
1.2		1	
1.3	2		
1.4		1	
1.5		1	
1.6	1		
1.7	1		
1.8		2	
1.9		2	
1.10	2		
1.11	1		
1.12		3	
1.13			1
1.14	3		
1.15		2	
1.16	2		
1.17			2
1.18	3		
2.1	3		
2.2			3
2.3	3		
2.4		15	
2.5			15
Total	21	28	21
%	30%	40%	30%