RHODES HIGH SCHOOL
TECHNOLOGY: Grade 9
JUNE ASSIGNMENT 2020

Total Marks: 120

Name :……Grade 9:……

Instructions

- **Answer all the questions.**
- **Write clearly and legibly with a blue / black pen.**
- **All drawings must be neat, accurate and clear.**
- **All drawings must be drawn in pencil**

Section A (40)

Question 1: Different opinions are given as answers for the following questions. Choose the most correct answer. (10)

1.1 The following are examples of mechanical control systems
A) Cleats, hydraulics, pawl, disc brakes
B) Bicycle brakes, disc brake, ratchet and pawl, cleats
C) Disc brake, ratchet, bicycle brake, pulley
D) Cleats, disc brake, gear

1.2 Refers to the study of the measurements of the human body:
A) Anthropometrics
B) Aesthetics
C) Perspective
D) Fatigue

1.3 A closed hydraulic system is closed at both ends and keeps the fluid and maintains a
A) Constant pressure inside the system
B) An indirect pressure inside the system
C) Transference of pressure inside the system
D) Change in pressure inside the system

1.3 The mechanical advantage of a single fixed pulley is …
A) MA is greater than 0
B) MA is less than 0
C) MA is not equal to 0
D) MA is equal to 0

1.4 …….. is a drawing of an object drawn looking directly from above
A) Plan view
B) Front view

C) Right side view
D) Left side view

1.5 A bicycle is an integrated system using ….
A) Wheels, axles and levers
B) Gears, wheel axles and levers
C) Pulleys, levers, wheels and axles
D) Levers, pulleys, gears, wheels

1.6 The mechanical arm on the mechanical digger shown in the illustration lifts loads using
A) Levers and hydraulics
B) Gears, hydraulics and pulleys
C) Pulleys, levers and gears
D) Winches and hydraulics

1.7 In the mechanical system shown in the illustration, if the driver gear is turning clockwise, the follower gear….
A) Would not move
B) Would turn clockwise
C) Would turn anti-clockwise
D) Would turn clockwise and anti-clockwise

1.8 One of the main constraints that make our design process successful is
A) Time
B) Safety factors
C) Describing the problem
D) Solutions to the problems

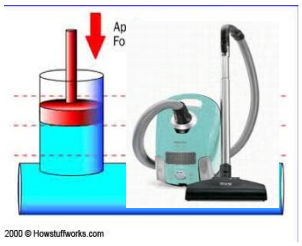
1.9 Which statement is true? (1)
A) Mechanisms allow you to do more work with less effort.
B) Mechanisms allow you to do less work with less effort.
C) Mechanisms require more effort to do more work.
D) Mechanisms require more force to do less work.

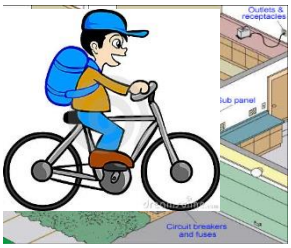
1.10 These brakes are used in cars within a combination of mechanical, electrical and hydraulic systems
A) Disc brake
B) Cleats
C) Rim brakes
D) Ratchet and pawl

Question 2 (20)
Answer the following questions.

2.1 Label each picture by stating which is: 4

- Pneumatic
- Hydraulic
- Electrical
- Mechanical





Picture 1 Picture 2 Picture 3 Picture 4

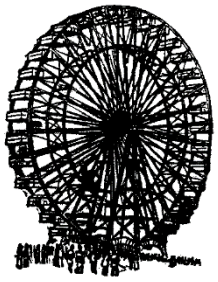
Picture 1	
Picture 2	
Picture 3	
Picture 4	

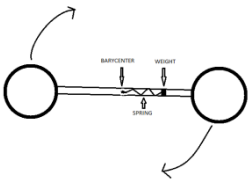
2.2 Study each diagram carefully and state which of the following motions are illustrated below: 4

Rotary **Linear**

Oscillation **Reciprocating**

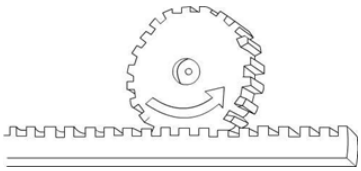
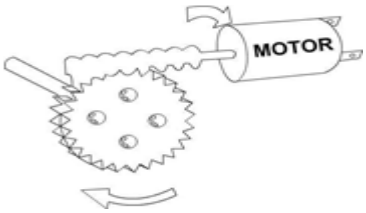
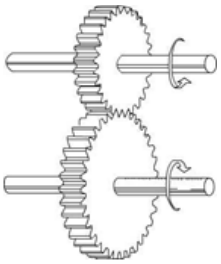
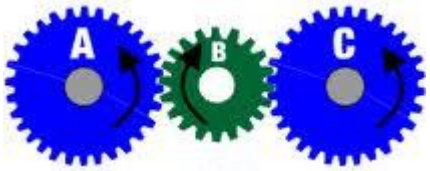
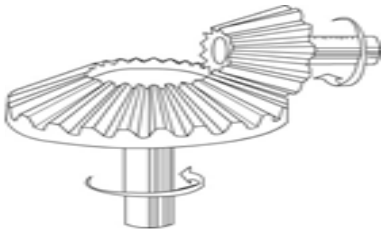
Rotary





…… …… …… ……

2.3 Match the Columns. Match the picture of the gear to the correct gear's name. (2x5=10)

Column A	Column B	Answer : Name of gear
2.1 Spur Gear	a) 	
2.2 Bevel Gear	b) 	
2.3 Rack and pinion Gear	c) 	
2.4 Worm Gear	d) 	
2.5 Spur Gear with an idler	e) 	

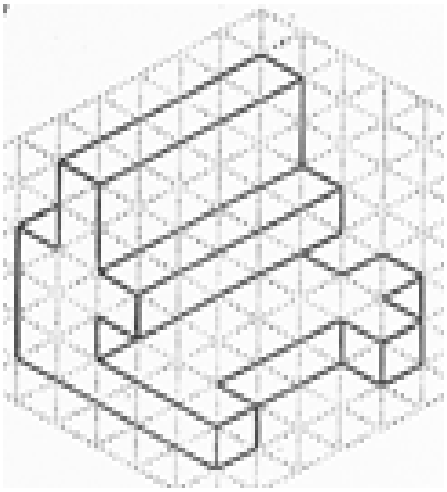
2.4 Name 2 other mechanical control systems. (2)

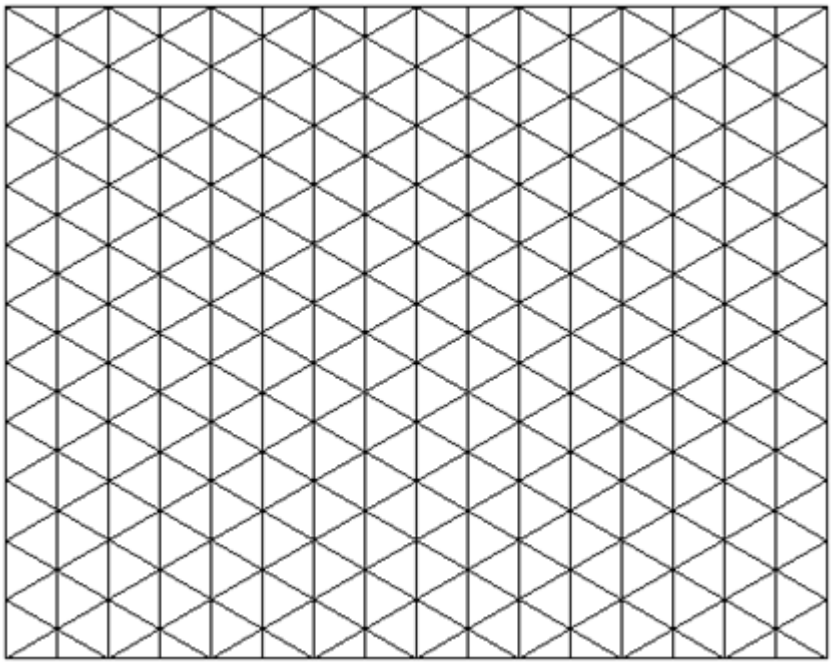
1. ----------

2. ----------

Question 3 (10)

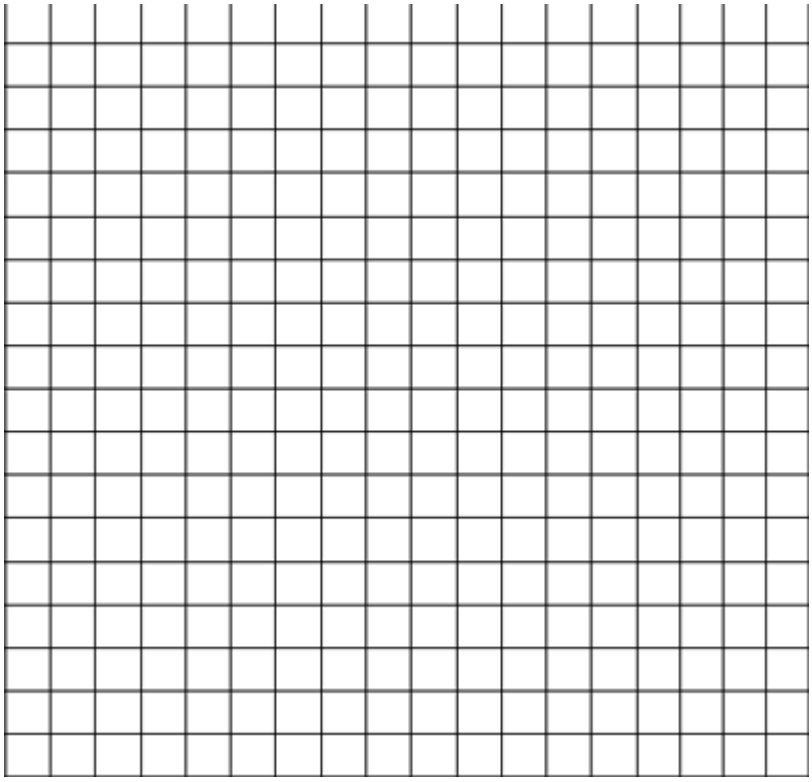
4.2. Study the figures below and then redraw them in the isometric grid and orthographic grid provided. (10)





RUBRIC: Isometric drawing

Criteria	Mark
Correct proportions	/2
Appropriate scale	/2
Neat and clear	/1
Total	**/5**



RUBRIC: Orthographic drawing

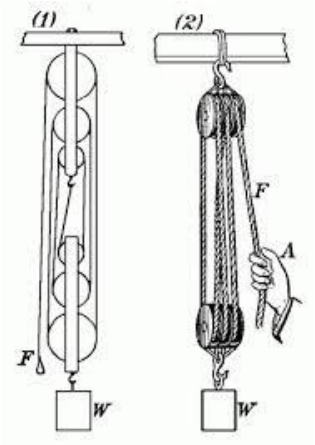
Criteria	Mark
Correct proportions	/2
Appropriate scale	/2
Neat and clear	/1
Total	**/5**

Section B (40)
Question 4 (30)

4.1 Draw a cam cleats neatly with labels. (2)

4.2 Provide an example where of how a cam cleats could be used. (2)

4.3 Identify and interpret the following illustration



4.3.1 Name the main mechanism used in this system. (2)

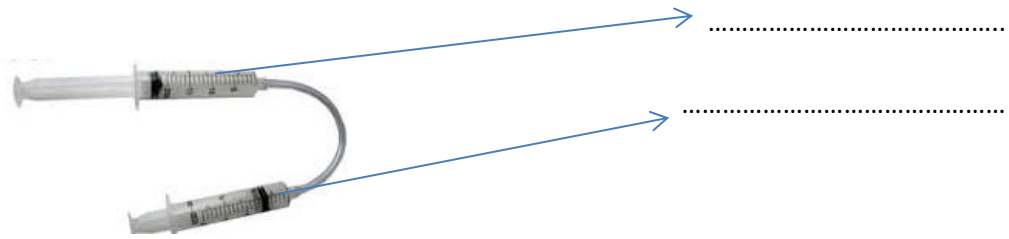
4.3.2 State what this type of compound system is called? (2)

4.3.3 Give two examples of where this type of system could be used. (2)

4.3.4 Describe how mechanical advantage works when using this type of compound system.(2)

4.4.1 Explain Pascal's principle. (2)

4.4.2 Label the following diagram. (2)

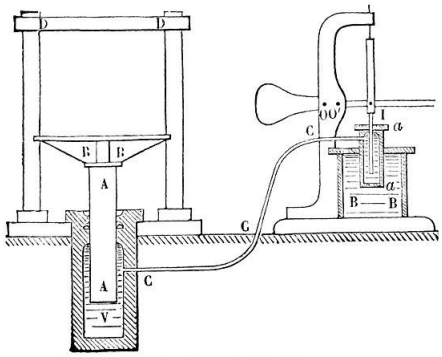


4.4.3 Differentiate between a hydraulic and pneumatic system. (2)

Hydraulic	Pneumatic

4.4.4 Complete a system diagram of the person using a hydraulic jack. (5)

4.5 Complete the following questions by interpreting the illustration below.



4.5.1 In a hydraulic system, what is pressurised to achieve mechanical advantage. (2)

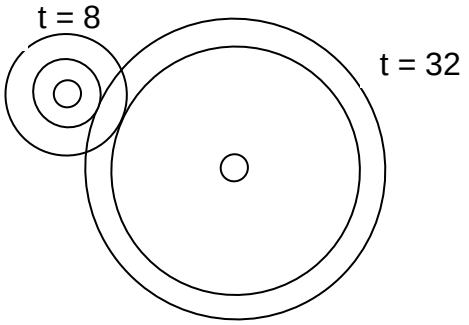
4.5.1 Arrange the following information in the correct order to explain the given system. (5)

a) force is transferred
b) force is multiplied
c) force is applied
d) … to the driver (master) cylinder
e) … to the follower (slave) cylinder

1	2	3	4	5

Question 5 (10)

5.1 Study the drawing of a simple gear train. Calculate the velocity if the smaller, driven gear has 8 teeth and the larger, driver gear has 32 teeth.



5.1.1 Calculate the velocity ration as follows (4)

Velocity ratio = number of teeth on driven gear

number of teeth on driver gear

=

Ratio =

5.1.2 Explain what your velocity ratio answer means. (2)

5.1.3 Predict what effect the velocity ratio will have on the speed and force in this device. (4)

Speed …….

Force……

Section C (40)

Question 6

Refer to the scenario below and answer the questions.

Scenario

Rhodes High School has renovated their computer room. The school has installed new computer stations with new computers and screens. The main frame server structure is too large and cannot be taken into the building via the front doors. The Grade 9 technology learners have been asked to design and make a system to hoist the structure up to the computer room. The system must be an integrated system including a control mechanical device. This system must be attached to a structure for easy operation. The system must not cost more than R2000 and needs to be completed in 2 weeks.

6.1 Name the 4 design/ technological processes. (2)

1	2	3	4

6.2 Decide on the mechanism that can be used in this device. Name and describe 4 of these mechanisms. (4)

1.---

2.---

3.---

4.---

6.3 Justify why a *winch* devise could be used in this mechanical system? (2)

6.4 Identify the type of structure that can be used to mount the mechanical devise on. (2)

6.5 State a reinforcement technique that is used to make structures stronger. (2)

6.7 Write a design brief for the above scenario. (2)

6.8 Describe two specifications from the above scenario. (1)

6.9 Select two constraints from the above scenario. (1)

6.10 Draw ***rough*** sketches of two possible designs for the hoisting device. You will need to have annotated (labelled) sketches showing detail. (2x2=4)

Design 1	Design 2

6.11 Draw a first angle orthographic projection of the chosen (either design 1 or design 2) , including a front view, side view and top view, using a scale of 1:100. (3)
Design Number:

Front view	Side view
Top view	

6.12 Illustrate your devise by using a double view vanishing point perspective. (2)

Question 7 (15)

Read the article below and answer the questions that follow

Ergonomics and the workplace

There's been a lot of talk in recent years about “ergonomics”. Ergonomics is the study of the relationship between people and their work environments, where machines are designed to including the height, depth and edges of shelving, all handles, switches and dials on devices and computer keyboards and mouse devices, which is very important to both health and safety. Good ergonomics adapt the job to fit the person rather than forcing the person to fit the job. In an ergonomic workplace, tasks and tools are designed to fit individual capabilities and limitations so people can do their jobs without being injured.

Ergonomics has emerged as a hot issue because it shows the link between certain types of injuries and the ways in which people perform their jobs. We now realize that the human body can only stay in awkward or unnatural positions for so long without paying a price.

This article will explore ergonomics and how to avoid the poor ergonomics that put our bodies at risk.

General hazards
Poor ergonomics leads to a number of serious physical problems. Often, we brush off the symptoms that could help us identify problems at an early stage. But that's the worst possible thing to do. With the types of physical problems discussed here, it's important to deal with them as soon as possible. If you wait until the pain is too much to bear, you may already have permanent damage.

Probably the most talked-about physical problem resulting from poor ergonomics is musculoskeletal disorders (MSDs). MSDs are the fastest-growing occupational concerns. MSDs develop over long periods of time. They're painful, sometimes even crippling, conditions that affect nerves, tendons, tendon sheaths and muscles, especially in the arms, hands and wrists. MSDs are sometimes called “repetitive motion syndrome” because repetitive motion is one common cause of this problem. Other causes include forceful exertion, vibration, and awkward positions or movements. The longer you expose your body to any of these situations, the more likely you are to develop a painful problem.

One of the most common MSDs is carpal tunnel syndrome. Other MSDs primarily affect the tendons, especially at or near the joints. Let a supervisor know immediately if you experience: Pain or achiness, Numbness or tingling, Stiffness, Burning, Swelling, and Weakness.

Another type of ergonomic problem relates to vibration. So if you work with pneumatic tools, grinders, chain saws or other tools that vibrate, you have to be very alert. If you work with these tools when it's cold or if you smoke, you're particularly at risk. Here are the symptoms to watch out for: Tingling, Numbness, Pain, Fingers turning white and losing feeling and Loss of finger dexterity.

Vibration-related injuries can be permanently crippling if you don't catch them early. To minimize vibration and its negative physical effects:

- Operate tools at the lowest speed possible without lengthening the time it takes to do the job.
- Keep tools well-maintained.
- Hold tools as loosely as safety permits.
- Wear gloves designed to protect against vibration.
- Use offset or spring-loaded handles or shock-absorbing exhaust mechanisms to reduce vibration.
- Use mechanical aids rather than your hands to grasp and hold pieces.
- Avoid bending your wrists or placing your hands and arms in awkward positions.
- Keep your body, especially your hands, warm.
- Try to alternate tasks so you don't spend all day operating a vibrating tool.

Identifying hazards
As mentioned above, the study of ergonomics has identified a number of tasks and positions that are most likely to lead to cumulative trauma disorders and other physical problems. Among the risk factors for cumulative trauma disorders of the arm and hand are:

- Repetitive activities – making the same motion over and over. The longer you repeat the same movement, the greater the risk.
- Forceful exertions, particularly with the hands. The combination of repetitive motion and force, such as pushing on a tool over and over, is a particular risk.
- Staying in the same position, whether sitting or standing, for an extended time.
- Awkward body postures, such as reaching above your shoulders or behind your back or twisting your wrists to perform tasks.
- Continued physical contact between hands or arms and a work surface or surface edge.
- Excessive power tool vibration.
- Hand tools that either don't fit the job or don't fit the hand.

Poor ergonomics can also injure the back. Among the factors that raise the risks of back injury are:

- Bending continually from the waist.
- Lifting from below the knees or above the shoulders.
- Twisting at the waist, especially while lifting.
- Lifting or moving objects that are too heavy or awkward.
- Sitting for long periods of time, especially if you have poor posture.

By including training and education, OSHA- Occupational Safety and Health Administration is emphasizing that good ergonomics is everyone's responsibility. It's up to the employer to provide you with information and guidance on how to avoid risks, but only you can use that information to do your job in the proper way.

Engineering and work practice controls

When it comes to preventing and controlling hazards, OSHA recommends that employers look first at engineering controls that can help improve the way the job fits the person, rather than forcing the person to fit the job.

One type of engineering control might be to modify the design of a workstation – for instance, moving the work surface to a height that's more comfortable for the individual worker. It's also possible to redesign the work method. You could, for example, put handles on boxes to make them easier to lift. Engineering controls can also mean redesigning tools. One recommendation is to provide tools with a selection of handle sizes so that each individual (of any size, right- or left-handed) can find one that's comfortable to hold and use.

When engineering controls aren't enough, you can try to ease the strain with work practice or administrative controls. That might mean scheduling more rest pauses for someone who works with a vibrating tool, rotating tasks so the worker is not constantly in the same position using the same muscles, or using mechanical equipment for a task rather than doing it by hand.

Safety procedures

Let's talk now about things you can do to improve the ergonomics of your workplace and reduce the chance of injury. The positions you work in and the movements you make are key parts of ergonomics. And, these are things over which you have control.

First, look at how your workstation is organized. Do you have to reach more than 20 inches to get to tools or materials you need? If so, try to rearrange your workstation to bring those things closer.

Bending and twisting are also problems. For most people, a comfortable work surface is at about waist height. A work surface that's more than 6 inches below your waist is probably not in accordance with good ergonomics.

If you can't make these changes yourself, talk to someone. You will need to figure out a way to make your workstation more comfortable. Here are some other things you can do to reduce the risk of injuries caused by poor ergonomics:

- Keep your elbows down on the work surface instead of leaning on the elbows.
- Work with your palms down.

- Work with your wrists straight, not bent.
- Shift positions every so often; don't sit or stand for too long at a stretch.
- Perform tasks with two hands rather than one when possible.
- Grip objects with your whole hand and your fingers – a power grip – in order to distribute the force over a larger area of your hand.
- Try to avoid applying pressure to a tool with the center of your palm; that spot is much weaker than the parts of the hand padded with more muscle.

Tool use and selection
Tools are another important part of ergonomics. First and foremost, select a tool that fits the job. If a tool is too small or not really designed for your purpose, you're going to be forcing the tool – and yourself – into bad positions. It's also a good idea to use a power tool rather than a hand tool when possible. Another suggestion is to use the lightest available tool for the job.

Other ergonomically desirable things to look for in tools include:
- Padded handles
- Textured grips, rather than grips with pre-cut finger-hold grooves
- Triggers that are operated by more than one finger.
- Tools that can be supported by two hands or an overhead suspension system.

Saving your back
When it comes to avoiding back problems, the most important thing is to lift properly – let your knees rather than your back do the work. The details of back safety, including proper lifting, are important enough for their own safety meeting. But in general, remember to:
- Avoid lifting; whenever possible, use material handling systems.
- Don't try to lift objects that are too heavy for you or whose size and shape are too awkward to allow a good grip.
- Don't twist while lifting or carrying a load; that's one of the fastest routes to back injury.

This article has outlined some of the most common ergonomic problems, their causes and some actions you can take to reduce the risk of injury. But, as you know, ergonomics seeks ways to make the job fit the person, rather than the other way around. That means it is, by definition, a very individualized approach to designing tools, tasks and work areas.

So pay attention to how your body feels when you're working. Try to identify what causes pain, numbness or other symptoms. Work with your supervisors to make sure you have a workplace that's free of ergonomic hazards.

7.1 Explain the term “Ergonomics”. (1)

7.2 How are machines designed in our homes using ergonomics? (2)

7.3 Poor ergonomics leads to a number of serious physical problems. Discuss 2 physical problems.(2)

7.4 How can one minimise physical injury from vibrating tools? (2)

7.5 “The study of ergonomics has identified a number of tasks and positions that are most likely to lead to cumulative trauma disorders and other physical problems”. Support this statement by listing the risk factors involved for cumulative trauma disorders of the arm and hand. (2)

7.6 State what abbreviation “OHSA” is? (2)

7.7 Summarise the things a person can do to reduce the risk of injuries caused by poor ergonomics. (4/2=2)

7.8 “ Let your knees rather than your back do the work”. Justify this statement. (2)
