Before the video

CNC machining

U	U	G	I	N	T	R	I	C	A	C	I	E	S	Q	E	K	F
V	L	N	L	F	X	H	V	R	J	D	Y	T	F	B	R	K	Y
A	C	I	C	R	S	T	E	E	L	A	T	X	I	J	O	X	C
Z	G	H	E	N	K	E	P	R	Y	C	L	I	J	B	A	G	A
L	F	S	N	S	E	F	L	U	E	P	F	F	P	K	E	E	M
Y	V	I	I	R	R	A	S	D	B	L	O	O	T	V	F	U	E
Q	Z	L	I	J	T	E	T	I	B	L	L	I	R	D	I	P	C
H	A	O	N	H	C	S	V	M	J	O	T	H	R	N	A	L	E
J	L	P	E	O	U	N	O	E	L	G	J	K	A	T	A	N	A
D	U	N	A	A	Y	J	A	N	R	D	D	T	D	F	G	U	F
P	M	R	C	K	Y	L	X	T	M	J	I	E	F	I	C	W	F
G	I	U	C	P	F	C	E	A	D	T	H	P	N	Y	I	T	O
D	N	I	U	O	Y	F	S	R	Z	C	Z	E	J	J	I	O	R
U	I	Z	R	E	G	O	O	Y	N	N	E	K	M	C	S	J	D
C	U	R	A	M	H	K	T	U	C	R	L	K	L	P	X	M	A
F	M	N	C	G	V	U	P	K	U	D	N	A	J	A	E	B	B
L	K	Y	Y	K	I	X	C	L	J	E	A	M	G	F	T	H	L
L	Q	I	Z	C	H	V	O	G	N	I	L	L	I	M	N	S	E

ACCURACY
AFFORDABLE
ALUMINIUM
AXES
CAD
CAM
DRILL BIT
ENGINEER
INTRICACIES
LATHE
MILLING
POLISHING
PUNCHED TAPE
RELY ON
REVERSE
RUDIMENTARY
STALK
STEEL
TITANIUM
TOOL

Use the spaces next to the words to translate them if you need to.

LIVEWORKSHEETS

Fill in the sentences. After that, you are going to watch the video and check your answers.

A. are measured in thousands of an inch
B. is a way to transform a stalk piece of material such as aluminium, steel or titanium
C. fed into a system that would then interpret the data
D. like lathes and other machining techniques
E. that can manipulate tools around a varying number of axes
F. the contrast between these two techniques is stark

CNC machines or computer numerically controlled machines are electro-mechanical devices ____[1], usually 3 or 5 with high precision per instruction from a computer program.

CNC machining is one of two ways that engineers, machinists, or makers can generate a physical part from a computer design file with the other being 3D printing known as additive manufacturing. ____[2]. CNC machining like other machining processes is a subtractive process where material is removed form a stalk. 3D printing on the other hand is an additive process, essentially functioning in reverse.

The first CNC machines were developed in the 1940s and 50s and relied primarily on a data storage technique known as punched tape. The code to control the machines would be manually punched into a data card and ____[3]. Needless to say, these early machines were rudimentary, and their functionality was limited. CNC machining technologies rapidly grew as technological capability only accelerated in the late 20th century which brings us to how modern CNC machined work.

As mentioned before machining ____[4] into a finished product or part. CNC machines rely on digital instructions specifically referred to as G-code. Before modern computed aided manufacturing and computer aided design programs such as AUTODESK's FUSION 360 were around, machinists would manually write the G-code to control these machines. CAM programs today allow you to take a 3D model and automatically generate G-code that will drive the machine with little input.

When you compare the capabilities of automated CNC machining to the manual alternative ____[5], you can start to see the benefits. CNC machines simply run faster at higher precision and accuracy while simultaneously allowing the transformation of a digital design into a physical part.

CNC machines are precise and ____[6], referred to as thou. Standard machining can provide tolerances on parts around ±0.005" (±0.127 mm); fine machining can produce tolerances of about ±0.001" (0.0254 mm); and specialized processes like polishing can offer up repeatable tolerances as tight as ±0.00005" (±0.00127 mm). For reference a human hair is .00069" (.017526 mm).

Now watch the video.

LIVEWORKSHEETS

After the video

Fill in the correct words.

conventional	degree	drills	growth	hundreds	lathes
possibilities	precision	properties	require	shapes	stalk

Now that we have the basics of CNC machining out of the way, we can start to dig into the intricacies held within. Many designs or specific machining processes _____[1] the use of multiple tools to make cuts. One tool doesn't function universally. For this, machinists will often build digital tool libraries that interface with the physical CNC machine. These machines often costing _____[2] of thousands of dollars can automatically switch tooling when directed by their digital instructions allowing for them to become manufacturing workhorses.

Basic CNC machining will move one or two axes referred to as the x-axis and the y-axis. You'll often hear the terms 2.5 axes, 3 axes and 5 axes CNC machines which simply refer to the _____[3] of freedom a machine can make cuts in. A 3-axis machine will move in the X, Y and Z axis, whereas a 5-axis machine can move in these 3 axes along with two additional rotational axes. As you might be able to imagine, the _____[4] of production with 5-axis machines are practically endless. 5-axis machines used to be relegated to high precision work, but as they have become more affordable, they are quickly becoming standard in many shops.

There are three _____[5] machining technologies that you need to understand to grasp the basics of how the material is removed from stalk in CNC machines, the first being drills. Drills work by spinning a drill bit in moving the bit in the contact with a stationary _____[6]. Next, we have lathes which function in reverse to drilling. Lathes spin the block of material against the stationary drill bit or cutter to remove material in a circular or fluid path. The shape capabilities on _____[7] are more limited than other techniques, but modern technology does allow these machines to create things such as square holes or noncircular _____[8]. Lastly, the most common CNC machine type is referred to as a milling machine. Milling machines involve the use of rotary cutting tools to remove material from a stalk piece. These machines function similar to _____[9] with their tooling capabilities encompassing much more variety.

Almost any material can be used in CNC machines from plastic to titanium. Different materials have different _____[10] so machinists and engineers will overcome their unique challenges by altering machining variables like tool selection, RPM, feed rate and coolant flow among an extensive variety of other factors.

CNC machined parts are all around you – they hold together your car and perform vital functions aboard SpaceX rockets. CNC machining is arguably the only way to produce high _____[11] metal parts for engineering designs across the world.

CNC machining is arguably the most significant manufacturing process of the 21st century and its functionality drives technological advancement across the globe. It's a trade that is keeping up with the _____[12] of technology and machinists across the planet are changing the world with their CNC machining skills.

LIVEWORKSHEETS

Answer the following questions.

What is CNC machining?

How many axes can a CNC machine move?

What are the three conventional machining techniques? Pick one of them and describe it in detail.

Are there any limitations to what material an engineer can use?

What kind of parts do you usually make at school?

LIVEWORKSHEETS