1. A machine weighs 4 tons. It is loaded on rollers and pushed by men. The co-efficient friction between rollers and ground is 0.25. If each man can exert a force of 75 kgf. Minimum how many men are required to push the machine?

    (a) 12   (b) 11   (c) 14   (d) None

    Ans:(c) (4000 x 0.25/75 = 13.33)

2. Measure of resistance to wear of material is indicated by its

    (a) Tensile strength   (b) Hardness
    (c) Shear strength   (d) Toughness

    Ans:(b)

    Note: Material hardness is the property of the **material** which enables it to resist penetration or indentation. In mineralogy, hardness is normally described as the resistance of a material to being scratched by another material. The ability of materials to resist scratching by another material can be ranked by referring to the Mohs scale which assesses relative hardness of the materials.

3. A pressure of 100 pounds per square inch (psi) is approximately = ... kg/cm^2

    (a) 5   (b) 6   (c) 8   (d) 6.9

    Ans:(d) (100/14.5=6.9, since 1 kg/cm2 = 14.5 psi)

4. The speed of a double start worm is 500 rpm. The number of teeth on the worm wheel is 50. What is the speed of the worm wheel?

    (a) 20 rpm   (b) 1000 rpm   (c) 500 rpm   (d) 40 rpm

    Ans:(a).

5. Which of the following elements can be used in a machine for converting rotatary motion into linear motion?

    (a) Lead screw   (b) Belt drive   (c) Chain drive   (d) Spur gears

    Ans:(a)

    Note: One way **to convert rotary motion into linear** is through a lead screw and nut assembly. A cam and follower is the typical mechanical component *used* in the *rotary-linear motion conversion* mechanism.

    A slider-crank mechanism is a typical design which converts **rotary motion** into **linear motion**. It is achieved by connecting a slider and a crank with a **rod**. This mechanism is also utilized as a system that converts the reciprocating linear motion of an automobile engine into rotary motion of the crank shaft.

6.   The machine element which engages and disengages the drive is

        (a) Motor   (b) Brake   (c) Engine   (d) Clutch

        Ans: (d)

Note: A clutch is a mechanical device that **engages and disengages** power transmission especially from **driving** shaft to driven shaft. In the simplest application, clutches connect and disconnect two rotating shafts **drive** shafts or line shafts

7.   A double start worm turns the worm wheel.... teeth per revolution

        (a) 1   (b) ½ (half)   (c) 2   (d) 0 (zero)

        Ans:(c)

8.   Which of the following materials can be used for manufacture of shafts?

        (a) Mild steel   (b) ceramics   (c) EN-24   (d) None of these

        Ans: (c).

Materials. The **material used** for ordinary **shafts** is mild steel. When high strength is required, an alloy steel such as nickel, nickel-chromium or chromium-vanadium steel is **used**. **Shafts** are generally formed by hot rolling and finished to size by cold drawing or turning and grinding.

9.   Which of the following gears is used for converting rotary motion into linear motion?

        (a) Rack and pinion(b) Spur gear   (c) Helical gear   (d) Worm gear

        Ans: (a)

10.   Which of the following is the most important property of lubricant?

        (a) Smell   (b) Colour   (c) Viscosity index   (d) Density

        Ans:(c)

11.   The hearth of a furnace is built by

        (a) Cement   (b) Clay   (c) Refractory bricks   (d) Sand

        Ans:(c)

12.   Which of the following techniques is used for repairing and restoring worn out components?

(a) Heat treatment   (b) Metal spraying   (c) Powder metallurgy   (d) None of these

Ans:(b)

13.   The process by which the surface hardness is increased is called

(a) Annealing   (b) Case hardening   (c) Normalising   (d) Tempering

Ans:(b)

14.   A pressure of 5 kg/cm^2 is acting on a square plate of side 10 cm. What is the thrust?

(a) 500 kgf   (b) 50 kgf   (c) 10 kgf   (d) None of these

Ans:(a)

15.   The joints in oil pipelines are made tight by ...

(a) Couplings   (b) Washers   (c) Keys   (d) Seals

Ans:(d)

16.   The hydraulic cylinder bores can be effectively surface finished by

a) Boring   (b) Turning   (c) Grinding   (d) Honing

Ans:(d)

17.   The hardness of rubber is measured in

(a) BHN   (b) Shore hardness   (c) Vickers   (d) Rockwell

Ans:(b)

Note: The Shore durometer is a device for measuring the hardness of a material, typically of polymers, elastomers, and rubbers. Higher numbers on the scale indicate a greater resistance to indentation and thus harder materials. Lower numbers indicate less resistance and softer materials.

A durometer scale is a type of measurement for rubber material hardness. Generally, most rubber materials fall under the rubber durometer scale of Shore A

18.   One micron is equal to

(a) 0.1 mm   (b) 1 mm   (c) 0.01 mm   (d) 0.001 mm

Ans:(d) Also 10^{-6} m.

19.   The portion of shaft inside the bearing is known as

(a) Inner casing   (b) Journal   (c) Rollers   (d) Axle

Ans:(b)

20.   The bed of a lathe is made of

(a) Close grained Cast iron   (b) Mild steel
(c) Stainless steel   (d) Alloy steel

Ans:(a)

Note: Gray Cast iron is the most often used in the machine structural elements design (bodies, housings, machine tools beds etc.). The materials significantly differ in physical and mechanical properties. The ability to suppress vibration is one of the most important factors determining the dynamic properties of the machine and has a significant impact on the machining capabilities of a machine tool.

21.   The operation by which bed ways of a machine can be restored is

(a) Shaping   (b) Planing   (c) Turning   (d) Sawing

Ans:(b)

NOTE: RESTORING THE GEOMETRIC ACCURACY OF THE BED BY PLANNING. ALSO BY HAND SCRAPING AND GRINDING.

22.   Which of the following is a position sensor?

(a) Saddle   (b) Limit switch   (c) Plunger   (d) clutches

Ans:(b)

Position sensor is a device that can detect the movement of an object and converts these into signals suitable for processing, transmission, or control. Both off -the-shelf and custom position sensing solutions are available featuring our core technologies, including inductive, potentiometric, magnetoresistive, hall effect, reed switch, electrolytic and capacitive sensing.

Note: A position sensor is a **sensor** that facilitates measurement of mechanical **position**. **A position sensor** may indicate absolute **position** (location) or relative **position** (displacement), in terms of linear travel, rotational angle, or three-dimensional space. They can detect the movement of an object or determine its relative position measured from an established reference point. These types of sensors can also be used to detect the presence of an object or its absence.

The primary types of position sensors include the following[ ]:

Potentiometric Position Sensors (resistance-based)
Inductive Position Sensors
Eddy Current-Based Position Sensors
Capacitive Position Sensors
Magnetostrictive Position Sensors
Hall Effect-Based Magnetic Position Sensors
Fiber-Optic Position Sensors
Optical Position Sensors
Ultrasonic Position Sensors.

https://www.thomasnet.com/articles/instruments-controls/all-about-position-sensors/

23. Choose the hardest material

(a) Aluminium   (b) Copper   (c) Mild steel   (d) Diamond

Ans:(d)

24. Which of the following is a good conductor of electricity?

(a) Copper   (b) Glass   (c) Rubber   (d) Teflon

Ans:(a)

25. The screw of the micrometer has a pitch of 1 mm. If the rim of the thimble is divided into 50 divisions, the least count of the micrometer is ....mm

(a) 0.05   (b) 0.02   (c) 0.005   (d) None

Ans: (b)

26. The hardness of steel... with increase in carbon content

(a) Increases   (b) Remains same   (c) Decreases   (d) None

Ans:(a)

27. Tool steels are ----

(a) Stainless steel   (b) High carbon steel (c) Low carbon steel (d) All of these

Ans: d.

INTRODUCTION

Tool steels are a family carbon and alloy steels having distinct characteristics such as hardness, wear resistance, toughness, and resistance to softening at elevated temperatures. Tool steels comprise carbide-forming elements such as chromium, vanadium, molybdenum

and tungsten in different combinations. They also contain cobalt or nickel which improves their high-temperature performance. They are generally heat-treated to improve the hardness and used for stamping, forming, shearing and cutting metals and forming of plastics. They are classified according to their composition and properties into various categories.

CLASSIFICATIONS

Tools steels fall into three basic categories -Cold work tool steels, Hot work tool steels, High-speed tool steels

https://www.azom.com/article.aspx?ArticleID=6138

28. The tendency of a metal to fail under repeated cyclic stressing is known as

(a) Toughness   (b) Fatigue   (c) Poisson's ratio   (d) Permanent set

Ans: (c)

Note – Mechanical properties of materials

Definition

Fatigue - when a material is subjected to repeated cycles of stress or strain and its structure breaks down and ultimately leads to fracture

Creep - when a material is subjected to a load for a very long time it may continue to deform until a sudden fracture occurs

Fatigue - Fractures due to fatigue is common in cyclic loaded parts like connecting rods, crankshafts, turbine blades, railroad wheels and so on. Fractures occur at stress less than the material yield stress. Yield strength is defined in engineering as the amount of stress (up to yield point) that a material can undergo before moving from elastic deformation into plastic deformation. Most steels have an endurance or fatigue limit about half the tensile strength.

Tensile Strength - *(Ultimate Tensile Strength)* - of a material is the limit stress at which the material actually breaks, with sudden release of the stored elastic energy.

CREEP - THE TIME DEPENDENT DEFORMATION DUE TO HEAVY LOAD OVER TIME IS KNOWN AS **CREEP**.
In general both stress and temperature influence on the rate of creep.Normally creep strength decreases with temperature.Allowable creep strain can be specified - typical *0.1 %/year* for steel bolts and piping

Fatigue limit, **endurance limit**, and **fatigue strength** are used to describe the amplitude (or range) of cyclic stress that can be applied to the material without causing fatigue failure.

https://www.engineeringtoolbox.com/steel-endurance-limit-d_1781.html

29.   Cast iron contains about ... % of carbon

   (a) 1 to 2   (b) 0.5   (c) 10   (d) 2 to 4

   Ans:(d)

> **Note: Cast iron**, an alloy of iron that contains 2 to 4% carbon, along with varying amounts of silicon and manganese and traces of impurities such as sulfur and phosphorus. It is made by reducing iron ore in a blast furnace. The liquid iron is cast, or poured and hardened, into crude ingots called pigs, and the pigs are subsequently remelted along with scrap and alloying elements in cupola furnaces and recast into molds for producing a variety of products

30.   .... is an intentional difference between the maximum material limits of mating parts

   (a) Nominal size   (b) Allowance   (c) Basic size   (d) Dimension

   Ans:(c)

> Note: Allowance: It is an intentional difference between maximum material limits of mating parts. It is a minimum clearance or maximum interference between mating parts. Deviation: The algebraic difference between a size (actual, maximum, etc.) and the corresponding basic size

31.   If a dimension is specified as $50+^{0.03\,-\,0.02}$ mm the tolerance is (in mm)

   (a) 0.03   (b) 0.02   (c) 0.05   (d) None

   Ans:(c)

32.   The clearance between the mating parts can be measured using

   (a) Plug gauge   (b) Screw gauge   (c) Feeler gauge   (d) Dial gauge

   Ans:(c)

33.   The roughness of a machined surface is generally measured in

   (a) Microns   (b) mm   (c) Centimetre   (d) Minutes

   Ans:(a)

> **Note: Surface Roughness, Waveness& Form**
>
> Surface roughness is an important parameter that affects the tribologicalbehavior of surfaces, e.g., asperity interlocking or deformation can increase friction

Surface roughness is defined as the irregularities which are inherent in the production process (e.g. cutting tool or abrasive grit)

Waviness -that part of the texture on which roughness is superimposed. It may result from vibrations, chatter or work deflections and strains in the material.

Form -the general shape of the surface, ignoring variations due to roughness and waviness.

34.   One micron is equal to

(a) 10^{-6} cm   (b) 10^{-6} mm   (c) 10^{-6} m   (d) None of these

Ans:(c)

35.   Paint dry film thickness is measured by

(a) Feeler gauge   (b) Micrometer   (c) Elcometer   (d) Profilometer

Ans:(c)

Note: The Elcometer coating thickness gauge is available with a wide range of interchangeable probes; providing greater coating thickness measurement flexibility on metal substrates.

36.   A jig is an element comprising

(a) Tool guidance   (b) Clamping of job
(c) Locate and clamp the job and guide tool   (d) Locate job

The successful mass production depends upon the interchangeability to facilitate easy assembly and reduction of unit cost. Jigs and fixtures are specially designed so that large numbers of components can be machined or assembled identically, and to ensure interchangeability of components.

Jig

It is a work holding device that holds, supports and locates the workpiece and guides the cutting tool for a specific operation, like drilling. Jigs are usually fitted with hardened steel bushings for guiding or other cutting tools. A jig's primary purpose is to provide repeatability, accuracy, and interchangeability in the manufacturing of products. A jig differs from a fixture in that it guides the tool to its correct position in addition to locating and supporting the workpiece.

Fixture

It is a work holding device that holds, supports and locates the workpiece for a specific operation but does not guide the cutting tool. The main purpose of a fixture is hold a workpiece during either a machining operation or welding or some other industrial process.

Examples: Vices, chucks, welding fixture, etc.

Advantages of Jigs and Fixtures include – increase in productivity, interchangeability of a components produced in mass scale, and repeatability of quality, skill reduction, cost reduction, etc.

38.   In 18-4-1 high speed steel the percentage of tungsten is

(a) 4   (b) 1   (c) 18   d) 23

Ans:(c)

Note:A common type of **high-speed steel** contains 18% **tungsten**, 4% chromium, 1% vanadium, and only 0.5–0.8% carbon

39.   In a production belt for measurement of diameters the gauge that will be ideally suited is

(a) Vernier   (b) Micrometre   (c) Tape   (d) Snap gauge

Ans:(d)

Note: A **snap gauge** is a form of go/no go **gauge**. It is a limit **gauge** with permanently or temporarily fixed measurement aperture(s) (gaps) which is used to quickly verify whether an outside dimension of a part matches a preset dimension or falls within predefined tolerances

41.   The stress at the elastic limit of the material is called ... strength

(a) Yield   (b) Crushing   (c) Compressive   (d) Tensile

Ans:(a)

42.   The accuracy of slip gauges is of the order of

(a) mm   (b) nanometer   (c) angstom   (d)micron

Ans:(d)

 Note: The means to do so are '**slip gauges**'. They can be used to measure tolerances in the range of 0.001 to 0.0005 mm very accurately.

Rringing is the process of sliding two blocks together so that their faces bond. Because of their ultraflat surfaces, when wrung, gauge blocks adhere to each other tightly.

43.   The surface finish requirement is indicated by

(a) Triangle　　　(b) Square　　　(c) Round　　　(d) Inverted triangle

Ans:(d)

44.　A dial gauge is an example of

(a) Fixed gauge　　(b) Go gauge　　(c) No-Go gauge　　(d) Indicator gauge

Ans:(d)

45.　The screw of the micrometer has a pitch of 1mm. and no. of divisions on thimble are 100. What is the least count?

(a) 0.1 mm　　(b) 0.01 mm　　(c) 0.001 mm　　(d) 0

Ans:(b)

46.　Which of the following tools is used for thread cutting in a drilled hole?

(a) Drill　　(b) Reamer　　(c) Broaching　　(d) Tap

Ans:(d)

Note:Taps and dies are tools used to create screw threads, which is called threading. Many are cutting tools; others are forming tools. A tap is used to cut or form the female portion of the mating pair (e.g.. a **nut**). **A die** is used to cut or form the male portion of the mating pair (e.g. a bolt)

Thread chasers – used to cut external threads on pipes: When threads get damaged on bolts or in bolt holes, there are two options: taps & dies, or thread chasers. Thread chasers aren't designed for cutting new threads, only for cleaning rusty or damaged threads.

Taps, dies, and thread chasers are all tools that are designed to create or repair threads either in holes or on bolts and studs, and come in a variety of diameters and thread pitches. They look like nuts and bolts, but the hardness of the material they're made of and the slots in the threads are what make them cut out material.

A **die head** is a threading die that is used in the high volume production of threaded components. Die heads are commonly used on lathes, turret lathes, screw machines and CNC lathes. They may be used for either cutting a thread or rolling a thread. They may also be used for internal or external thread cutting.

https://en.wikipedia.org/wiki/Die_head

47.　A pressure of 5 kg/cm^2 is acting on a square plate of side 10 cm. What is the thrust on the plate?

(a) 50 kgf　　(b) 5 kg　　(c) 500 kgf　　(d) 10 kgf

Ans:(c)

48.　Find the odd man out

(a) Hot chisel   (b) Hammer   (c) Hot punch   (d) Reamer

Ans:(b)

49. Marking media is
(a) Substance in the form of powder or crystals
(b) Used to make scribed lines visible clearly
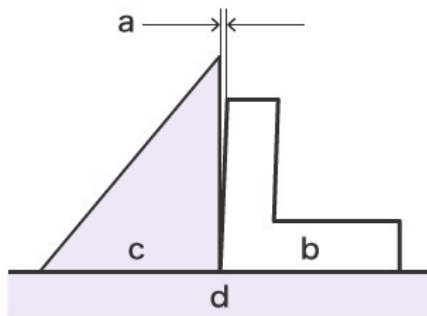(c) Marking pen used
(d) Both a and b

Ans:(d)

50. Perpendicularity can be checked by using

(a) Try-square   (b) Straight edge   (c) Template   (d) Protractor

Ans:(a)

Note: measuring perpendicularity to check how perfectly the target is perpendicular to the datum (reference plane or line).
Methods

1. Using a Square Ruler and Feeler Gauge
2. Using a Coordinate Measuring Machine (CMM)

1. USING A SQUARE RULER AND FEELER GAUGE

ACCURACY IS LOW DUE TO THE SIMPLICITY OF THE MEASURING TOOLS USED. THIS METHOD CANNOT BE USED WHEN THE MEASUREMENT SURFACE IS NOT PERPENDICULAR TO THE SURFACE ON THE SURFACE PLATE. THE MEASUREMENT DATA NEEDS TO BE HANDWRITTEN OR MANUALLY INPUT.
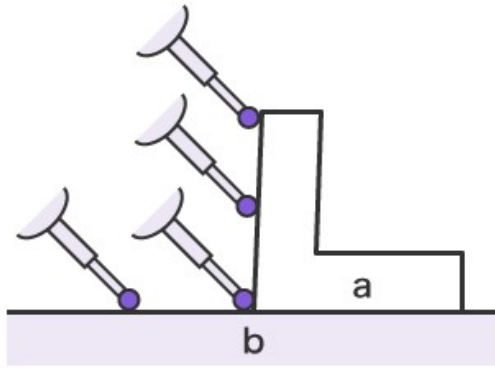
Figure: a) Target and b) Surface plate

2. USING A COORDINATE MEASURING MACHINE (CMM) -

Set the datum by putting the stylus on multiple points on the datum plane (surface plate), and then measure the perpendicularity by putting the stylus on the measurement plane (target). This enables accurate measurement even when the target's measurement surface is not perpendicular to the surface plate. It is also possible to measure the perpendicularity of axes of cylinders, bores, and circular cones.

https://www.keyence.com/ss/products/measure-sys/gd-and-t/orientation-tolerance/perpendicularity.jsp