Chemist and Metallurgist

1. Production of holes in flat blank is termed as

   1. blanking (2) piercing (3) perforating (4) punching

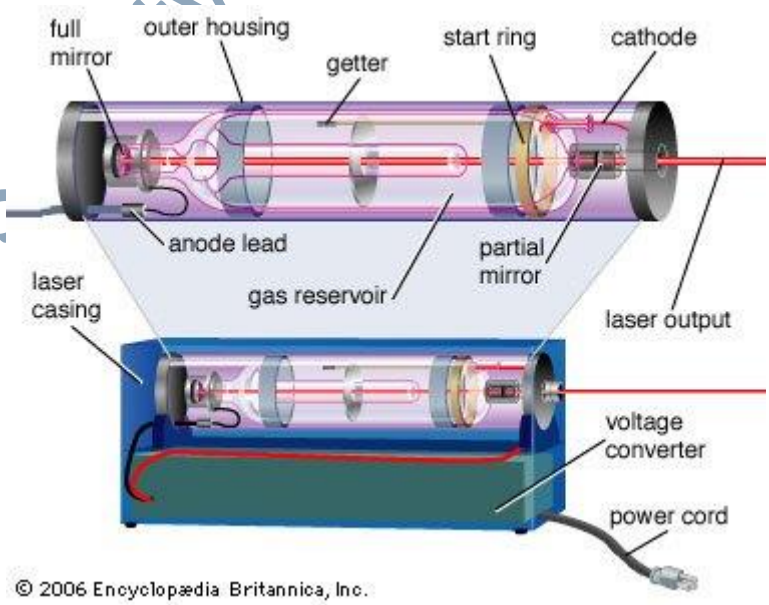
   Ans: 2

2. Laser can be produced using

   (1) graphite (2) ruby (3) diamond (4) emerald

   Ans: 2

Laser (light amplification by stimulated emission of radiation), a device that stimulates atoms or molecules to emit light at particular wavelengths and amplifies that light, typically producing a very narrow beam of radiation. The emission generally covers an extremely limited range of visible, infrared, or ultraviolet wavelengths. Many different types of lasers have been developed, with highly varied characteristics. ***Laser*** is an acronym for "light amplification by the stimulated emission of radiation."



https://www.britannica.com/technology/laser
Hecht, Jeff. "laser". ***Encyclopedia Britannica***, 15 Aug. 2021, https://www.britannica.com/technology/laser. Accessed 23 November 2021.

Lasers are used in optical disc drives, laser printers, barcode scanners, DNA

sequencing instruments, fiber-optic, semiconducting chip manufacturing (photolithography), and free-space optical communication, laser surgery and skin treatments, cutting and welding materials, military and law enforcement devices for marking targets and measuring range and speed, and in laser lighting displays for entertainment. Semiconductor lasers in the blue to near-UV have also been used in place of light-emitting diodes (LED's) to excite fluorescence as a white light source. This permits a much smaller emitting area due to the much greater radiance of a laser and avoids the droop suffered by LED's; such devices are already used in some car headlamps.

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

3. Compression molding is the ideal method of processing

(1) plastics
(2) thermo-setting plastic
(3) thermoplastics
(4) nonferrous materials

Ans: 3

4. Identify the item that is not cold formed

(1) Food container
(2) Stainless steel vessel
(3) Crank shaft
(4) Heating duct

Ans: 3

5. Advantage of cold forming is

(1) grain refinement takes place
(2) **close dimensional tolerances, good surface finish quality**
(3) no consequent heat treatment is needed
(4) force required is relatively small

Ans: 2. (The major advantages of cold forging are **close dimensional tolerances, good surface finish quality)**

6. If the grain diameter increases, then yield strength of metal

(1) decreases
(2) increases
(3) remains constant
(4) none of these

Ans: 1

7. During heat treatment, microstructure that develops in steel depends on

(1) Heat treatment process
(2) Carbon content
(3) Both (1) and (2) above
(4) None of the above

Ans: 3

8. Thoria is a

(1) fiber reinforced composite
(2) particle reinforced composite
(3) dispersion-strengthened composite
(4) concrete

Ans: 3

9. In galvanizing, layer of zinc is applied to the surface of steel by

(1) Hot peening
(2) Cold peening
(3) Hot dipping
(4) Cold dipping

Ans: 3 (or by electroplating)

10. Intergranular corrosion occurs

(1) along grain
(2) along grain boundaries
(3) at the surface
(4) in the core of material

Ans: 2 (mostly due to weld decay in austenitic SS, i,e., chromium carbide precipitation – chromium added for improving corrosion resistance is being depleted from main alloy structuree)

- Intergranular corrosion (IGC) is a selective attack in the vicinity of the grain boundaries of a stainless steel
- Chromium carbides can be precipitated if the stainless steel is sensitized in the temperature range 550–850°C (1020–1560°F), for example during heat treatment or welding
- https://www.materials.sandvik/en/materials-center/corrosion/wet-corrosion/interngranular-corrosion/

11. In superconducting state, materials are

(1) paramagnetic
(2) ferromagnetic
(3) diamagnetic
(4) none of the three are correct

Ans: 3

Superconductivity, complete disappearance of electrical resistance in various solids when they are cooled below a characteristic temperature. This temperature, called the transition temperature, varies for different materials but generally is below 20 K (−253 °C).

The use of superconductors in magnets is limited by the fact that strong magnetic fields above a certain critical value, depending upon the material, cause a superconductor to revert to its normal, or nonsuperconducting, state, even though the material is kept well below the transition temperature.

Suggested uses for superconducting materials include medical magnetic-imaging devices, magnetic energy-storage systems, motors, generators, transformers, computer parts, and very sensitive devices for measuring magnetic fields, voltages, or currents. The main advantages of devices made from superconductors are low power dissipation, high-speed operation, and high sensitivity.

Ginsberg, Donald M.. "Superconductivity". ***Encyclopedia Britannica***, 13 Feb. 2018, https://www.britannica.com/science/superconductivity. Accessed 17 October 2021.

12. Cope in foundry practice refers to

(1) middle portion of the moulding box
(2) bottom half of the moulding box
(3) coating on the mould face
(4) top half of a moulding box

Ans: 4

13. Drag in foundry practice refers to

middle portion of the moulding box
2.bottom half of the moulding box
coating on the mould face
3.top half of moulding box

Ans: 2

14. Among the following materials, the most suitable material for withstanding shock and vibration without danger of cracking is

(1) Malleable cast iron
(2) Gray cast iron
(3) White cast iron
(4) Graphite

Ans: 1

15. Which of the following element is added to steel to import high strength, abrasion resistance, and toughness?

(1) Magnesium
(2) Manganese
(3) Sulphur
(4) Tungsten

Ans: 2

16. Pressing of ore fines, with or without a binder into a block of suitable size and shape and then subjecting the same to a hardening process is known as

(1) Sintering
(2) Pelletization
(3) Briquetting
(4) None of these

Ans: 3

17. Which of the following material has more shrinkage allowance?

(1) Lead
(2) Cast iron
(3) Aluminium alloy
(4) Brass

Ans: 1

BOX 1. SHRINKAGE ALLOWANCE:

When any metal cools, it naturally shrinks in size. The total contraction of a casting comprises of three elements viz., the contraction of liquid from pouring temperature to freezing temperature, contraction on account of change from liquid to solid and lasting contraction of solid casting from freezing temperature to surroundings. While, first two contractions are taken care of in the design of castings, last effect is taken care of by designing pattern of bigger size.

If the actual object itself is used for the pattern, the resulting casting would be slightly smaller than desired. To compensate for this possibility, a shrink rule is used in laying out of measurements for the pattern.

Typical shrinkage allowances for important casting materials in mm/metre are as under:

Grey cast iron—7 to 10.5,

white cast iron—21,

malleable iron—15, s

teel—20,

brass—14,

aluminium—18,

aluminium alloys—13 to 16,

bronze—10.5 to 21,

magnesium—18.

https://www.engineeringenotes.com/metallurgy/casting/pattern-allowances-for-proper-casting-of-metals-industries-metallurgy/20910

Box 2. Shinkage allowance

SHRINKAGE ALLOWANCE FOR CASTING METALS

All the matels shrink when cooling except perhaps bismuth. This is, because of the inter-atomic vibrations which are amplified by an increase in temperature. However, there is a distinction to be made between liquid shrinkage and solid shrinkage.

Liquid Shrinkage refers to the reduction in volume when the matel changes from liquid to solid state at the solidus temperature.

Solid shrinkage is the reduction in volume caused, when metal loses temperature in solid state. The shrinkage allowance is provided to take care of this reduction.

The Shrinkage allowance of casting metals are as follows:

Grey cast iron: 0.7-1.05%,

Mallable Iron: 1.5%,

Steel: 2.0%,

Aluminum alloys: 1.3-1.6%,

Brass: 1.4%,

Bronze 1.05-2.1

http://www.guokuncasting.com/shrinkage-allowance-for-casting-metals/

18. The major problem in welding of stainless steel is

(1) formation of oxide film
(2) high electrical resistance
(3) poor thermal conduction

(4) formation of chromium carbide and its precipitation along grain boundaries due to which its corrosion resistance is sacrificed

Ans: 4

19. Butt welding of dissimilar metal rods can be performed by

(1) Laser beam welding
(2) Electron beam welding
(3) Flash butt welding
(4) Friction welding

Ans: 4

20. The soldering iron is made of

(1) Steel
(2) Stainless steel
(3) Copper
(4) Tin

Ans: 3

21. Acetylene gas is generated from

(1) Calcium
(2) Carbon
(3) Adding water to Calcium carbide
(4) Calcium chloride

Ans: 3

22. Thermoplastic material are produced by

(1) die casting process
(2) shell moulding process
(3) cold forming process
(4) injection moulding process

Ans: 1

23. In die casting process

(1) any metal cab be cast
(2) any size casting can be prepared
(3) very high production rate is possible
(4)die is cheap

Ans: 3

24. Natural sand is used in the moulding sand mainly due to fact that it is

(1) refractory
(2) easily available
(3) cheap
(4) refractory and granular

Ans: 4

25. Slag inclusion in casting is a

(1) surface defect
(2) internal defect
(3) superficial defect
(4) none of the three are correct

Ans: 1

Slag inclusion is caused when molten metal containing slag particles is poured into the mold cavities and solidifies.

Preventing slag inclusion is a simple fix. Remove slag particles from the molten metal before pouring it into the mold cavity.

As, in most cases, this defect is related to furnace or melt treatment. it can occur in all casting materials, independent of the molding or casting process.

This defect is often observed on casting surfaces on top in the mold, cores, and protruding mold sections. These non-metallic inclusions can be accompanied by gas bubbles.

26. Casting process is preferred for parts having

(1) few details
(2) many details
(3) no detail
(4) complex/non-symmetrical shape

Ans: 4

27. In drawing operation the metal flows due to

(1) ductility
(2) work hardening
(3) plasticity
(4) shearing

Ans: 3

28. The principles of motion economy are mostly used while conducting

(1) a method study of an operation
(2) a time study on an operation
(3) a financial appraisal of an operation
(4) a feasibility study of the proposed manufacturing plant

Ans:1

29. Parts of circular cross section which are symmetrical about the axis of rotation are made by

(1) Hot spinning
(2) Hot forging
(3) Hot extrusion
(4) Hot piercing

Ans: 1

30. Process used for making seamless tube is

(1) extrusion
(2) piercing
(3) forging
(4) casting

Ans: 2

31. Process used for making nuts and bolts is

(1) extrusion
(2) cold peening
(3) hot piercing
(4) upsetting

Ans: 4

32. Process used to improve fatigue resistance of the metal by setting up compressive stresses in its surface, is known as

(1) extrusion
(2) piercing
(3) cold peening
(4) swaging

Ans: 3

33. Mechanical properties of the metal improve in hot working due to

(1) recovery of grain size
(2) recrystallization
(3) grain growth
(4) refinement of grain size

Ans: 4 (Heat treatment techniques include **, normalizing, quenching, annealing, case hardening, precipitation strengthening, tempering, etc.)**

Heat treating is used to alter and improve the physical properties of a given material using a heat treat furnace. Typical heat treatment techniques applied to steel forgings include annealing, normalizing, quenching, and tempering. Precipitation hardening applies to superalloys, titanium and some PH stainless steels.

ANNEALING

Annealing is a rather generalized term that consists of heating a metal to beyond the upper critical temperature and then cooling very slowly and at a rate that will produce a refined microstructure. The rate of cooling for annealing is typically slow. Annealing is most often used to soften a metal to improve machinability and to produce a uniform microstructure.

NORMALIZING

Normalizing is a technique used in a heat treating forge to provide uniformity in grain size throughout an alloy metal. When normalizing, the metal is heated to a temperature just above its upper critical point and then held long enough for smaller and more uniform metal grains to form. This transformation is called grain refinement and leads to the formation of a more uniform piece of metal improving strength and toughness. After a steel piece is heated to a temperature above its critical point, it is air-cooled until it drops to room temperature.
The more uninformed and smaller metal grains can also improve a forging's response to further heat treatment.

STRESS RELIEVING

Stress relieving is a forging technique to remove or reduce the internal stresses in a metal. These stresses may be caused by a number of reasons, ranging from cold working to non-uniform cooling after forging. Stress relieving in forging is usually accomplished by heating a metal below the lower critical temperature and then cooling uniformly.

QUENCHING

In quenching, a metal is heated above the upper critical temperature and then quickly cooled. Depending on the alloy and other considerations, such as concern for maximum hardness versus cracking and distortion, cooling may be done by different cooling methods. Cooling speeds for the various quench methods, from fastest to slowest, are brine, polymer, freshwater, oil and forced air. The proper quench media is important because quenching certain steels too fast can result in cracking.

Upon being rapidly cooled, the alloy transforms to martensite, a hard, brittle crystalline structure. The quenched hardness of a metal depends on its chemical composition and quenching method. Typically, parts are tempered soon after quenching.

TEMPERING

Untempered martensitic steel is very hard but is too brittle to be used for almost any application. Tempering is used to develop the required combination of hardness, strength, and toughness or to relieve the brittleness of fully hardened steels. The combination of quenching and tempering in

forging is important to make tough parts.

Tempering is effective in relieving stresses caused by quenching in addition to lowering hardness to a specified range. It's also used for meeting certain mechanical property requirements for certain steels. Tempering is the process of reheating a steel at a relatively low temperature while time is controlled to produce the final property requirements of a particular steel. The result is a component with the appropriate combination of hardness, strength, and toughness for the intended application.

https://cantondropforge.com/capabilities/equipment/heat-treatment/#:~:text=be%20left%20unchanged.-,Heat%20treating%20is%20used%20to%20alter%20and%20improve%20the%20physical,and%20some%20PH%20stainless%20steels.

34. Production of contours in flat blank is termed as

(1) blanking (2) piercing (3) perforating (4) punching

Ans: 1

35. A mixture of ethanol and phenol can be separated by

(1) Fractional distillation (2) Paper chromatography
(3) Ion exchange (4) Sublimation

Ans: 1

36. Isotonic solutions must have the same

(1) Normality (2) Molar concentration
(3) Density (4) Critical temperature

Ans: 2

37. Cathode rays are a stream of

(1) Protons (2) Electrons
(3) Neutrons (4) Positrons

Ans: 2

38. A X-rays beam

(1) is an electromagnetic radiation
(2) is emitted from the atomic nucleus
(3) can penetrate through bones
(4) is made of electrons

Ans: 1

39.How many chain isomers can be obtained from the alkane C_4H_{10}?

(1) 1 (2) 2 (3) 6 (4) 8

Ans: 2

40. The standard time of an operation while conducting a time study is

(1) mean observed time + allowances
(2) normal time + allowances
(3) mean observed time x rating factor + allowances
(4) normal time x rating factor + allowances

Ans:1

41.Esters are usually

(1) Non-volatile
(2) Volatile
(3) pleasant smelling
(4) (2) and (3)

Ans: 4