

1. Which one of the following welding processes uses non-consumable electrodes?

- (1) TIG welding
- (2) MIG welding
- (3) Manual welding
- (4) Submerged arc welding

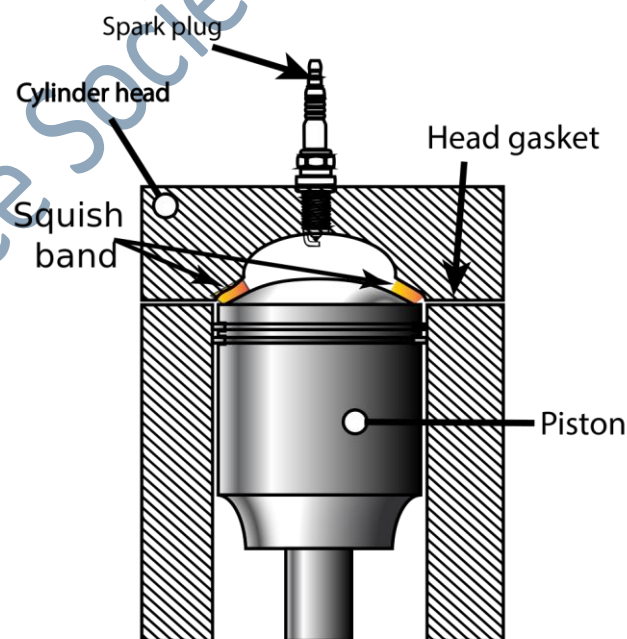
Ans: 1

2. In the operation of a four-stroke diesel engine, the term 'squish' refers to

- (1) the injection of fuel in the pre-combustion chamber
- (2) the discharge of gases from the pre-combustion chamber
- (3) the entry of air into the combustion chamber
- (4) the stripping of fuel from the core of jet

Ans: 1

Squish is an effect in internal combustion engines which **creates sudden turbulence of the air-fuel mixture as the piston approaches top dead centre (TDC)**. In an engine designed to use the squish effect, at top dead centre the piston crown comes very close (typically less than 1 mm) to the cylinder head.



By KDS4444 - Own work, CC BY-SA 4.0,

<https://commons.wikimedia.org/w/index.php?curid=38732897>

3. To sustain vibration, a body should possess mass and

- (1) inertia force (2) kinetic energy  
 (3) potential energy (4) elasticity

Ans: 1

4. In the dynamic balancing of several masses revolving in different planes and attached to a shaft, which one of the following axioms is used to draw the couple and force polygons?

- (1) The d'Alembert's principle  
 (2) The Ganono's principle  
 (3) The Hamilton's principle  
 (4) The Lechatelier's principle

Ans: 1

5. The solution kept in Orsat apparatus for absorbing carbon monoxide while analyzing the flue gases is

- (1) potassium hydroxide (2) pyrogallol  
 (3) cuprous chloride (4) hydrogen sulphide

Ans:3

An **Orsat gas analyser** is a piece of laboratory equipment used to analyse a gas sample (typically fossil fuel flue gas) for its oxygen, carbon monoxide and carbon dioxide content. Although largely replaced by instrumental techniques, the Orsat remains a reliable method of measurement and is relatively simple to use.

The most common absorbents are:

- Potassium Hydroxide (Caustic Potash) for carbon dioxide
- Pyrogallol (Pyrogallic Acid) for oxygen
- Copper(I) chloride (ammoniacal Cuprous chloride) for carbon monoxide

[https://en.wikipedia.org/wiki/Orsat\\_gas\\_analyser](https://en.wikipedia.org/wiki/Orsat_gas_analyser)

6. If the connecting rod and crank of a hypothetical single slider crank chain mechanism are each 10 cm long, then the stroke of the slider in cm is

- (1) 10 (2) 20  
(3) 30 (4) 40

Ans:2

7. The mass of air required for complete combustion of unit mass of fuel can always be calculated from the formula

- (1)  $0.1152C + 0.3456 H$   
(2)  $0.1152C + 0.3456 (H - 0.125 O)$   
(3)  $0.1152C + 0.3456 (H - 0.125 O) + 0.0432S$   
(4)  $0.1152 C + 0.3456 (H + 0.125 O) + 0.0432 S$

Ans:4

8. Which one of the following graphical constructions can be used for finding the velocity and acceleration of the piston in a single slider crank chain mechanism with offsetting?

- (1) The Bennett's method (2) The Klein's method  
(3) The relative velocity method (4) The Ritterhaus's method

Ans: 2

9. Which one of the following changes in the metals is responsible for measurement of temperatures in bimetallic dial thermometer?

- (1) volumetric expansion of metals (2) relative strain of metals  
(3) conductivity of metals (4) resistance of metals

Ans:3

10. The two most important properties of a lubricant for journal bearings are viscosity and

- (1) flash point (2) fire point  
(3) oiliness (4) pour point

Ans:3 and 4

11. In fluid dynamics, separation of flow is caused
- (1) by an adverse pressure gradient
  - (2) by reduction of pressure due to vapour pressure
  - (3) by reduction of pressure gradient to zero
  - (4) when the boundary layer thickness reduces to zero

Ans:1

12. The Reynolds number is defined as the ratio of
- (1) gravity forces to inertia forces
  - (2) inertia forces to viscous forces
  - (3) viscous forces to pressure forces
  - (4) viscous to gravity forces

Ans: 2

13. In turbulent flow
- (1) The fluid particles move in an orderly manner
  - (2) Viscosity is more effective than momentum transfer
  - (3) One lamina glides smoothly over another
  - (4) The shear stresses are generally larger than in a similar laminar flow

Ans: 4

14. A fluid is substance that
- (1) is practically incompressible
  - (2) cannot remain at rest under the action of any shear
  - (3) cannot be subjected to shear forces
  - (4) always expands until it fills the container

Ans: 2

15. Ball bearings are provided with a cage
- (1) to reduce the friction
  - (2) to maintain the balls at a fixed distance apart
  - (3) to prevent the lubricant from flowing out
  - (4) to facilitate slipping of balls



the steam turbine, where it expands.

<https://www.nuclear-power.com/nuclear-power-plant/turbine-generator-power-conversion-system/what-is-steam-turbine-description-and-characteristics/reheat-steam-turbine/>

18. Which thermodynamic property acquired a greater value during a throttling process?

- (1) enthalpy (2) pressure  
(3) volume (4) temperature

Ans: 3 (enthalpy remains constant)

19. Which thermodynamic property remains constant value during a throttling process?

- (1) enthalpy (2) pressure  
(3) volume (4) temperature

Ans: 1

20. Who introduced the concept of entropy in thermodynamics?

- (1) Catnot (2) Clausius  
(2) Joule (4) Kelvin

Ans:2

**Entropy**, the measure of a system's thermal energy per unit temperature that is unavailable for doing useful work. Because work is obtained from ordered molecular motion, the amount of entropy is also a measure of the molecular disorder, or randomness, of a system. The concept of entropy provides deep insight into the direction of spontaneous change for many everyday phenomena. Its introduction by the German physicist Rudolf Clausius in 1850 is a highlight of 19th-century physics.

Drake, Gordon W.F.. "entropy". *Encyclopedia Britannica*, 2 Jun. 2021, <https://www.britannica.com/science/entropy-physics>. Accessed 17 October 2021.

21. Which type of the prime mover has the lowest maximum operating pressure?

- (1) Diesel engine (2) gas turbine  
 (3) Petrol engine (4) Steam turbine

Ans: 2

22. Which one of the following changes/sets of changes in the higher ( $T_1$ ) and lower ( $T_2$ ) temperatures of a Carnot refrigerator would result in the maximum improvement in its coefficient of performance (C.O.P)?

- (1)  $T_2 + \Delta T$  (2)  $T_1 + \Delta T$   
 (3) ( $T_2 + \Delta T$ ) and ( $T_1 - \Delta T$ ) (4) ( $T_2 + \Delta T$ ) and ( $T_1 + \Delta T$ )

Ans:2

Carnot efficiency,  $\eta = 1 - T_c/T_h$  or  $1 - T_1/T_2$

Carnot's interesting result implies that 100% efficiency would be possible only if  $T_c = 0$  K—that is, only if the cold reservoir were at absolute zero, a practical and theoretical impossibility. But the physical implication is this—the only way to have all heat transfer go into doing work is to remove *all* thermal energy, and this requires a cold reservoir at absolute zero.

It is also apparent that the greatest efficiencies are obtained when the ratio  $\frac{T_c}{T_h}$

is as small as possible. Just as discussed for the Otto cycle in the previous section, this means that efficiency is greatest for the highest possible temperature of the hot reservoir and lowest possible temperature of the cold reservoir. (This setup increases the area inside the closed loop on the  $PV$  diagram; also, it seems reasonable that the greater the temperature difference, the easier it is to divert the heat transfer to work.) The actual reservoir temperatures of a heat engine are usually related to the type of heat source and the temperature of the environment into which heat transfer occurs. Consider the following example.

<https://courses.lumenlearning.com/physics/chapter/15-4-carnots-perfect-heat-engine-the-second-law-of-thermodynamics-restated/>

23. A reversible heat engine operates between 1600 K and  $T_2$ K and another reversible heat engine operates between  $T_2$ K and 400K. If both the engines have the same output, the temperature  $T_2$  must be equal to

- (1) 600 (2) 800  
 (3) 1200 (4) 1400

Ans:2

$$\eta = \frac{T_1 - T_2}{T_1} = \frac{T_2 - T_3}{T_2} \rightarrow \frac{1600 - T_2}{1600} = \frac{T_2 - 400}{T_2} \rightarrow 800$$

24. The combustion flame front velocity inside the cylinder of SI engine is

- (1) subsonic (2) transonic  
(3) supersonic (4) hypersonic

Ans:3

25. If two meshing gears have 4:1 gear ratio and the smaller gear has 12 teeth, the larger gear will have

- (1) 12 teeth (2) 24 teeth  
(3) 36 teeth (4) 48 teeth

Ans:4

26. For a thorough inspection, a tyre should be

- (1) on the car (2) on the wheel  
(3) off the wheel (4) inflated

Ans: 4

27. Which one of the following quantities is assumed constant for an internal combustion engine while estimating its friction power by extrapolation through William's line ?

- (1) Brake thermal efficiency  
(2) Indicated thermal efficiency  
(3) Mechanical efficiency  
(4) Volumetric efficiency

Ans:2

28. The distance between adjacent meshing teeth of mating gears is called

- (1) backlash (2) clearance  
(3) flank (4) pitch

Ans: 4

29. Clutch noises are usually most noticeable when the engine is

- (1) accelerating (2) decelerating  
(3) idling (4) being started



Ans:1

30. What is the dimension of resistance?

- a)  $M L T^{-2}$                       b)  $M L T$                       c)  $M^1 L^2 T^{-3} I^{-2}$                       d)  $M L T^{-1}$

Ans: c

**Dimensional Formula of Resistance**

The dimensional formula of resistance is given by,

$$M^1 L^2 T^{-3} I^{-2}$$

where,

M = Mass

I = Current

L = Length

T = Time

31. The most preferred process for casting gas turbine blade is

- (1) diemoulding                      (2) shell moulding  
 (3) investment casting                      (4) sand moulding

Ans:3

32. In order to get uniform thickness of the plate by rolling process, one provides

- (1) camber on the rolls                      (2) offset on the rolls  
 (3) hardening of the rolls                      (4) antifriction bearings

Ans:

33. In value engineering the terms 'value' refers to

- (1) market value  
 (2) relation between cost an efficiency  
 (3) relation between function and cost  
 (4) relation between productivity and

Ans:3

**Value engineering (VE)** is a systematic method to improve the "value" of goods or products and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be manipulated by either improving the function or reducing the cost. It is a primary tenet of value engineering that basic functions be preserved and not be reduced as a consequence of pursuing value improvements.

[https://en.wikipedia.org/wiki/Value\\_engineering](https://en.wikipedia.org/wiki/Value_engineering)

34. The shearing area of a key of length  $l$ , breadth  $b$  and depth  $h$  is equal to

- (1)  $b \times h$  (2)  $h \times L$   
 (3)  $l \times b$  (4)  $L \times h/2$

Ans:3

35. Addition of magnesium to cast iron increases its

- (1) hardness (2) ductility and strength in tension  
 (3) corrosion resistance (4) creep strength

Ans:2

36. Quartz is a

- (1) ferroelectric material (2) ferromagnetic material  
 (3) piezoelectric material (4) diamagnetic material

Ans:3 . Quartz is a **hard, crystalline mineral composed of silica (silicon dioxide)**.

37. Invar is used for measuring tapes primarily due to its

- (1) Non-magnetic properties  
 (2) High nickel content  
 (3) Low coefficient of thermal expansion  
 (4) Hardenability

Ans:3

38. The object of providing masked inlet valve in the air passage of compression ignition engine is

- (1) to enhance the flow rate (2) to induce vortex  
 (3) to induce primary swirl (4) to contribute turbulence

Ans:3

In order to produce a swirling motion in the combustion gases, including the air introduced into the cylinder of an internal combustion engine, inlet valves are used upon which are mounted masks so that the stream of the intake gas is throttled across a portion of the valve seat, and the intake gas thus given a desired swirling

direction into the cylinder. However, such a valve having a fixed mask must be prevented from rotating in order to keep the mask in its proper aerodynamical position with respect to the valve port. This results in the disadvantage in that the valve head is kept from rotating, and can not self-grind itself upon the valve seat. In general, the objects of this invention are obtained by forming the mask of a separate piece and mounting it upon the valve head so that it will move in a longitudinal direction with the valve head during the opening and closing of the valve,

<https://patents.google.com/patent/US2868187A/en>

39. The object of providing felt lining for the intake manifold interior walls of a petrol engine is

- (1) To throw the impinging liquid particles into the air stream
- (2) To absorb the high frequency sounds of the air stream
- (3) To increase the air stream velocity for enhancing volumetric efficiency
- (4) To aid thorough mixing of petrol with the air stream

Ans:2

40. Bernoulli's equation signifies the conservation of

- (1) hydraulic pressure
- (2) force
- (3) momentum
- (4) energy

Ans:4

41. Continuity equation signifies the conservation of

- (1) mass
- (2) force
- (3) momentum
- (4) energy

Ans:1

42. A cantilever beam is subjected to a concentrated transverse load at mid-span. The deflected shape of the beam is

- (1) a continuous straight line
- (2) a continuous parabola
- (3) straight from the fixed end to the loading point and parabolic beyond that point
- (4) parabolic from the fixed end to the loading point and straight beyond that point

Ans:4

43. The base metal which has the highest composition in nimonic engine valves is

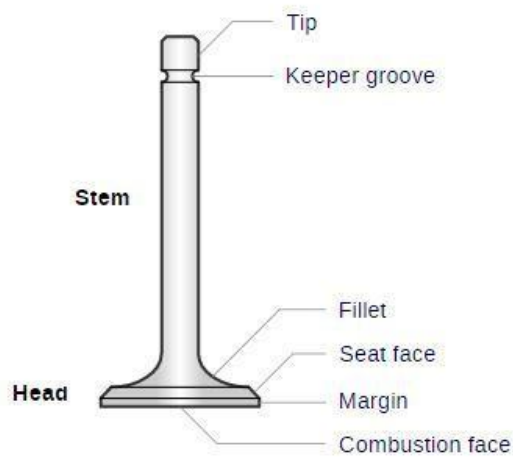
- (1) Chromium
- (2) Molybdenum
- (3) Nickel
- (4) Zinc

Ans:3

**Nimonic** is a registered trademark of Special Metals Corporation that refers to a family of nickel-based high-temperature low creep superalloys. Nimonic alloys typically consist of more than 50% nickel and 20% chromium with additives such as titanium and aluminium.

The main use is in gas turbine components and extremely high performance reciprocating internal combustion engines.

<https://en.wikipedia.org/wiki/Nimonic>



<https://www.thomasnet.com/articles/pumps-valves-accessories/all-about-engine-valves/>

44. In a blanking operation, the clearance is provided on

- (1) the die
- (2) both the die and the punch equally
- (3) the punch
- (4) neither the punch or the die

Ans: 3

In blanking the punched out piece is used and called a blank; in piercing the punched out piece is scrap.

In blanking operation, the clearance is provided on Punch

45. The ductility of a material with work hardening

- (1) increases
- (2) decreases
- (3) remains unaffected
- (4) unpredictable

Ans: 2

46. If the wire diameter of a closed coil helical spring subjected to compressive load is increased from 1 cm to 2 cm, other parameters remaining same, the deflection will decrease by a factor of

- (1) 16                      (2) 8                      (3) 4                      (4) 2

Ans:1

Deflection,  $\delta = \frac{8WD^3N}{Gd^4}$

where  
 D = Spring coil diameter  
 d = coil wire diameter  
 W = Axial load  
 G = modulus of rigidity  
 N = Number of active coils

Note: Deflection is inversely proportional to the 4th power of wire diameter, d.

If Coil/ wire dia d  $\rightarrow$  2d and  $\therefore$  deflection  $\delta \rightarrow \delta/16$

47. The relationship between Young's modulus (E), Bulk modulus (K) and Poisson's ratio ( $\mu$ ) is given by

- (1)  $E=3 K (1-2 \mu)$   
 (2)  $K=3 E (1-2 \mu)$   
 (3)  $E=3 K (1-\mu)$   
 (4)  $K=3 E (1-\mu)$

Ans: 1

48. The natural frequency  $f_n$  of a mass m at the end of a cantilever beam of length l and negligible mass is

1.  $\frac{1}{2\pi} \left( \frac{3EI}{ml^3} \right)^{\frac{1}{2}}$                       2.  $\frac{1}{\pi} \left( \frac{6EI}{ml^3} \right)^{\frac{1}{2}}$   
 3.  $\frac{1}{2\pi} \left( \frac{6EI}{ml^3} \right)^{\frac{1}{2}}$                       4.  $\frac{1}{\pi} \left( \frac{3EI}{ml^3} \right)^{\frac{1}{2}}$

Ans. 1

49. In centrifugal casting, the impurities are

- (1) uniformly distributed
- (2) forced towards the outer surface
- (3) trapped near the mean radius of the casting
- (4) collected at the centre of the casting

Ans: 4

#### Centrifugal Casting Controls Impurities

Unique to the centrifugal process is the high force that effectively isolates less dense substances in the casting's bore area. These impurities are later machined away, leaving a defect free part.

The centrifugal force pushes high density metal against the mould sidewall while lower density components migrate or "float" toward the I.D. These lower density items include metal oxides, sulfides, gas, and other impurities that would otherwise have been inclusions in the casting. This phenomenon is termed "secondary refining".

<https://www.metaltek.com/blog/centrifugal-casting-process-advantages-and-limitations/>

50. The temperature of a carburizing flame in gas welding is ----- that of a neutral or an oxidizing flame.

- (1) lower than
- (2) higher than
- (3) equal to
- (4) unrelated to

Ans:1

There are three basic flame types: neutral (balanced), excess acetylene (carburizing), and excess oxygen (oxidizing) as shown below.

**A neutral flame** in most cases will have no chemical effect on the metal being welded.

**A carburizing flame** will produce iron carbide, causing a chemical change in steel and iron. For this reason a carburizing flame is not used on metals that absorb carbon.

**An oxidizing flame** is hotter than a neutral flame and is often used on copper and zinc.

#### Flame Temperature

Carburising flame – 2900°C. In carburising, due to insufficient acetylene, complete oxygen is not utilized that is why lower temperature than neutral or oxidising flame.

Neutral flame – 3100°C

Oxidising flame – 3300°C

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