1. Which is true for reversible polytropic process?

(1) temperature remains constant (2) entropy remains constant
(3) enthalpy remains constant (4) some heat transfer takes place

Ans. 2

2. For which of the following substances, the internal energy and enthalpy are the functions of temperature only?

(1)Any gas (2) staturated steam (3)water (4)perfect gas
Ans: 4

3. Change in enthalpy in a closed system is equal to heat transferred if the reversible process takes place at constant

(1)Pressure (2)Temperature (3)Volume (4)Internal energy
Ans: 1

4. The ratio of two specific heats of air is equal to

(1) 0.17 (2) 0.24 (3)0.1 (4) 1.41
Ans: 2
Note: For air, $C_p/C_v = 0.24$

5. Change in properties like pressure, temperature and volume of a thermodynamic system follow

(1)Path functions (2)Point functions (3)Cyclic functions (4)Real functions

http://www.ecourses.ou.edu/cgi-bin/ebook.cgi?topic=th&chap_sec=01.3&page=theory
A Point function is a function whose **value** depends on the final and initial states of the thermodynamic process, irrespective of the path followed by the process. **Example** of point functions are volume, enthalpy, internal **energy**, entropy, etc.

Path function: Their magnitudes depend on the path followed during a process as well as the end states, e.g.,Work done (W) and heat transfer.

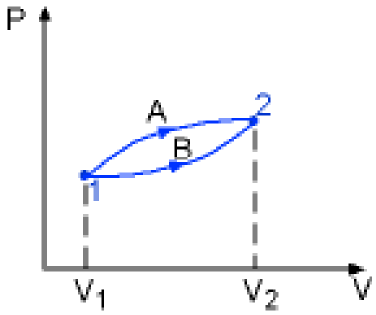


Fig.-Path Function and Point Function. V_1 and V_2 are point functions whereas A and B depicts path functions.

6. The strain energy stored in a body due to external loading, within the elastic limit, is known as

(1)Malleability (2) Ductility (3) toughness (4) Resilience

Ans: 4. (The energy stored within a material when work has been done on it is termed the *strain energy* or *resilience*, i.e. strain energy = work done.)

The elastic potential energy gained by a wire during elongation with a tensile (stretching) force is called strain energy. For linearly elastic materials, strain energy is:

$$U = \frac{1}{2}V\sigma\epsilon = \frac{1}{2}VE\epsilon^2 = \frac{1}{2}\frac{V}{E}\sigma^2$$

where σ is stress, ε is strain, V is volume, and E is Young's modulus:

$$E = \frac{\sigma}{\epsilon}$$

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

7. If m and k refer to mass and stiffness of a coiled spring, the frequency of vibration, f is proportional to

(1) $2\sqrt{mk}$ (2) $\sqrt{m/k}$ (3) $\sqrt{k/m}$ (4) $\sqrt{2mk}$

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

8. If m and k refer to mass and stiffness of a coiled spring, the time period of one vibration, T is proportional to

(1) $2\sqrt{mk}$ (2) $\sqrt{m/k}$ (3) $\sqrt{k/m}$ (4) $\sqrt{2mk}$

Note: $T = 2\pi\sqrt{\frac{m}{k}}$

9. If m and k refer to mass and stiffness of a vibrating body, the cirtical damping coefficient is

(1) $2\sqrt{mk}$ (2) $\sqrt{m/k}$ (3) $\sqrt{mk}$ (4) $\sqrt{2mk}$

10. Compression ratio is defined as the ratio of

1. $\frac{\text{Total volume}}{\text{Swept volume}}$ 2. $\frac{\text{Swept volume}}{\text{Total volume}}$

3. $\frac{\text{Total volume}}{\text{Clearance volume}}$ 4. $\frac{\text{Swept volume}}{\text{Clearance volume}}$

Ans: 4 (swept volume is also known as displacement volume)

Compression ratio, CR of an internal-combustion engine, degree to which the fuel mixture is compressed before ignition. It is defined as the maximum volume of the combustion chamber (with the piston farthest out, or at bottom dead centre) divided by the volume with the piston in the full-compression position (with the piston nearest the head of the cylinder, or at top dead centre).

$$CR = \frac{V_d + V_c}{V_c}$$

Where:

V_d = displacement volume. This is the volume inside the cylinder displaced by the piston from the beginning of the compression stroke to the end of the stroke.
V_c = clearance volume. This is the volume of the space in the cylinder left at the end of the compression stroke.

V_d can be estimated by the cylinder volume formula

$$V_d = \frac{\pi}{4} b^2 s$$

Where:

b = cylinder bore (diameter)
s = piston stroke length

Because of the complex shape of V_c it is usually measured directly. This is often done by filling the cylinder with liquid and then measuring the volume of the used liquid.

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

Typically, petrol engines have a CR of 8–10, while diesel engines have a CR of 15–20. The CR of petrol engines is limited by the requirement that the fuel burns uniformly in the cylinder and does not ignite thermally prior to the spark (so-called 'engine knocking'). In a spark-ignition engine, the CR at which pre-ignition takes place is determined by the octane number of the petrol. High-octane fuel permits a high CR. Until about 30 years ago, lead tetraethyl was added to petrol as an anti-knock agent. This was phased out for environmental reasons and non-toxic additives are now sometimes used. Improvements in engine design over recent years have, however, led to satisfactory compression ratios with lower octane fuel.

https://www.sciencedirect.com/topics/engineering/compression-ratio

11. Air contains by volume

(1)23% O_2 and 77% N_2 | (2) 21%O_2 and 79% N_2

(3)77 % O_2 and 23 % N_2 | (4) 79 % O_2 and 21% N_2

By volume, dry air contains **78.09%** nitrogen, **20.95%** oxygen, **0.93%** argon, 0.04% carbon dioxide, and small amounts of other gases. Air also contains a variable amount of water vapor, on average around 1% at sea level, and 0.4% over the entire atmosphere.

12. When two dissimilar metals are heated at one end and cooled at the other end, an e.m.f. is developed which is proportional to

(1)ratio of temperatures at the two ends

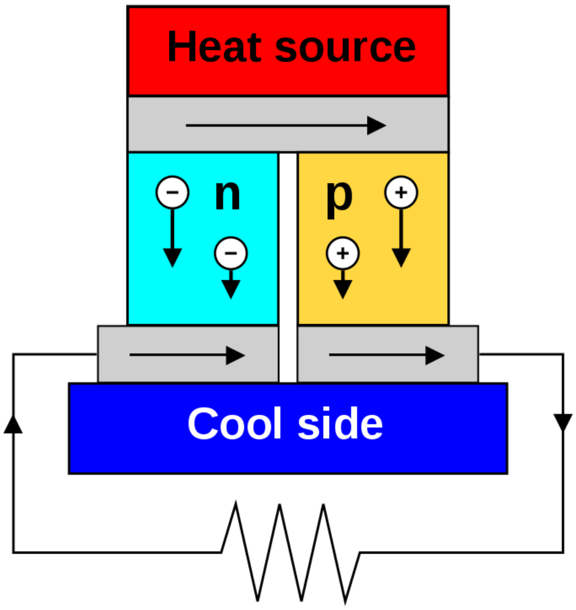
(2)difference of temperatures between the two ends

(3)product of temperatures at two ends

(4)length of the metals.

The **thermoelectric effect** is the direct conversion of temperature differences to electric voltage and vice versa via a thermocouple. A thermoelectric device creates a voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, heat is transferred from one side to the other, creating a temperature difference. At the atomic scale, an applied temperature gradient causes charge carriers in the material to diffuse from the hot side to the cold side.

This effect can be used to generate electricity, measure temperature or change the temperature of objects. Because the direction of heating and cooling is affected by the applied voltage, thermoelectric devices can be used as temperature controllers.



By Ken Brazier - self-made, based on w:Image:ThermoelectricPowerGen.jpg by CM Cullen (which is GFDL 1.2 and CC-by 2.5 licensed), CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=3372874

The term "thermoelectric effect" encompasses three separately identified effects: the **Seebeck effect**, **Peltier effect**, and **Thomson effect**.

The Thomson effect is an extension of the Peltier–Seebeck model and is credited to Lord Kelvin.

Joule heating, the heat that is generated whenever a current is passed through a conductive material, is not generally termed a thermoelectric effect. The Peltier–Seebeck and Thomson effects are thermodynamically reversible, whereas Joule heating is not.

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

13. Air contains by weight

1. 23 parts O_2 and 77 parts N_2
2. 21 parts O_2 and 78 parts N_2
3. 77 parts O_2 and 23 parts N_2
4. 79 parts O_2 and 21 parts N_2

Ans: 1

- The water or vapor content in air varies. The maximum moisture carrying capacity of air depends primarily on temperature
- The composition of air is unchanged until elevation of approximately 10.000 m

- The average air temperature diminishes at the rate of 0.6°C for each 100 m vertical height
- "One Standard Atmosphere" is defined as the pressure equivalent to that exerted by a 760 mm column of mercury at 0°C sea level and at standard gravity (32.174 ft/sec^2)

Other components in air

- Sulfur dioxide - SO_2 - 1.0 parts/million (ppm)
- Nitrous oxide - N_2O - 0.5 parts/million (ppm)
- Ozone - O_3 - 0 to 0.07 parts/million (ppm)
- Nitrogen dioxide - NO_2 - 0.02 parts/million (ppm)
- Iodine - I_2 - 0.01 parts/million (ppm)
- Carbon monoxide - CO - 0 to trace (ppm)
- Ammonia - NH_3 - 0 to trace (ppm)
-

https://www.engineeringtoolbox.com/air-composition-d_212.html

14. 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

15. The working cycle of an engine (IC engine) in which the expansion ratio exceeds the compression is called-

(1)Brayton cycle (2) Ranking cycle (3) Diesel cycle (4) Atkinson cycle

Ans: 4

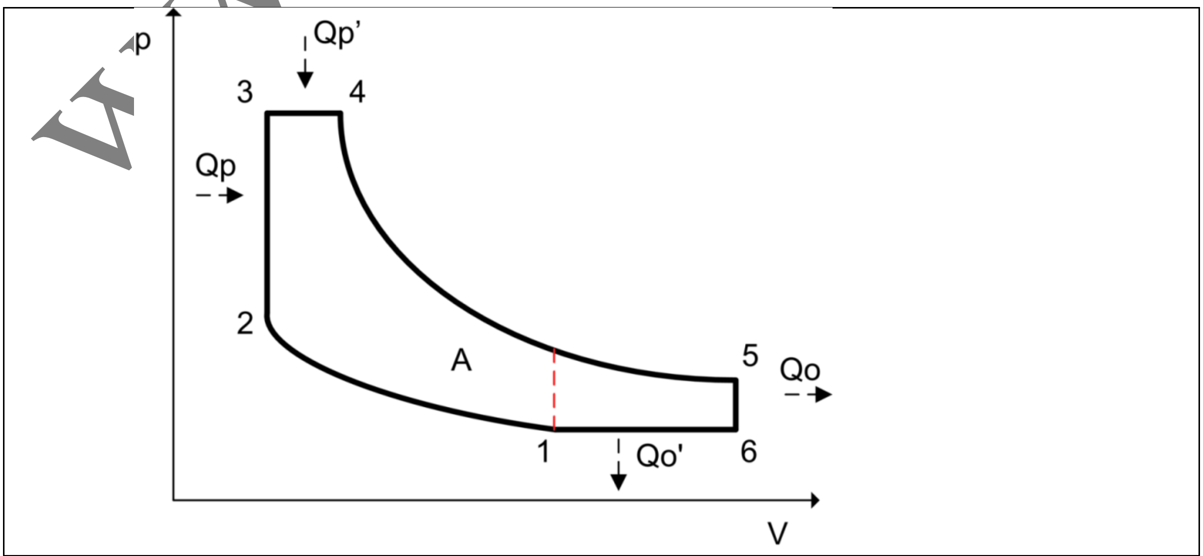


Fig. Ideal Atkinson cycle

The ideal Atkinson cycle consists of:

- 1–2 Isentropic, or reversible, adiabatic compression
- 2–3 Isochoric heating (Qp)
- 3–4 Isobaric heating (Qp')
- 4–5 Isentropic expansion
- 5–6 Isochoric cooling (Qo)
- 6–1 Isobaric cooling (Qo')

https://en.wikipedia.org/wiki/Atkinson_cycle
https://en.wikipedia.org/wiki/Atkinson_cycle#/media/File:T_cycle_AtkinsonMiller.png

24. 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

Eqn.

$$Re = \frac{\rho \cdot V \cdot L}{\mu} \; or \; Re = \frac{V \cdot L}{\nu}$$

Re = Reynolds number
ρ = Density
$V = Velocity$
L = Length
μ = Bulk viscosity
ν = Kinematic viscosity

https://en.paulmueller.com/academy/how-does-the-reynolds-number-affect-mixer-design

16. In turbulent flow

(1)The fluid particles move in an orderly manner

(2) The flow is characterized by the irregular movement of particles of the fluid.

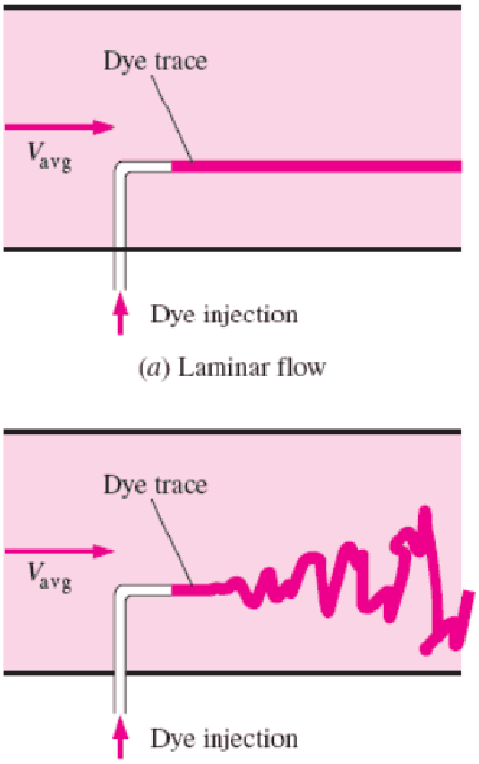
(3)One fluid layer/lamina glides smoothly over another

(4)the speed of the fluid at a point is continuously undergoing changes in both magnitude and direction.

Characteristics of Turbulent Flow

Turbulent flow tends to occur at **higher velocities**, **low viscosity** and at higher **characteristic linear dimensions**.

Laminar vs. Turbulent Flow



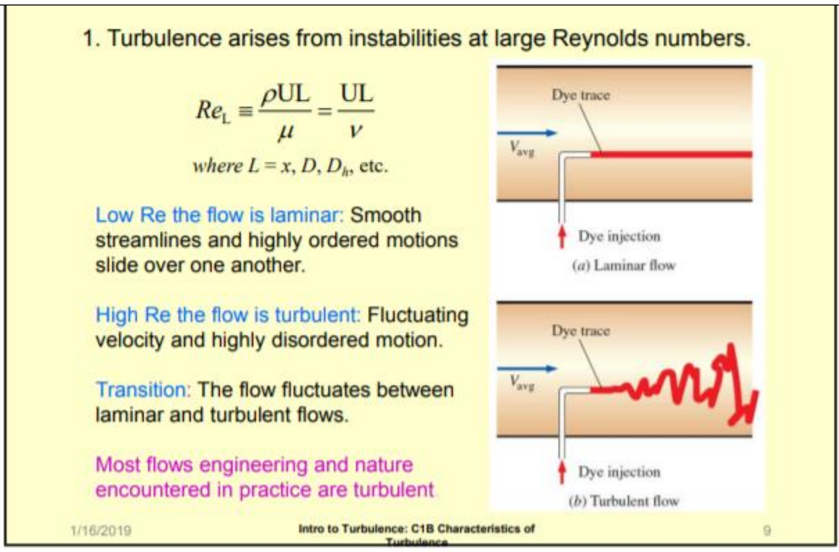
Laminar flow:
Reynolds number, Re < 2000
'low' velocity
Fluid particles move in **straight lines**
Layers of flow over one another at different speeds with **virtually no mixing** between layers.
The flow velocity profile for laminar flow in circular pipes is parabolic in shape, with a maximum flow in the center of the pipe and a minimum flow at the pipe walls.

Turbulent Flow:
Re > 4000
'high' velocity
The flow is characterized by the **irregular movement** of particles of the fluid.

https://www.nuclear-power.net/nuclear-engineering/fluid-dynamics/turbulent-flow/characteristics-of-turbulent-flow/

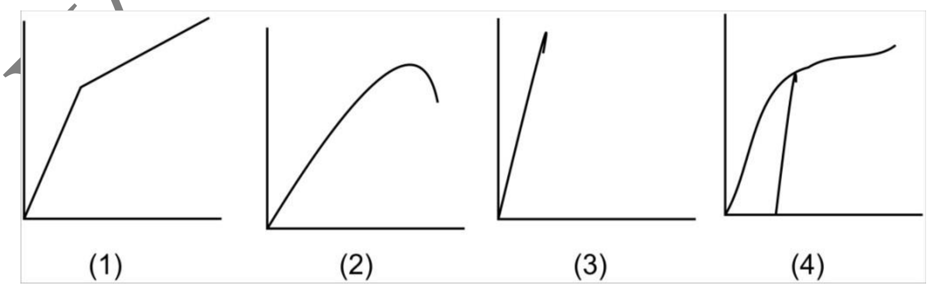
Turbulent flow, type of fluid (gas or liquid) flow in which the fluid undergoes irregular fluctuations, or mixing, in contrast to laminar flow, in which the fluid moves in smooth paths or layers. In turbulent flow the speed of the fluid at a point is continuously undergoing changes in both magnitude and direction.. Common examples of turbulent flow are blood flow in arteries, oil transport in pipelines, lava flow, atmosphere and ocean currents, the flow through pumps and turbines, and the flow in boat wakes and around aircraft-wing tips.

Britannica, The Editors of Encyclopaedia. "Turbulent flow". *Encyclopedia Britannica*, 5 Feb. 2020, https://www.britannica.com/science/turbulent-flow. Accessed 4 June 2021.



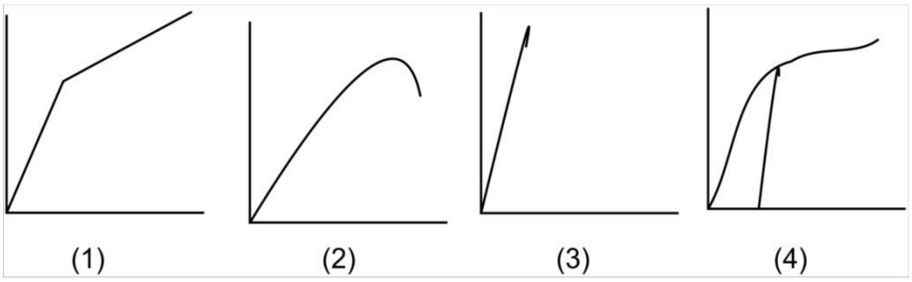
http://www.ase.uc.edu/~pdisimil/classnotes/Turbulence%202019/ABR_2018%20TURB_C1B_Charateristics_16Jan2019.pdf

17. Which one of the following stress-strain diagrams represents a brittle material?



Ans. 3.

18. Which one of the following stress-strain diagrams represents an elastic/ductile material?



Ans. 3.

19. A fluid is substance that

(1)is practically incompressible

(2)cannot remain at rest under the action of any shear force

(3)cannot be subjected to shear forces

(4)always expands until it fills the container

Ans: 2

20. The dynamic viscosity of gases

(1)decreases with an increase in temperature

(2)increases with an increases in temperature

(3)does not depend upon temperature

(4)depends upon the pressure alone

Ans: 2

21. The dynamic viscosity of liquids

(1)decreases with an increase in temperature

(2)increases with an increases in temperature

(3)does not depend upon temperature

(4)depends upon the pressure alone

Ans: 1

1 Pa s = 1 N s/m^2 = 10 poise = 1,000 milli Pa s

For dry air at 0°C, the dynamic viscosity is about 1.7×10^{-4} g $cm^{-1}s^{-1}$. While the dynamic viscosity of most gases increases with increasing temperature, that of most liquids, including water, decreases rapidly with increasing temperature.

22. Which of the following processes is used for making internal splines ?

(1)shaping (2) milling (3) slothing (4) broaching

Ans: 4

23. In free cutting steel, machinability is increased by the presence of

(1) Silicon and sulphur (2) Phospherous, lead and sulphur
(3) Sulphur, graphite and aluminium (4) Phospherous and aluminium

Ans: 2

Free machining steel is steel that forms small chips when machined. This increases the machinability of the material by breaking the chips into small pieces, thus avoiding entanglement in the machinery. This enables automatic equipment to run without human interaction. Free machining steel with lead also allow for higher machining rates. Free machining steel costs 15 to 20% more than standard steel, but this higher cost is offset by increased machining speeds, larger cuts, and longer tool life.

The disadvantages of free machining steel are: ductility is decreased; impact resistance is reduced; copper-based brazed joints suffer from embrittlement with bismuth free machining grades; shrink fits are not as strong.

Free machining steels are carbon steels that have sulfur, lead, bismuth, selenium, tellurium, or phosphorus added.

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

25. The dynamic viscosity of gases

(1)decreases with an increase in temperature

(2)increases with an increases in temperature

(3)does not depend upon temperature

(4)depends upon the pressure alone

Ans: 2

26. Pitot tube is used for the measurement of

(1) viscosity (2) Pressure (3) Velocity (4) surface tension

Ans: 3

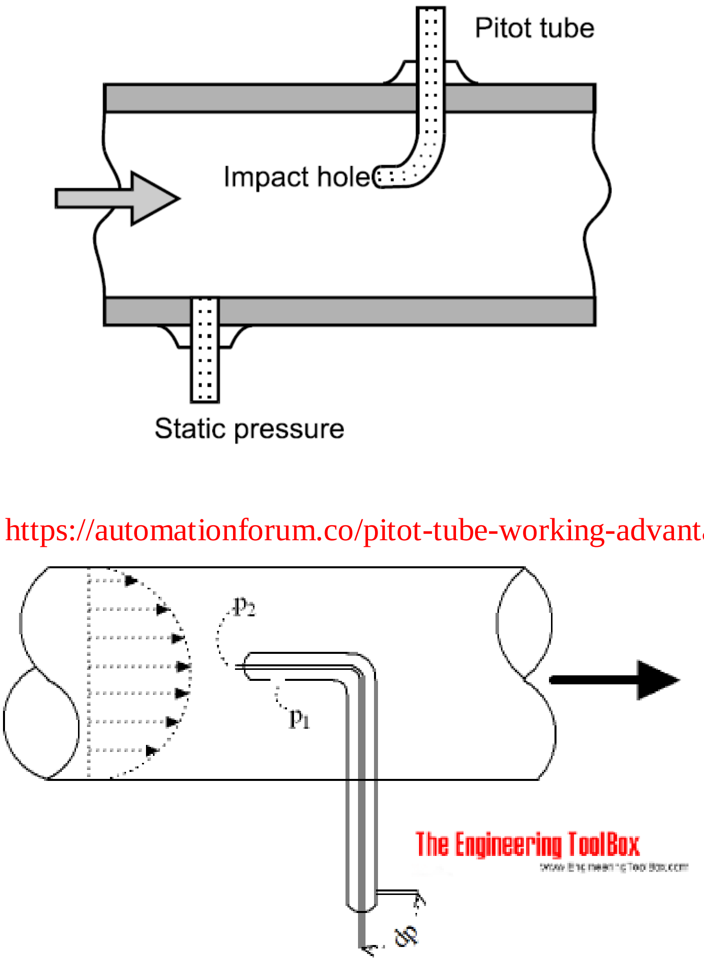


Figure: Pitot Tube

27. The dynamic viscosity of liquids

(1)decreases with an increase in temperature

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

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

Ans: 3

Characteristics of throttling process:

No Work Transfer
No Heat Transfer
Irreversible Process
Isenthalpic Process

29 A reversible heat engine operates between 1600 K and T_2K and another reversible heat engine operates between T_2K and 400K. If both the engines have the same output, the temperature T_2 must be equal to

(1) 800 (2) 1000

(3) 1200 (4) 1400

Ans:1

Thermal efficiency of Carnot cycle, $\eta = \frac{T_1 - T_2}{T_1} = \frac{T_H - T_L}{T_H}$

For the given condition, $\eta_1 = \eta_2 \rightarrow \frac{T_1 - T_2}{T_1} = \frac{T_2 - T_3}{T_2}$

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

30. For a cutting speed of 30 m/min, a work piece 100 mm dia will have N RPM. If the diameter of the work piece is reduce to 50 mm, to maintain the speed the spindle RPM will be:

(1)96 RPM (2) 191 RPM (3)64 RPM (4)128 RPM

Ans:2. (V $= \frac{\pi DN}{1000}$; If d= 100mm → 50mm and V remains same, N should be 2 times the original value. i.e., V → 2V)

31. The critical radius of insulation for cylindrical pipe is given by

1. $\frac{\text{Thermal conductivity of the insulating material}}{\text{(Heat transfer coefficient at inner surface)}}$

2. $\frac{\text{Thermal conductivity of the insulating material}}{\text{Heat transfer coefficient at outer surface}}$

3. $\frac{\text{Thermal conductivity of the insulating material}}{\text{Heat transfer coefficient at outer surface}}$

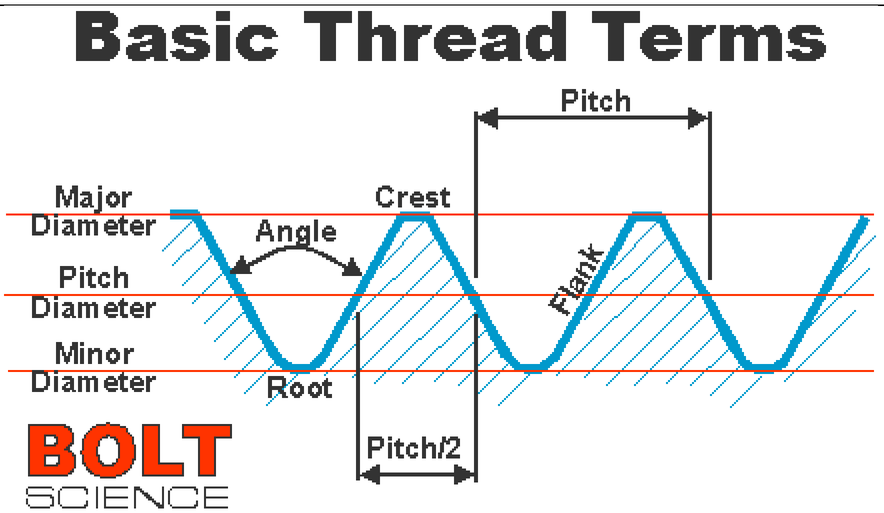
4. None.

Ans: 3

32. The straight part of the thread which connects the crest with the root is

(1) Flank (2) Fillet (3) Crest (4) None.

Ans: 1



The pitch diameter (often called the effective diameter) of a parallel thread is the diameter of the imaginary co-axial cylinder which intersects the surface of the thread in such a manner that the intercept on a generator of the cylinder, between the points where it meets the opposite flanks of a thread groove, is equal to half the nominal pitch of the thread.

The major diameter of a thread is the diameter of the imaginary co-axial cylinder that just touches the crest of an external thread or the root of an internal thread.

The minor diameter is the diameter of an imaginary cylinder that just touches the roots of an external thread and (or) the crests of an internal thread.

The crest of a thread is the prominent part of a thread, whether internal or external.

The root is the bottom of the groove between the two flanking surfaces of the thread whether internal or external.

The flanks of a thread are the straight sides that connect the crest and the root.

The angle of a thread is the angle between the flanks, measured in an axial plane section.

The pitch of a thread is the distance, measured parallel to its axis, between corresponding points on adjacent surfaces, in the same axial plane.

https://www.boltscience.com/pages/screw3.htm#:~:text=The%20flanks%20of%20a%20thread,the%20crest%20and%20the%20root.

33. Thermal efficiency of a heat engine is equal to

(1). $\frac{\text{Ideal work done}}{\text{Heat supplied}}$ (2) $\frac{\text{Actual work done}}{\text{Heat supplied}}$

(3) $\frac{\text{Heat supplied}}{\text{Actual work done}}$ (4) $\frac{\text{Indicated work done}}{\text{Heat supplied}}$

Ans: 2

35. The area under the pressure-volume (P-V) of any thermodynamic process represents

(1)work done during the process (2)heat absorbed only

(3)heat absorbed or rejected (4)heat rejected only

Ans: 1

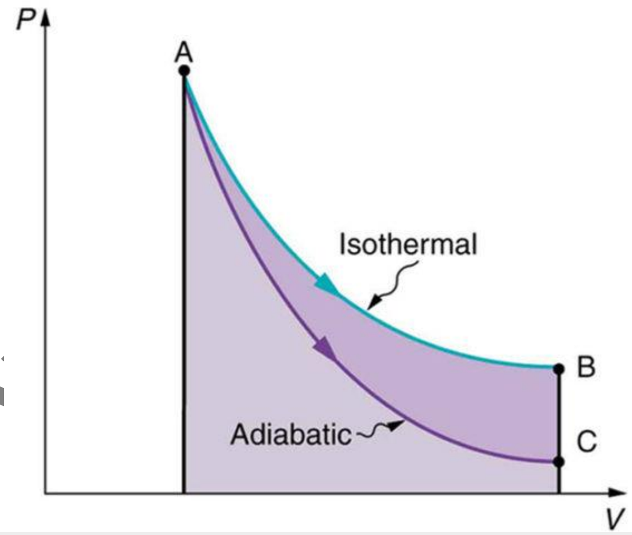


Figure. The upper curve is an isothermal process ($\Delta T = 0$), whereas the lower curve is an adiabatic process ($Q = 0$).

Table 1. Summary of Simple Thermodynamic Processes

Isobaric	Constant pressure	$W = P\Delta V$
Isochoric	Constant volume	$W = 0$
Isothermal	Constant temperature	$Q = W$

Adiabatic	No heat transfer	$Q = 0$

Glossary

Heat engine: a machine that uses heat transfer to do work

Isobaric process: constant-pressure process in which a gas does work

Isochoric process: a constant-volume process

Isothermal process: a constant-temperature process

Adiabatic process: a process in which no heat transfer takes place

Reversible process: a process in which both the heat engine system and the external environment theoretically can be returned to their original states

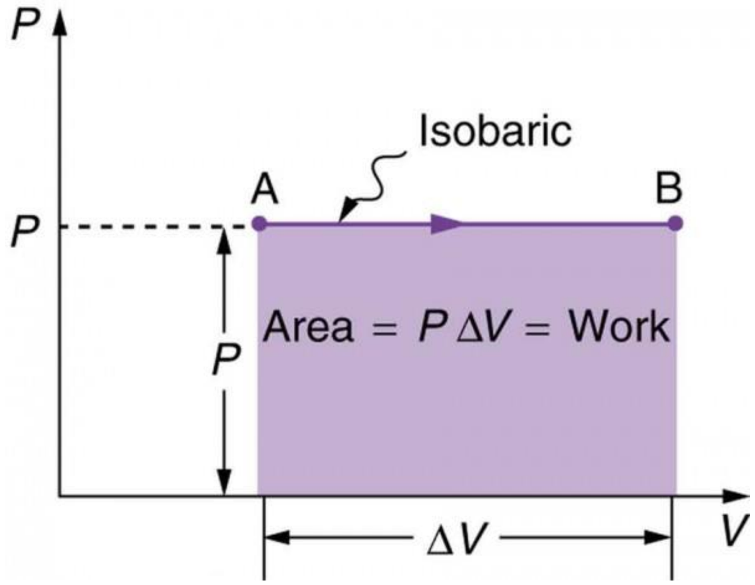


Figure . A graph of pressure versus volume for a constant-pressure, or isobaric, process, such as the one shown in Figure 4. The area under the curve equals the work done by the gas, since $W = P\Delta V$.

https://courses.lumenlearning.com/physics/chapter/15-2-the-first-law-of-thermodynamics-and-some-simple-processes/

36. The Hook's law is valid up to

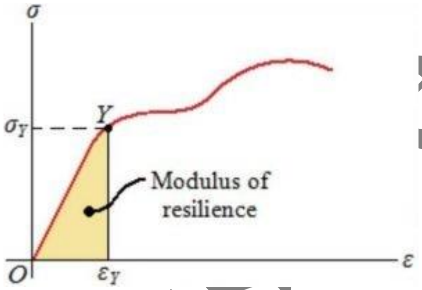
(1)yield point (2) plastic limit (3)elastic limit (4)all of the above

Ans: 3

37. Modulus of resilience is

(1)property to resist shocks
(2)an index of elasticity
(3)an index of compressibility
(4)the property to store energy without undergoing permanent deformation.

The **modulus of resilience** is defined as the maximum energy that can be absorbed per unit volume without creating a permanent distortion. It can be calculated by integrating the stress–strain curve from zero to the elastic limit.

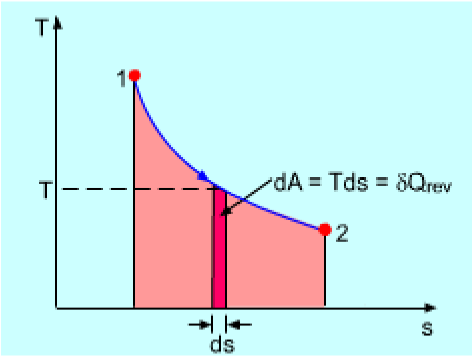


38. The area under the temperature-entropy curve (T-S curve) diagram of any thermodynamic process represents

(1)work done during process (2)heat absorbed only
(3)heat absorbed or rejected (4)heat rejected only

Ans: 3

The T-s Diagram

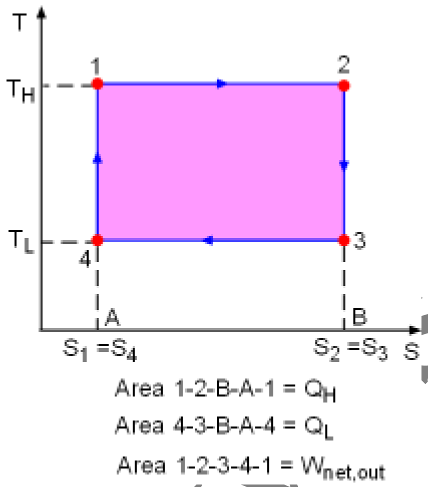


The Total Heat Transfer Equals the Total Area under the Process Curve on the T-s Diagram

On a P-v diagram, the area under the process curve is equal, in magnitude, to the work done during a quasi-equilibrium expansion or compression process of a closed system. On a T-s diagram, the area under an internally reversible process curve is equal, in magnitude, to the heat transferred between the system and its surroundings. That is,

$$Q_{rev} = \int_1^2 \delta Q_{rev} = \int_1^2 T\,ds$$

Note the area has no meaning for irreversible processes.



T-s Diagram of a Carnot Cycle

The T-s diagram of a Carnot cycle is shown on the left. The area under process curve 1-2 (area 1-2-B-A-1) equals the heat input from a source (Q_H). The area under process curve 3-4 (area 4-3-B-A-4) equals the heat rejected to a sink (Q_L). The area enclosed by the 4 processes (area 1-2-3-4-1) equals the net heat gained during the cycle, which is also the net work output.

https://www.ecourses.ou.edu/cgi-bin/ebook.cgi?doc=&topic=th&chap_sec=06.2&page=theory

39. The strength of riveted joint is equal to

(1)The pull required to shear off the plate (2)The pull required to crush the rivet
(3)The pull required to tear off the plate (4)Minimum of the above three values

Ans: 4

Strength of riveted joint: Strength of a riveted joint is evaluated taking all possible failure paths in the joint into account. Since rivets are arranged in a periodic manner, the strength of joint is usually calculated considering one pitch length of the plate. There are four possible ways a single rivet joint may fail.

a) Tearing of the plate:
b) Shearing of the rivet:
c)Crushing of rivet
d)Tearing of the plate at edge

40. Transducer used in load cell is

(1)Thermistor
(2) Strain gauge
(3)Bi-metal strip
(4) Bourdon gauge

Ans: 2

What is a Load Cell?

By definition, **load cell** is a type of transducer, specifically a force transducer. It **converts an input mechanical force** such as **load**, **weight, i.e.,** weight sensors), **tension**, **compression or pressure, i.e.,** pressure sensors into another physical variable, in this case, into an electrical output signal that can be measured, converted and standardized. As the force applied to the force sensor increases, the electrical signal changes proportionally.

Starin gauge

Working. Metal foil strain gage is a material whose electrical resistance varies with applied force. In other words, it converts (or transduces) force, pressure, tension, compression, torque, weight, etc, into a change in electrical resistance, which can then be measured. So, metal foil strain gauge is the building block of force sensor working principle. It can also be used for weight measurement.

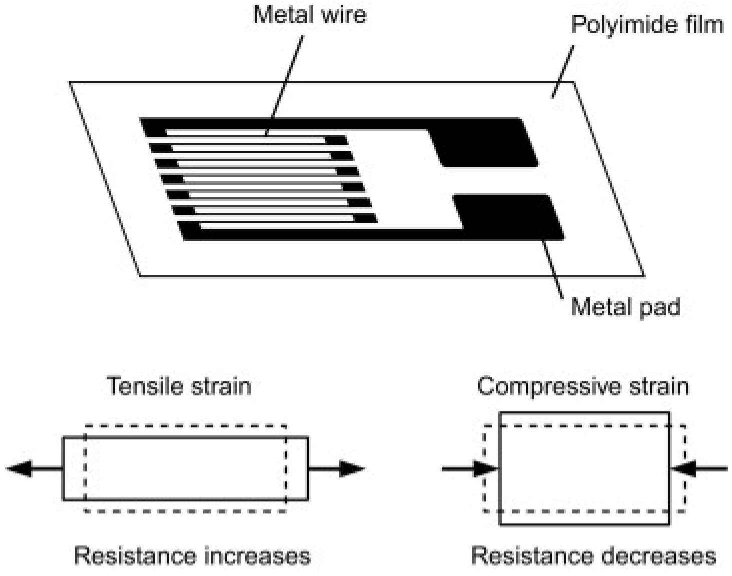


Fig : Metal Foil Strain gage.

https://www.futek.com/how-a-load-cell-works

41. The heat engine is supplied heat at the rate of 30,000 Joules/sec, and gives and output of 9 KJ, the thermal efficiency of the engine will be.
(1)30% 2. 33% 3.40% 4. 50%

Ans: 2

42. What is the nearest heating value of Indian Coal?
(1)10,000 kcal/kg (2) 7,000 kcal/kg
(3)4,000 kcal/kg (4) 2,000 kcal/kg
Ans: 3

43. According to kinetic theory of gases, temperature at which all molecular motion ceases is called-
(1)Critical temperature (2) Absolute zero temperature
(3)Freezing point (4) Adiabatic temperature
Ans: 2

44. In the heat transfer equation $Q=\frac{KA(t_1-t_2)}{x}$ (known as Fourier eqn of heat conduction in solids),
where
Q = heat transfer rate, W
A = cross – sectional area, m^2
t_1 = temperature on one side of a slab of thickness x m, K
t_2 = temperature on the other side of the slab, K an

K = thermal conductivity of the material of the slab, W/m K

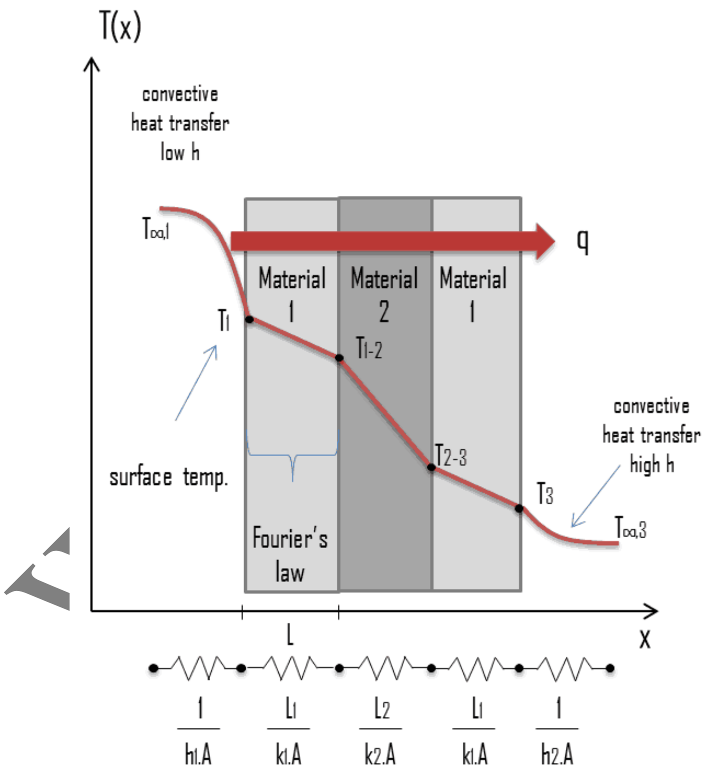
The term R_t=x/KA is known as following

(1)thermal resistance (2) temperature gradient
(3)thermal coefficient (4) heat flux

Ans: 1

Heat is the flow of thermal energy from a warmer place to a cooler place. There are three kinds of heat transfer: Conduction: Heat flow through motionless materials. Convection: Heat flow through moving fluids. Radiation: Heat flow through electromagnetic waves.

If Q is the rate at which heat is flowing through a solid with cross-sectional area A,
q = Q/A is the heat flux.
Fourier's law states that heat flux is proportional to thermal gradient:
q = k dT/dx, where k is thermal conductivity.



https://thermal-engineering.org/wp-content/uploads/2019/05/thermal-resistance-definition-analogy.png

45. Useful isotope of uranium in nuclear system is

1. $_{92}U^{234}$ 2. $_{92}U^{235}$ 3. $_{92}U^{236}$ 4. $_{92}U^{238}$

Ans: 2

Uranium-235 is important for both **nuclear** reactors and **nuclear** weapons because it is the only **isotope** existing in nature to any appreciable extent that is fissile in response to thermal neutrons.

Uranium fission

The nucleus of the U-235 isotope comprises 92 protons and 143 neutrons (92 + 143 = 235). When the nucleus of a U-235 atom is split in two by a neutron, some energy is released in the form of heat, and two or three additional neutrons are thrown off. If enough of these expelled neutrons split the nuclei of other U-235 atoms, releasing further neutrons, a chain reaction can be achieved. When this happens over and over again, many millions of times, a very large amount of heat is produced from a relatively small amount of uranium.

It is this process, in effect 'burning' uranium, which occurs in a nuclear reactor. In a nuclear reactor the uranium fuel is assembled in such a way that a controlled fission chain reaction can be achieved. The heat created by splitting the U-235 atoms is then used to make steam which spins a turbine to drive a generator, producing electricity.

Whereas the U-235 atom is 'fissile', the U-238 atom is said to be 'fertile'. This means that it can capture a neutron and become (indirectly) plutonium-239, which is fissile. Pu-239 is very much like U-235, in that it can fission following neutron capture, also yielding a lot of energy.

Both uranium and plutonium were used to make bombs before they became important for making electricity and radioisotopes. But the type of uranium and plutonium for bombs is different from that in a nuclear power plant. Bomb-grade uranium is highly enriched (>90% U-235, instead of about 3.5-5.0% in a power plant); bomb-grade plutonium is fairly pure (>90%) Pu-239 and is made in special reactors.

https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/uranium-resources/uranium-and-depleted-uranium.aspx

46. One bhp – British horse power is equal to

1. 746 watt 2.736 watt 3.550 watt 4. 75 watt

Ans: 1

47. Thermal efficiency of an engine is equal to

1. $\frac{\text{Ideal work done}}{\text{Heat supplied}}$ 2. $\frac{\text{Actual work done}}{\text{Heat supplied}}$

3. $\frac{\text{Heat supplied}}{\text{Actual work done}}$ 4. $\frac{\text{Indicated work done}}{\text{Heat supplied}}$

Ans: 2

48. A perfect gas is heated at constant pressure. The final volume of the gas becomes 1.5 times the initial volume. If its initial temperature is 30°C, the final temperature will be

1. 45°C 2. 90°C 3.181.5°C 4. 330°C

Note: $V_1/T_1 = V_2/T_2$(T in Kelvin)
T_1=303K, $V_2 = 1.5\ V_1$

Ans: 3

49. The area under the temperature-entropy curve (T-S curve) of any thermodynamic process represents

1. work done during process 2. heat absorbed only
3. heat absorbed or rejected 4. heat rejected only

Ans: 3

50. The thermal efficiency of two-stroke cycle engine as compared to four-stroke cycle engine is

1. more 2. equal 3. less 4. none of these

Ans: 1