

**1. Mention the effects of heat.**

- a) Increase in the temperature of a body.
- b) Expansion of the body.
- c) Change of state of matter.
- d) Chemical change in the body.

**2. Which effect of heat is used in conversion of heat energy into mechanical energy?**

Change of liquid to gaseous state of matter is most in designing heat engines.

**3. Why cannot increase in temperature and expansion not be used for converting heat energy into mechanical energy?**

Increase in temperature cannot be used to convert heat energy in to mechanical energy. Expansion of solids, liquids and gases by heat is very small to make it convert into mechanical energy.

**4. What is the principle of working of steam engine?**

The pressure exerted by the large volume of steam is the basis of working of steam engine.

**5. Explain the principle of working of a diesel or petrol engine.**

Chemical change of liquid fuels like petrol or diesel when under goes combustion produces large volume of gases and exerts pressure. This is the basis of working of petrol or diesel engine.

**6. Name the two types of movement of air current.**

Air current has two types of movement:

- a) Random movement of molecules within the system.
- b) Enmass laminar flow along the direction of flow.

**7. Why is the Enmass laminar flow along the direction of flow used in the working of heat engines?**

Enmass laminar flow along the direction of flow results in developing pressure hence it is used in working of heat engines.

**8. What is a heat engine?**

A heat engine is a device which converts heat energy into mechanical energy.

**9. Name the two types of heat engines.**

- a) External combustion engine
- b) Internal combustion engine

**10. What is an external combustion engine? Give example.**

A heat engine in which combustion of fuel takes place outside the cylinder of the engine is called external combustion engine.

Ex: Steam engine.

**11. Briefly explain the working of a steam engine.**

**Description:** A steam engine consists of a cylinder fitted with an airtight piston. The piston is connected to a crankshaft by means of a connecting rod. A boiler is connected to the cylinder through the inlet valve. The cylinder is also connected to a condenser through the outlet valve. The condenser is connected to the boiler through a pump.

**Working:** The working of the steam engine is divided into two strokes

**Expansion stroke:**

In this stage, the water in the boiler is heated to generate steam of high pressure which is passed into a cylinder fitted with a piston through the inlet valve. As steam occupies larger volume than the same amount of water, it exerts great pressure on the walls of the container in all directions. Steam expands in the cylinder, it pushes the piston forward. Crank shaft connected to the piston also moves. The wheel of the crankshaft makes half rotation during the expansion stroke.

**Exhaust stroke:**

After the forward movement of the piston, the steam expands and loses some of its kinetic energy. As a result it condenses into water. The piston is then pushed back into the cylinder due to low pressure region. Due to inertia of the crankshaft, the wheel makes another half rotation and completes one cycle. The condensed water is expelled out through the outlet valve.

The cycle repeats and the movement of crankshaft is used for mechanical energy.

**12. Give reason: Steam exerts great pressure on the walls of the piston during expansion stroke.**

As steam occupies much larger volume than the same amount of water, it exerts great pressure on the walls of the piston.

**13. Give reason: After the expansion stroke of a steam engine, steam condenses into water.**

As steam expands, it loses its kinetic energy and gets condensed into water.

**14. Give reason: The wheel makes another half rotation after the expansion stroke of steam engine.**

Due to inertia of the crankshaft, the wheel makes another half rotation and completes one cycle.

**15. Give reason: Use of steam engines for transport vehicles is outdated today.**

Use of steam engines for transport vehicles is outdated today because they have low efficiency.

16. Draw a neat schematic diagram of the expansion stroke of a steam engine.

17. Draw a neat schematic diagram of the exhaust stroke of a steam engine.

**18. What are the disadvantages / drawbacks of an external combustion / steam engine?**

- a) Steam engine is bulky and heavy. It cannot be used in small machines.
- b) The efficiency is very low.
- c) The engine cannot be started immediately.

**19. Give reason:****a) Steam engine cannot be used in small machines.**

External combustion/steam engines are bulky and heavy hence cannot be fitted into small machines.

**b) Efficiency of external combustion/steam engine is low.**

Efficiency of steam engine is low as there is more loss of heat. Most of the heat is lost in boiling of water to increase the temperature of water to its boiling point.

**c) External combustion/steam engine cannot be started immediately.**

Heating water to produce steam takes time, so the engine cannot be started instantly. To keep the steam ready fuel must be burnt continuously even if the engine is at rest.

**20. What is an internal combustion engine?**

A heat engine in which combustion of fuel takes place inside the cylinder of the engine is called internal combustion engine.

Ex: Petrol engine, Diesel engine.

**21. Mention the types of internal combustion engine.**

- a) Petro engine
- b) Diesel engine

**22. Briefly explain the construction of a petrol engine.**

A petrol engine consists of an air tight piston fitted inside a cylinder. The piston can move smoothly inside the cylinder. The cylinder has two valves – an inlet valve and an outlet valve. It has a spark plug. The piston is connected to a crankshaft. The engine is linked with a carburetor where air and petrol are mixed in proper proportion before letting into the cylinder.

**23. Draw a neat diagram showing the parts of a petrol engine.**

**24. What is meant by stroke of an engine?**

The motion of piston from one end to another end is called stage/stroke of an engine.

**25. Mention the five stages in the working of a petrol engine.**

- a) Intake stroke
- b) Compression stroke
- c) Ignition stroke
- d) Expansion stroke
- e) Exhaust stroke

**26. Briefly explain the working of a petrol engine.**

In a petrol engine, petrol vapours are mixed with correct amount of air in the carburetor. This mixture is passed into the cylinder

**a) Intake stroke:**

In this stroke, the piston moves away from the sparkplug creating a low pressure inside. The inlet valve opens and the fuel-air mixture from the carburetor enters the cylinder. The outlet valve remains closed.

**b) Compression stroke:**

In this stroke, both inlet and outlet valve remain closed. The petrol-air mixture is compressed by the piston moving towards the sparkplug. The compression increases the temperature of the mixture but it is not sufficient to ignite petrol.

**c) Ignition stroke:**

In this stroke, the compressed petrol-air mixture is ignited by the sparks produced by the spark plug.

**d) Expansion stroke:**

In this stroke, the fuel burns quickly producing heat and gaseous products such as carbon dioxide, carbon monoxide and water vapour along with carbon particles. The gaseous products expand suddenly and pushes the piston outwards with a great force.

**e) Exhaust stroke:**

In this stroke, the outlet valve opens. Piston moves inside towards the sparkplug. The products of combustion gases are pushed out of the cylinder through the outlet valve.

**27. In the expansion stroke of a petrol engine, the piston is pushed with a great stroke. Why?**

When the petrol-air mixture is ignited, carbon dioxide, carbon monoxide and water vapour expands suddenly. This exerts a great force on the piston.

**28. How is the initial kinetic energy needed to start the engine?**

The initial kinetic energy needed to start the engine is provided by the starter motor or kick starter.

**29. Briefly explain the working of a diesel engine.**

Construction:

A diesel engine consists of an airtight piston fitted inside a cylinder. The piston is free to move inside the cylinder. The cylinder has two valves – an inlet valve and an outlet valve. It has no sparkplug or carburetor as in the case of petrol engine. In place of the spark plug there is an injection pump.

Working:

The working of diesel engine consists of five strokes.

a) **Intake stroke:**

In this stroke, the piston moves away from the sparkplug creating a low pressure inside. The inlet valve opens and the filtered air enters the cylinder. The outlet valve remains closed.

b) **Compression stroke:**

In this stroke, both inlet and outlet valve remain closed. The air is compressed by the piston moving towards the head of the engine. The compression is 4:1 to 25:1. The compression increases the temperature of the air.

c) **Ignition stroke:**

In this stroke, a controlled amount of diesel is injected into the cylinder.

d) **Expansion stroke:**

In this stroke, Diesel bursts into flame producing heat and gaseous products such as carbon dioxide, carbon monoxide and water vapour along with carbon particles. The gaseous products expand suddenly and pushes the piston outwards with a great force.

e) **Exhaust stroke:**

In this stroke, the outlet valve opens. Piston moves inside towards the sparkplug. The products of combustion gases are pushed out of the cylinder through the outlet valve.

**30. Why there is not sparkplug in a diesel engine?**

The compression of air in the cylinder is 4:1 to 25:1. This compression increases the temperature to around 1000K which is enough to ignite diesel. In the ignition stroke, a required amount of diesel is injected. Hence no sparkplug is needed.

**31. Why is air compressed in a diesel engine?**

In a diesel engine, filtered air enters the cylinder and gets compressed to generate enough heat to ignite the diesel.

**32. Diesel engines are best suited for heavy vehicles, such as lorries, trucks, railway engines and ships. Why?**

As they have more power and efficiency of diesel engine is more.

**33. Mention the uses of diesel engine.**

Diesel engines are used a) in transport vehicles b) in generators to produce electricity  
d) by some sugarcane juice vendors to crush sugarcane. d) by cement concrete mixers

**34. What is meant by emission test?**

The test conducted to determine the amount of carbon monoxide emitted by vehicles is called emission test.

**35. List the differences between petrol engine and diesel engine.**

Petrol Engine	Diesel engine
1. Petrol vapour is used as fuel	1. Diesel is used as fuel
2. Petrol engines are spark ignition engines. It requires a spark plug.	2. Diesel engine are compression ignition engines. It does not require sparkplug.
3. Cost of petrol is comparatively high.	3. The cost of diesel is comparatively less
4. Expansion of gaseous products with pressure impulse	4. Expansion against constant pressure.
5. Efficiency is comparatively less	Efficiency is comparatively more
6. Compression of petrol-air mixture is in the ratio 4:1 to 10:1	6. Compression of air is in the ratio 4:1 to 25:1

**36. Define efficiency of a heat engine.**

The efficiency of a heat engine is defined as the ratio of the actual work done to the heat energy consumed. It is expressed as percentage.

$$\text{Efficiency} = \frac{\text{Actual work done}}{\text{Heat energy consumed}} \times 100\%$$

**37. Write the formula to calculate efficiency.**

$$\eta = \frac{W}{H} \times 100 \quad \text{where } \eta \text{ (pronounced as Eeta) = Efficiency}$$

W = workdone by the engine

H = Heat energy input

**38. Is it possible to have a heat engine with 100% efficiency? If no why?**

No, we cannot have a heat engine that is 100% efficient. Whenever heat energy is converted into mechanical energy by a heat engine, a part of the heat energy is lost. Hence we cannot have 100% efficient.

**39. The efficiency of a heat engine is 25%. If 50,000 joules of heat is supplied to the engine. Calculate the useful work done by the engine.**

40. An engine is designed to convert 40KJ of heat energy into work. If the heat engine consumed by the engine is 60KJ, how high would this engine lift an object of mass one kilogram from the ground?
41. Calculate the efficiency of an engine which performs work of 400 joules utilizing 1000j of heat energy.
42. Which of the following is the best engine?  
a) 720KJ of work done by 1800KJ of heat  
b) 450KJ of work done by 900KJ of heat  
c) 100KJ of work done by 1000KJ of heat



**43. A person develops an engine whose efficiency is 45%. What do you mean by this?**

An engine is 45% efficient means 45% of the heat supplied is converted into mechanical energy.

**44. An engine is 35% efficient. If 800KJ of heat is consumed by the engine. How much mechanical work is done by it?**

**45. Efficiency of a heat engine is 40% and it consumes 900KJ of heat energy. Calculate the mechanical workdone.**

**46. An engine is designed to convert 20% of heat energy into work. If the steam in the engine has 80KJ of heat energy, Calculate the useful work done by the engine.**

47. **State the function of the following parts in a heat engine:**  
a) Crank shaft b) spark plug c) carburettor d) kick starter e) inlet valve f) outlet valve
- a) Crankshaft converts the linear movement of piston into circular motion.  
b) Spark plug is used in petrol engine to ignite the mixture of petrol and air in the cylinder.  
c) Carburettor helps to mix petrol vapours and air in proper proportion.  
d) Kick starter is used to provide the initial kinetic energy needed to start the engine.  
e) Inlet valve allows the mixture of petrol-air or air into the cylinder.  
f) Outlet Valve allows the exhaust gases out of the cylinder.
48. **What is the disadvantage of internal combustion engine?**  
Internal combustion engine causes more pollution as it produces exhaust gases like carbon monoxide, carbon dioxide and carbon particles.
49. **What are the advantages of internal combustion engine?**
- a) The efficiency of internal combustion engine is greater than that of external combustion engine.  
b) It can be started immediately.  
c) It can be fitted into small machines
50. **Write the meaning of a) unleaded petrol b) antiknock value of petrol c) CNG**
- a) Unleaded petrol means petrol without the lead added to it  
b) Antiknock value of petrol is  
c) CNG stands for Compressed Natural Gas. It is a clean fuel. It is environment friendly.

**Fill in the blanks:**

1. The effect of heat used in converting heat energy to mechanical energy is **change of state of matter.**
2. Volume of steam is **700** times more at STP than the volume of water from which it is obtained by heating.
3. The energy transformation in a heat engine is **heat into mechanical.**
4. Forward movement of a piston in a steam engine is called **expansion stroke.**
5. The basis of working of steam engine is the pressure exerted by the large volume of steam.
6. The basis of diesel/petrol engine is Chemical change of liquid when under goes combustion produces large volume of gases and exerts pressure.
7. The conversion of steam pressure into mechanical energy was known since **Roman Empire.**
8. First commercially useful steam engine was constructed by **Thomas Savery.**
9. Steam locomotives helped to bring about **industrial** revolution.
10. In a steam engine, the special shutters used are called **valves.**

11. In a steam engine, the cylinder is connected to the condenser by outlet valve.
12. The fuel used in Raichur Thermal power plant is coal.
13. In a temporary forest camp, the best way to generate electricity for several hours is to use diesel engine.
14. Internal combustion engine was invented by Rudolf Diesel and Nikolaus.
15. The ignition stroke and expansion stroke are together called power stroke.
16. The stroke in which both valves are closed is compression/expansion stroke.
17. The part of a petrol engine in which petrol vapour and air are mixed is carburetor.
18. Linear motion of the piston in a heat engine is converted into circular motion by Crankshaft.
19. The stroke of a heat engine in which outlet valve opens is exhaust stroke.
20. Internal combustion engine that does not use spark plug is Diesel engine.
21. The compression of air in a diesel engine is 4:1 to 25:1.
22. The part that is not needed in a diesel engine is sparkplug/carburetor.
23. If an engine is not maintained the production of carbon monoxide increases
24. The formula to calculate the efficiency of a heat engine is  $\eta = \frac{W}{H} \times 100$
25. If work done by an engine is equal to the heat supplied, then its efficiency is 100%.

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