Introduction to Steam
Course Quiz

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CHAPTER 2 – INTRODUCTION

QUESTION 1

Select all the correct answers. The main industrial purposes of steam are:

a) Heating.
b) Actuating pneumatic instruments.
c) Actuating mechanical devices.
d) Sanitation.
e) Power generation.
f) Industrial processes.

QUESTION 2

Within the context of engineering, what does the term 'energy fluid' mean?

a) Energy fluids are drinks that provide an energy boost, for example Red Bull.
b) The term 'energy fluid' refers to either electricity or steam.
c) An energy fluid is a fluid used to convey energy, usually in the form of heat (thermal energy), pressure (pressure energy) and/or speed (kinetic energy).

QUESTION 3

When using steam as the energy fluid, what are its advantages?

a) Steam is made from water, which is plentiful and easy to access.
b) Steam is made from water, which is cheap compared to other energy fluids.
c) Steam is made from water, which can be easily conveyed (i.e. pumped).
d) Steam and water are both easily controlled (with valves).
e) All these options.

QUESTION 4

After water is converted to steam, it becomes an energy fluid with many advantageous properties. Which of the following is NOT a characteristic of steam?

a) A given mass of steam can hold five to six times more energy than an equivalent mass of water.
b) It can be distributed easily by creating a pressure difference in the steam system.
c) It is non-toxic and does not damage the environment.
d) Steam is non-corrosive and requires no chemical treatment.
e) It will not spark, ignite, or combust (intrinsically safe).
f) The amount of energy within a steam system can be regulated by regulating the steam pressure.
g) Steam's heat transfer properties are high.

QUESTION 5

A steam system requires several smaller systems in order to function. Select the systems required by a steam system.

a) Fuel system – provides chemical energy to the boiler.
b) Boiler – converts the fuel's chemical energy to thermal energy.
c) All these options.
d) Distribution – conveys steam to the point of use.
e) Collection/Recovery – recovers condensate (water) from the steam system and returns it to the boiler.

CHAPTER 3 – THERMODYNAMICS

QUESTION 6

Define the terms 'atmospheric pressure', 'gauge pressure' and 'absolute pressure'. Select all true statements.

a) Atmospheric pressure decreases as altitude above sea level increases.
b) Absolute pressure is equal to atmospheric pressure.
c) The pressure shown by a gauge is known as gauge pressure.
d) Gauge pressure is the pressure measured at sea level, which occurs due to the earth's atmosphere.
e) Absolute pressure is equal to the sum of gauge pressure and atmospheric pressure.
f) The pressure shown by a gauge is known as atmospheric pressure.

QUESTION 7

Pressure is often given in 'psi' or 'bar', but it is also possible that pressure may be given in 'psia', 'psig', 'bara' or 'barg'. The 'a' and 'g' indicate 'absolute' and 'gauge' pressure readings.

a) True
b) False

QUESTION 8

The boiling point is the temperature at which a liquid boils and becomes vapour, it is also referred to as the saturation temperature. How will the boiling point be affected if the pressure surrounding the liquid changes?

a) The boiling point of a liquid decreases as pressure increases and increases as pressure decreases.
b) The boiling point of a liquid increases as pressure increases and decreases as pressure decreases.
c) The boiling point of a liquid does not change with varying pressure.

QUESTION 9

Thermodynamics is the study of thermal energy and how it is transferred to other forms. There are two thermodynamic laws of importance when learning about steam. Which of the given statements are correct? There may be more than one answer.

a) Second Law of Thermodynamics – energy cannot be destroyed, or created, it can only change form.
b) Second Law of Thermodynamics – heat flows from hot to cold.
c) First Law of Thermodynamics – heat flows from hot to cold.
d) First Law of Thermodynamics – energy cannot be destroyed, or created, it can only change form.

QUESTION 10

Heat is defined as '*thermal energy transferred between two systems that are in direct contact with each other, but at different temperatures*.' If heat is transferred to a substance, the substance will change temperature, or change state.

a) True
b) False

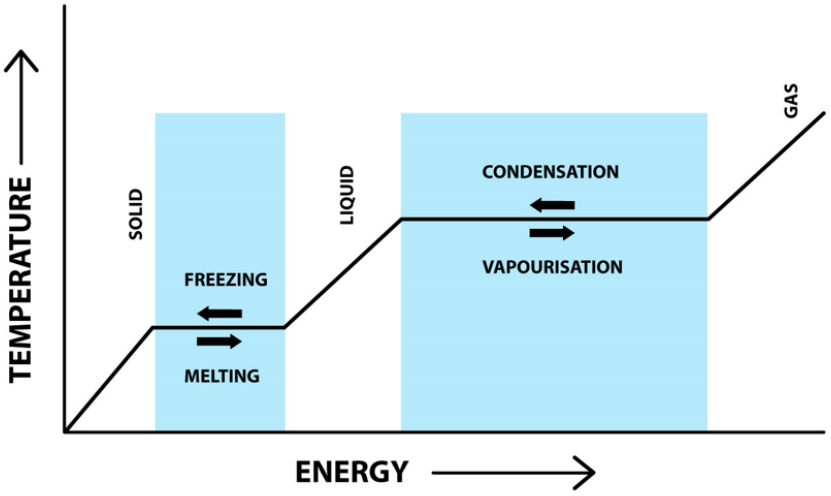
QUESTION 11

The term heat describes two types of heat, sensible heat and latent heat. Select the statements that best define latent and sensible heat.

a) Latent heat can be measured using a thermometer and sensed by a human.
b) Sensible heat can be identified by a substance's change in state/phase, but not by a change in temperature.
c) Latent heat can be identified by a substance's change in state/phase, but not by a change in temperature.
d) Sensible heat can be measured using a thermometer and sensed by a human.

QUESTION 12

With reference to the graph shown, which of the shown statements is NOT correct?



a) The graph shows that heat added does not always cause a temperature change.
b) Sensible heat is seen whenever heat is added and the temperature changes proportionately (sloped lines on the graph).
c) Latent heat is seen whenever heat is added and no change of temperature occurs (horizontal lines on the graph).
d) The graph shows that heat energy added always causes a temperature change.

QUESTION 13

Regarding sensible and latent heat, which of the given statements is NOT true?

a) Adding sensible heat to water will gradually increase its temperature.
b) Steam contains both the sensible and latent heat that was transferred into it.
c) Changing water into gas requires almost no latent heat and a lot of sensible heat.
d) A liquid at saturation temperature (temperature at which it boils), is literally saturated with sensible heat.

QUESTION 14

There may be more than one correct answer to this question. What are the means of transferring heat?

a) Conduction.
b) Reflection.
c) Convection.
d) Dissection.
e) Radiation.
f) Compression.

QUESTION 15

Which of the following statements describes heat transfer by conduction?

a) Heat is transferred directly from one molecule to another. Conduction occurs in solids, liquids and gases.
b) Heat is transferred by molecules in a fluid state. Conduction may be forced (using a pump or fan), or, natural, due to temperature and density differences in the fluid.
c) Heat is transferred via radiant energy (electromagnetic waves).

QUESTION 16

Which of the following statements describes heat transfer by convection?

a) Heat is transferred directly from one molecule to another. Convection occurs in solids, liquids and gases.
b) Heat is transferred by molecules in a fluid state. Convection may be forced (using a pump or fan), or, natural, due to temperature and density differences in the fluid.
c) Heat is transferred via radiant energy (electromagnetic waves).

QUESTION 17

Which of the following statements describes heat transfer by radiation?

a) Heat is transferred directly from one molecule to another. Radiation occurs in solids, liquids and gases.
b) Heat is transferred by molecules in a fluid state. Radiation may be forced (using a pump or fan), or, natural, due to temperature and density differences in the fluid.
c) Heat is transferred via radiant energy (electromagnetic waves).

QUESTION 18

Which of the listed is NOT a unit of measurement for temperature?

a) Degree Celsius (°C) – tends to be favoured in Europe. Fresh water boils at 100°C and freezes at 0°C.
b) Degree Fahrenheit (°F) – tends to be favoured in the Americas. Fresh water boils at 212 °F and freezes at 32°F. Saltwater freezes at 0 °F.
c) Kelvin (K). One of the seven SI units (International System of Units). Fresh water boils at 373 K and freezes at 273 K.
d) All options are units of measurement for temperature.

QUESTION 19

Temperature is a measure of the average kinetic energy that the molecules of a substance contain. Substances with more kinetic energy have a higher temperature than substances with lower kinetic energy.

a) True
b) False

QUESTION 20

Heat is a form of energy and is often given in British thermal units (Btus), Joules (J), or Calories (Cal). Which of the given statements are true?

a) British thermal unit (Btu) – the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
b) British thermal unit (Btu) – the amount of heat required to increase the temperature of one gram of water by one degree Celsius.
c) Calorie – the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
d) Calorie – the amount of heat required to increase the temperature of one gram of water by one degree Celsius.

QUESTION 21

What does the term *specific heat*, also known as *specific heat capacity* refer to?

a) Specific heat is a measure of the average kinetic energy that the molecules of a substance contain.
b) Specific heat is the amount of heat required to change one unit of a substance's mass by one unit in temperature.

CHAPTER 4 – COMBUSTION

QUESTION 22

Boiler combustion is termed *perfect*, *complete* or *incomplete*. Which of the given statements is true? There may be more than one correct answer to this question.

a) Complete combustion – minimum amount of air is provided to achieve complete combustion.
b) Complete combustion – too little air is provided, but complete combustion occurs.
c) Incomplete combustion – too little air is provided, and incomplete combustion occurs.
d) Incomplete combustion – the exact amount of air is provided in order to achieve complete combustion of the fuel.
e) Perfect combustion – the exact amount of air is provided in order to achieve complete combustion of the fuel.

QUESTION 23

Complete combustion is essential to avoid a reduction in boiler efficiency and potential safety hazards. Which of the following are products of complete combustion?

a) Carbon dioxide (CO_2).
b) Carbon monoxide (CO).
c) Water vapour (H_2O).
d) Soot and smoke.

QUESTION 24

Why is incomplete combustion not desired during boiler operation? Select all the correct answers.

a) Incomplete combustion may lead to generation of carbon monoxide, which poses a health and safety risk.
b) Incomplete combustion leads to generation of large amount of water vapour, which could flood the machinery space.
c) By-products of incomplete combustion include excessive heat and noise, both of which are not desired.
d) By-products of incomplete combustion include soot and smoke, both of which can reduce heat transfer within the boiler.

QUESTION 25

Choose the true statement:

a) Efficiency is represented by the Greek letter η and the equation *Efficiency = Output / Input*.
b) Efficiency is represented by the Greek letter η and the equation *Efficiency = Input / Output*.

QUESTION 26

Concerning boiler thermal efficiency, which of the following equations is true?

a) Thermal Efficiency = Heat Absorbed by Boiler Water / Heat Generated by Combustion
b) Thermal Efficiency = Energy Output / Energy Input
c) Thermal Efficiency = Chemical Energy of the Fuel / Heat Absorbed by Boiler Water

QUESTION 27

It's possible to measure the gases of combustion to determine if combustion was complete or incomplete. Select the correct statements:

a) Too much oxygen in the gases of combustion indicates that too much air for combustion was provided.
b) Too much oxygen in the gases of combustion indicates that combustion was incomplete.
c) High levels of carbon monoxide in the gases of combustion indicates combustion was complete.
d) High levels of carbon monoxide in the gases of combustion indicates too little air was provided and combustion was incomplete.

QUESTION 28

The total air supplied to the boiler is further categorised as either *primary*, *secondary* or *excess air*. Select all true statements.

a) Secondary air is mixed with the fuel prior to ignition. Secondary air controls the amount of fuel burnt.
b) Primary air is mixed with the fuel prior to ignition. Primary air controls the amount of fuel burnt.
c) Secondary air is added to the combustion process after ignition. Secondary air controls how efficiently fuel is burnt.
d) Primary air is added to the combustion process after ignition. Primary air controls how efficiently fuel is burnt.
e) Excess air is secondary air that was not part of the combustion process.

CHAPTER 5 - STEAM PROPERTIES

QUESTION 29

The 'steam' that a viewer sees is actually water molecules suspended in the steam, not steam.

a) True
b) False

QUESTION 30

Pressure, volume and temperature, are all related, and the combined gas law (k = P x V / T) describes the relationship between them. Which of the given statements is correct?

a) If temperature is held constant, a decrease in pressure will be accompanied by a decrease in volume.
b) If temperature is held constant, an increase in pressure will be accompanied by a decrease in volume.

QUESTION 31

Pressure, volume and temperature, are all related, and the combined gas law (k = P x V / T) describes the relationship between them. Which of the given statements is correct?

a) If volume is held constant, a decrease in pressure will be accompanied by a proportional increase in temperature.
b) If volume is held constant, an increase in pressure will be accompanied by a proportional increase in temperature.

QUESTION 32

Which of the following statements is correct regarding saturated water?

a) Saturated water contains enough heat that if the temperature remains constant, and the pressure decreases, it will boil.
b) Saturated water contains the maximum amount of heat it can hold at a given pressure without beginning to change state to a vapour.
c) Both of these answers.

QUESTION 33

With reference to saturated steam, which of the following statements is NOT true?

a) Saturated steam (dry saturated steam) has just enough heat to remain in a gaseous state.
b) Saturated steam contains the minimum amount of heat it can hold at a given pressure without beginning to change state to a liquid.
c) Saturated steam is also referred to as superheated steam.

QUESTION 34

Steam is classified as either *wet* or *dry*. Which of the given statements best describes wet and dry steam?

a) Wet steam contains water droplets suspended in the steam. Dry steam contains no suspended water droplets in the steam.
b) Dry steam contains water droplets suspended in the steam. Wet steam contains no suspended water droplets in the steam.

QUESTION 35

Which of the given statements is true? Select all the correct answers.

a) Wet steam always contains less energy than drier steam, thus drier steam makes the system process more efficient and is consequently desired.
b) The inverse of the dryness fraction is the wetness fraction, although it is less commonly quoted in steam tables.
c) Steam containing 5% moisture by mass, also contains 95% steam; the steam is described as having a dryness fraction of 0.95.
d) All these statements are true.

QUESTION 36

Steam system contaminants include water treatment chemicals, suspended solids, and dissolved solids. How can these contaminants be controlled and/or reduced?

a) Reducing the amount of moisture within the steam is the most reliable method of reducing the number of contaminants present in the system.
b) Increasing the amount of moisture within the steam is the most reliable method of reducing the number of contaminants present in the system.
c) Feeding ultra-pure water to the boiler will increase steam purity.
d) All these answers.
e) None of these answers.

QUESTION 37

Concerning enthalpy, which of the given statements is NOT true?

a) Enthalpy can be thought of as the amount of heat (sensible and latent) a substance contains.
b) The amount of sensible heat required to raise a given mass of liquid from its freezing point to its boiling point (saturation temperature) is termed the enthalpy of a liquid at saturation temperature.
c) Enthalpy is the amount of heat required to change one unit of a substance's mass by one unit in temperature.
d) The amount of latent heat required to turn a given mass of saturated water (water at its boiling point) into dry saturated steam, is termed enthalpy of vaporisation.

QUESTION 38

Properties of steam at various pressures and temperatures (i.e. specific volume, enthalpy etc.) are listed in:

a) Steam tables.
b) Steam checklists.
c) Steam papers.
d) Steam notebooks.

CHAPTER 6 - BOILERS

QUESTION 39

There are two main types of boiler used in the industrial engineering world, these are the *fire tube boiler* and *water tube boiler*. Select all true statements.

a) Water tube boilers have water outside the tubes and gases of combustion inside the tubes.
b) Fire tube boilers have gases of combustion outside the tubes and water within the tubes.
c) Water tube boilers have water in the tubes and gases of combustion outside of the tubes.
d) Fire tube boilers have gases of combustion in the tubes and water outside of the tubes.

QUESTION 40

Concerning water tube boilers, which statement is NOT correct?

a) Combustion gases surround the tubes.
b) Very high steam generation rate compared to fire tube boilers.
c) Maximum allowable working pressure (MAWP) up to 362 psi (25 bar).

QUESTION 41

Concerning fire tube boilers, which statement is NOT correct?

a) Combustion gases in the tubes, water surrounding the tubes.
b) Very high steam generation rate compared to water tube boilers.
c) Maximum allowable working pressure (MAWP) up to 362 psi (25 bar).

QUESTION 42

There are two common types of electric boiler, these are the *electrode boiler* and *resistance boiler*. Which of the given statements are true?

a) Resistance boilers generate electrical arcs which heat the water until steam is formed.
b) Electrode boilers generate electrical arcs which heat the water until steam is formed.
c) Resistance boilers pass electrical current through submerged resistive elements in order to generate heat.
d) Electrode boilers pass electrical current through submerged resistive elements in order to generate heat.

ANSWERS

1. a/e/f
2. c
3. e
4. d
5. c
6. a/c/e
7. a
8. b
9. b/d
10. a
11. c/d
12. d
13. c
14. a/c/e
15. a
16. b
17. c
18. d
19. a
20. a/d
21. b
22. a/c/e
23. a/c
24. a/d
25. a
26. a
27. a/d
28. b/c/e
29. a
30. b
31. b
32. c
33. c
34. a
35. d
36. a/c
37. c
38. a
39. c/d
40. c
41. b
42. b/c