



PHYSICS

BOOKS - MTG IIT JEE FOUNDATION

TEMPERATURE AND HEAT

Illustrations

1. Change 40°C to the corresponding temperature on Kelvin scale.

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2. Change 300 K to the corresponding temperature on Fahrenheit scale.

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3. Show with the help of an activity that convection takes place in liquids.



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4. Why is radiator of motor car painted black?



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Solved Examples

1. When ice is added to water in a glass, why do we feel cold to touch the glass?



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2. One metal spoon and another plastic spoon are kept in hot water immersed for sometime. Which one of them will be hotter?



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3. A bottle of hot milk is placed in cold water for a long time. What will happen?



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4. Boiling hot water is poured into a glass with thick bottom. What is likely to happen?



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5. At what temperature will both the Celsius and Fahrenheit scales read the same value?



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6. State similarities and differences between the laboratory thermometer and the clinical thermometer.



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7. Give two examples each of conductors and insulators of heat.



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8. What differences can you find between the clinical thermometers and laboratory thermometers?



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9. Raghav has a temperature of 40°C . What would you tell him to do?



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10. Dhruv got a slab of chocolate from his friend on his birthday. He kept it in his bag. On reaching home, he opened his bag and found a brown sticky liquid oozing out of the wrapper. It had spread over some of his books. What do you think has happened?



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11. The bimetallic strip in the next picture is made from aluminium and copper. When heated it bends in the direction shown. Which metal expands more when the two are heated equally?



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12. Why do birds sometimes fluff out their feathers on a cold winter morning?



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13. Why do fire fighters wear special shiny suits when they enter a burning building?



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14. If you live on the top floor of a building, you must have noticed that, in summer the roof gets very hot. Suggest a few ways by which people who live on the top floor of a building can protect themselves from the radiant heat of the sun?



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15. What are the precautions needed while reading a laboratory thermometer?

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Exercise Multiple Choice Questions

1. When we touch a steel rod and a paper simultaneously, we feel that the rod is colder because

- A. iron being a good conductor conducts more heat from our body
- B. paper is a good conductor of heat
- C. more heat flows from the iron to our body
- D. more heat flows from the paper to our body.

Answer: A

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2. The lower fixed point on the Celsius scale is

- A. melting point of ice
- B. boiling point of water
- C. melting point of mercury
- D. mean of melting point and boiling point of water.

Answer: A



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3. In electric heater

- A. chemical energy is converted to electrical energy
- B. electrical energy is converted to chemical energy
- C. heat energy is converted to electrical energy
- D. electrical energy is converted to heat energy.

Answer: D



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4. Mercury is widely used in clinical thermometers because

- A. mercury is cheap
- B. mercury is clearly visible
- C. it is fashionable to use mercury
- D. mercury has a constant coefficient of expansion.

Answer: D



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5. According to the law of conservation of energy

- A. energy exists in only one form

- B. energy can be created but not destroyed, and it can be transformed from one form to another
- C. energy exists in many forms but it cannot be transformed
- D. energy can neither be produced nor be destroyed and it can be transformed from one to another form.

Answer: D

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6. When the temperature of a substance is increased

- A. kinetic energy of the molecules of the substance increases
- B. kinetic energy of the molecules of the substance decreases
- C. the amplitude of vibrations of molecules of the substance about their mean position decreases
- D. it does not show any change.

Answer: A



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7. The difference between lower fixed point and upper fixed point is divided into _____ parts on a Celsius scale

A. 100

B. 273

C. 180

D. 50

Answer: A



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8. What is the normal human body temperature?

A. 32 F

B. 212 F

C. 100.4 F

D. 98.6 F

Answer: D

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9. We cannot use mercury thermometer at low temperatures because

A. glass might break down at low temperature.

B. heat does not flow from the body whose measurement we are taking with the thermometer.

C. at low temperatures mercury becomes transparent and it becomes difficult to take the readings.

D. mercury freezes at low temperatures.

Answer: D



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10. Why a small gap is left between the iron rails of railway tracks ?

- A. gaps give the space to the tracks to expand in summer heat.
- B. gaps hold the tracks firmly.
- C. to produce gently rhythmic sound when the train moves on the track.
- D. it is customary to level the gaps.

Answer: A



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11. Electric wires sag in summer and become tight in the winter, because

- A. they perform periodic motion according to changes in the seasons
- B. they expand due to summer heat and contract due to winter cold.
- C. they expand due to winter cold and contract due to summer heat.
- D. there is no specific reason.

Answer: B

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12. At low temperatures _____ types of thermometer is used.

- A. mercury thermometer
- B. water thermometer
- C. alcohol thermometer
- D. thermometers cannot be used

Answer: C

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13. A dog pants with its tongue sticking out on a hot day. The reason is

- A. it is its habit
- B. producing more saliva cools down the body temperature
- C. saliva vapourises, cooling the tongue
- D. it is a genetic disease found in few animals like dogs

Answer: C



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14. The change of a solid into liquid is called

- A. melting
- B. freezing
- C. boiling

D. condensation

Answer: A



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15. Process of change of state from liquid to solid is called

A. melting

B. freezing

C. boiling

D. condensation

Answer: B



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16. Process of change of state from gaseous state to liquid state is called

- A. freezing
- B. sublimation
- C. boiling
- D. condensation

Answer: D

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17. When a substance changes its state from solid to liquid

- A. the temperature remains constant until the change of state is complete
- B. there is a constant rise in temperature
- C. there is a constant drop in temperature
- D. the temperature fluctuates.

Answer: A



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18. Sublimation is

- A. increasing the energy of a substance until the chemical reaction starts
- B. process of change of state from gas to liquid
- C. process of change of state from solid to gas
- D. process of preparing water vapour even below the boiling point by subjecting it to extra pressure.

Answer: C



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19. The temperature of the substance remains constant when it is melting and boiling though some quantity of heat is supplied. What happens to

this energy?

- A. It is dissipated as sound energy
- B. It is consumed to increase the energy of the molecules
- C. It is used to change the state of the substance
- D. It is still an unsolved problem in science.

Answer: C



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20. 1 calorie is equal to the

- A. amount of heat energy required to transform 1 kg of ice into water at 0°C .
- B. amount of heat energy required to raise the temperature of 1 kg of water through 1°C .

C. amount of heat required to raise the temperature of 1 g of water through 1°C .

D. quantity of work done at atmospheric pressure.

Answer: C



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21. When two bodies at different temperatures are placed in thermal contact with each other, heat flows from the body at higher temperature to the body at lower temperature until they both acquire the same temperature. Assuming that there is no loss of heat to the surroundings,

A. the heat gained by the hotter body will be equal to the heat lost by the colder body

B. the heat gained by the hotter body will be less than the heat lost by the colder body

C. the heat gained by the hotter body will be greater than the heat lost by the colder body

D. the heat lost by the hotter body will be equal to the heat gained by the colder body.

Answer: D

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22. The handles of cooking vessels are covered with plastic or wood because

A. they are beautiful

B. it is customary

C. they are good conductors of heat

D. they are bad conductors of heat

Answer: D



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23. Convection of heat takes place in

- A. metals only
- B. liquids only
- C. gases only
- D. liquids and gases

Answer: D



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24. Conduction is possible

- A. when the bodies are far apart from each other.
- B. when the bodies have same temperature and in thermal contact.

C. when they have different temperatures maintaining distance between them.

D. when the bodies are in contact and have different temperatures.

Answer: D

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25. A coin is dipped in the molten wax in a glass tube. When we heat the upper part of the glass tube, the wax around the coin will not melt because

A. wax has a very high melting point

B. wax is a good conductor of heat

C. glass is a good conductor of heat

D. wax and glass are bad conductors of heat

Answer: D



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26. It is warmer to have two thin blankets than to have a single thick blanket because

- A. thick blankets cannot give more warmth
- B. two blankets allow more heat to pass through them
- C. air between the two blankets is a good conductor of heat
- D. air between the thin blankets does not allow heat to pass through it since it is a bad conductor

Answer: D



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27. Firemen crawl when entering a burning building because

- A. it is easier to crawl

B. smoke rises high in the air

C. it helps to move faster

D. to resist more heat

Answer: B



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28. Black bodies are

A. good absorbers and bad radiators

B. good absorbers and good radiators

C. bad absorbers and good radiators

D. bad absorbers and bad radiators

Answer: B



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29. In solar cooker

- A. electricity is used to cook food
- B. chemical energy is converted to electrical energy
- C. radiation from the sun is used to cook food
- D. heat energy is converted light energy

Answer: C



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30. Can you say which of these is the temperature inside the Sun?

- A. $30^{\circ} C$
- B. $300^{\circ} C$
- C. $3000^{\circ} C$
- D. $3,000,000^{\circ} C$

Answer: D



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31. A cotton filled quilt keeps a person warm in winter because

- A. Cotton is a good insulator.
- B. A cotton quilt is light.
- C. A log of air is trapped in a cotton quilt.
- D. Cotton can be easily fluffed up.

Answer: C



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32. In summer, we prefer to wear

- A. light coloured clothes as they absorb less heat.

B. light coloured clothes as they absorb more heat.

C. dark coloured clothes as they absorb less heat.

D. dark coloured clothes as they absorb more heat.

Answer: A



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33. Have you seen buffaloes enjoy a dip in river or in lake on a hot summer afternoon. Can you say why they do this?

A. They enjoy taking a bath in summers.

B. They have to clean the mud from their body to prevent infections.

C. Their black bodies absorb heat and the water helps to keep them cool.

D. They like to swim.

Answer: C

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34. The normal temperature of human body is

A. 37 K

B. $37^{\circ}C$

C. 37 F

D. 37 K

Answer: B

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35. The heat from the sun reaches us on the earth by the process of :

A. Convection

B. Radiation

C. Conduction

D. All of these

Answer: B



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36. Heat flows always

- A. from hot body to a cold body.
- B. from cold body to a hot body.
- C. in both the directions.
- D. never flows from one body to other.

Answer: A



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37. When you put a metal key into its metal lock, you find the key is too tight. Which of the following methods will you adopt to make the key fit properly?

- A. Heat the key and lock.
- B. Cool the key and heat the lock.
- C. Heat the key and cool the lock.
- D. Cool the key and lock

Answer: B



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38. Deepak put twenty ice cubes of the same volume into four containers packed with different materials. He recorded the time taken for the ice to melt in each case. Which of the options should he choose to carry ice that he needs to take to a friend's house 12 km away?

- | | | |
|----|----------------------------|------------------------------|
| A. | Container with thermocole. | Melting time :
3 h 10 min |
| B. | Container with ice paper. | Melting time :
2 h 05 min |
| C. | Container with sand. | Melting time :
30 min |
| D. | Container with sawdust. | Melting time :
1 h 15 min |

Answer: A

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39. An iron ball at $40^{\circ}C$ is dropped in a mug containing water at $40^{\circ}C$.

The heat will

- A. flow from iron ball to water.
- B. not flow from iron ball to water or from water to iron ball.
- C. flow from water to iron ball.
- D. increase the temperature of both.

Answer: B

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40. A wooden spoon is dipped in a cup of ice cream. Its other end

- A. becomes cold by the process of conduction
- B. becomes cold by the process of convection
- C. becomes cold by the process of radiation
- D. does not become cold.

Answer: D

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41. Stainless steel pans are usually provided with copper bottoms. The reason for this could be that

- A. copper bottom makes the pan more durable
- B. such pans appear colourful

C. copper is a better conductor of heat than the stainless steel

D. copper is easier to clean than the stainless steel

Answer: C



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42. Which of the following statements about the expansion of matter is not true?

A. Expansion of matter is used in construction of thermometers.

B. Expansion of matter has both advantages and disadvantages.

C. Expansion varies with amount of heating.

D. Expansion of matter leads to decrease in mass of substance.

Answer: D



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43. A clinical thermometer is calibrated from

- A. $35^{\circ}C$ to $42^{\circ}C$
- B. $10^{\circ}C$ to $100^{\circ}C$
- C. $32^{\circ}C$ to $110^{\circ}C$
- D. $0^{\circ}C$ to $100^{\circ}C$

Answer: A



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44. In which of the following process, convection does not take place primarily

- A. Sea and land breeze
- B. Trade wind
- C. Boiling of water
- D. Warming of glass of bulb due to filament

Answer: D



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45. The equatorial and polar regions of the earth receive unequal solar heat. The convection current arising due to this is called

- A. land breeze
- B. sea breeze
- C. trade wind
- D. tornado

Answer: C



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46. Which of the following is true?

- A. Sea breeze happens during night time when the sea is cooler than the land.
- B. Sea breeze happens during day time when the land is cooler than the sea.
- C. Land breeze happens during night time when the land is cooler than the sea.
- D. Land breeze happens during day time when the sea is cooler than the land.

Answer: C

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Exercise Match The Following

1. In this section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as

options (a), (b), (c) and (d) out of which one is correct.

List-I

- (P) Metals
- (Q) Measuring temperature
- (R) Non conducting bodies
- (S) Boiling point of water
- (T) Human body temperature

List-II

- 1. Thermometer
- 2. Insulator
- 3. $100^{\circ}C$
- 4. $37^{\circ}C$
- 5. Good conductors

A. $P - 5, Q - 1, R - 2, S - 3, T - 4$

B. $P - 5, Q - 5, R - 3, S - 4, T - 4$

C. $P - 3, Q - 5, R - 1, S - 2, T - 5$

D. $P - 4, Q - 4, R - 5, S - 1, T - 3$

Answer: D



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2. In this section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as

options (a), (b), (c) and (d) out of which one is correct.

List-I

- (P) Boiling point of water
- (Q) Clinical thermometer
- (R) Good conductor of heat
- (S) Lower fixed point on celsius scale
- (T) Increase in surface area on heating

List-II

- 1. $0^{\circ}C$
- 2. Mercury
- 3. Superficial expansion
- 4. $212^{\circ}F$
- 5. Temperature of human body

A. $P - 1, Q - 2, R - 3, S - 4, T - 5$

B. $P - 4, Q - 5, R - 1, S - 3, T - 3$

C. $P - 2, Q - 1, R - 5, S - 5, T - 5$

D. $P - 5, Q - 3, R - 2, S - 4, T - 4$

Answer: B



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Exercise Assertion Reason Type

1. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : When we touch ice, heat flows from our body to ice.

Reason : Heat flows from a body at high temperature to a body at low temperature.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: A



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2. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : The heat of the sun reaches the earth by the process of radiation.

Reason : In process of transfer of heat by radiation, a material medium is must.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: C



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3. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : To check the body temperature, a thermometer is usually placed in mouth or in armpit.

Reason : The normal body temperature of a healthy person is $37^{\circ}C$ or 98.6 F.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: B



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4. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : Dark coloured clothes are preferred in winters.

Reason : Dark coloured objects are good absorbers of heat energy.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: A

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5. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : The hot water or steam pipes used for carrying hot water are provided with loops at regular intervals.

Reason : The increase or decrease of length of the pipe is absorbed by the loops.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: A



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6. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : The most common scales used to measure the temperature are celsius scale and fahrenheit scale.

Reason : The interval between upper fixed point and lower fixed point of these scales is divided into 100 equal parts.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: C



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7. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : Double walls are used in construction of water storage tanks leaving an air gap.

Reason : Air gap acts as an insulating layer and does not allow heat to flow in.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: A



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8. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : All solids expand by same amount when heated through the same temperature increase.

Reason : Copper expands more than steel on heating.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: D



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9. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : The sun's heat is transferred to earth through convection.

Reason : The mode of heat transfer radiation does not require medium.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: D



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10. Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion : A vacuum flask keeps hot liquids hot and cold liquids cold.

Reason : A thermos flask is silvered to minimise the heat transfer by convection.

Mark the correct choice as:

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true.

Answer: C



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Exercise Integer Numerical Value Type

1. The heat needed to convert 10 g of ice in to water ($L_{\text{ice}} = 3.30 \times 10^5 \text{ Jkg}^{-1}$) is $x \times 10^3 \text{ J}$. Find the value of x .

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2. Convert 41 F in to equivalent in degree celsius.

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3. Convert -15°C in to equivalent in degree fahrenheit.

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4. All substance expand on heating, but water shows an exception. This occur in case if temperature is from zero to what degree celsius?

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5. Convert 279 K into corresponding in degree celsius.

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