## Heat

6.

7.

**Direction (Q No. 1 and 2):** Read the given experiment and answer the following questions.

Paper pins are stuck to a metal rod with wax and a lighted candle is kept below the rod as shown in the diagram below.



**1.** Which one of the paper pins will fall off the metal rod first?

(a) P	(b) Q
(c) R	(d) S

- What does this experiment illustrate?
   (a) Wax melts easily.
  - (b) The candle flame conducts heat.
  - (c) The thumbtacks expand when heated,

(d) Heat gets transferred from hot part of a body to cold part.

**3.** Which canned drink will remain cold the longest?



**4.** Four boxes made of different materials are left in the Sun for half an hour. Which one of the boxes will be the hottest after half an hour?



**5.** A pot full of water is put to boil on the stove. Which one of the graphs below shows the correct change in temperature over time?





NATIONAL Science Olympiad

A student took an iron rod and a wooden rod and wrapped each of them in a piece of paper. These were then heated as shown. It was found that the paper around the iron rod does not burn whereas the one around the wooden rod catches fire. It is because



(a) Candle, in case of iron rod, is nearer to the paper

(b) Wood being a bad conductor of heat, takes away all the heat

(c) Iron being a good conductor of heat, conducts away the heat given to the paper (d) Paper in first case, is thicker

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Rohan wants to test whether a white object or a black object would heat up faster in the Sun. The given picture shows you his experiment. These thermometers were left out in the Sun for 30 minutes.

Which of the following statements is true?



(a) Thermometer 1 reads the same as thermometer 3.

(b) Thermometer 2 shows a higher temperature than thermometer 3.

(c) Thermometer 3 shows a higher temperature than thermometer 1.

(d) Thermometer 1 reads the same as thermometer 2.

**8.** The bimetallic strip made up of aluminium and copper, when heated bends in the direction shown below. Which metal expands more when the two are heated at the same temperature?



(a) Aluminium expands more than copper.

(b) Copper expands more than aluminium.

(c) Both aluminium and copper expand by the same amount.

(d) Neither aluminium nor copper expands.

**9.** Read the given statements and select the correct option.

**Statement 1:** An iron ball at  $35^{\circ}C$  is dropped in a mug containing water at  $305.15 \ K$ . Then the heat will flow from the water to the iron ball. **Statement 2:** In convection, heated molecules of a liquid themselves move to carry heat from the hot region to the cold region.

(a) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

(b) Both statements 1 and 2 are true and statement 2 is not the correct explanation of statement 1.

(c) Statement 1 is true but statement 2 is false.(d) Statement 1 is false and statement 2 is true.

**10.** A thermo flask is a household item that is used to keep things warm or cold support for a long time. What is the use of silvered wall in thermo flask?



(a) To reduce the flow of heat by conduction.

- (b) To increase the temperature by convection.
- (c) To reflect the heat back to reduce radiation.

(d) To prevent the glass vessel from breaking.

**11.** Which of the following statement(s) is/are in correct?

(i) Two thin woollen sweaters are warmer than a thick woollen sweater.

(ii) It saves fuel if we cook food in a vessel which is blackened at the bottom and polished from the sides.

(iii) The cable wires between two poles are left loose because in summers, the wires do not break on expanding.

(a) Only (i) and (iii)(b) Only (ii) and (iii)(c) Only (iii)(d) Only (i)

**12.** A saucepan is usually made up of two different materials, P and Q. Identify P and Q.



(a) P-Steel, Q-Aluminium(b) P-Ebonite, Q-Plastic

- (c) P-Steel, Q-Ebonite
- (d) P-Wood, Q-Ebonite
- 13. Which of the following statements is incorrect?
  (a) Thermometer is read by holding its bulb.
  (b) A few sharp jerks are given to clinical thermometer before using it.
  (c) The black fabric tent is preferred during winter.
  (d) Shopkeepers selling ice blocks usually cover them with jute sacks.
- **14.** Two glass test tubes are heated in two different directions. In which test tube will all the water heat up first?



**15.** A hot liquid is carefully poured into a beaker.

The graph shows how its temperature changes as it cools towards room temperature. Which process (es) is/are taking place at region X?

- (a) Boiling and evaporation
- (b) Condensation only
- (c) Evaporation only
- (d) Solidification and evaporation

## Achievers Section (HOTS)

- **16.** Two steel balls P and Q have same readings when measured by thermometers of Celsius readings and Fahrenheit readings respectively. Then,
  - (a) Ball P has greater temperature than ball Q
  - (b) Ball  $\boldsymbol{P}$  has lower temperature than ball  $\boldsymbol{Q}$
  - (c) Both the balls  $\boldsymbol{P}$  and  $\boldsymbol{Q}$  have same temperature
  - (d) None of these
- **17.** Which of the following quantities increases when a liquid at room temperature becomes a gas at its boiling point?
  - (a) The average kinetic energy of the molecules
  - (b) The molecular size
  - (c) The total number of molecules
  - (d) All of these
- **18.** 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) Heating the key and lock both
  - (b) Cooling the key and heating the lock
  - (c) Heating the key and cooling the lock
  - (d) Cooling the key and lock both
- **19.** In an experiment shown in figure, the water near the top of the tube starts boiling but the wax in the test tube does not melt completely. What do you conclude?



- (a) Convection cannot occur in water.
- (b) Water is a poor conductor of heat.
- (c) Wax is a bad radiator of heat.

(d) Heat is not reaching at the bottom of the test tube as tube is made of insulator.

**20.** Observe the given figure carefully and choose the correct option for matching the column I with column II.



Column I	Column II						
(A) X	(i) The process of transfer of						
	heat in a liquid or a gas by the						
	movement of liquid or gas.						
(B) Y	(ii) The flow of heat through a						
	substance without the						
	movement of the substance						
	itself.						
(C) Z	(iii) The process by which heat						
	travels without the help of						
	material medium.						

(a) (A)-(iii), (B)-(i), (C)-(ii) (b) (A)-(ii), (B)-(iii), (C)-(i) (c) (A)-(i), (B)-(ii), (C)-(iii) (d) (A)-(ii), (B)-(i), (C)-(iii)

Answer key									
1.	A	2.	D	3.	A	4.	А	5.	А
6.	С	7.	В	8.	A	9.	D	10.	С
11.	С	12.	С	13.	A	14.	A	15.	D
16.	С	17.	A	18.	В	19.	В	20.	A

## **HINTS & EXPLANATIONS**

- 1. (a): The paper pin P falls off first as the heat travels along the length of the rod from the hot end to the cold end.
- **2.** (d) Not Available
- **3.** (a): Bubble pack is a poor conductor of heat than cotton wool and aluminium foil because the air trapped inside it acts as an insulating layer and does not allow heat to flow in.
- **4.** (a) Not Available
- 5. (a): Once the water starts boiling, the temperature does not change, it remains at 100°C during the time the water boils.
  So, graph (a) shows the correct variation of temperature with time.
- **6.** (c) Not Available
- **7.** (b): A black surface absorbs more heat than a bright surface.
- **8.** (a): The outer edge of the curve is longer as aluminium expands more than copper, if both are heated at the same temperature.
- 9. (d):  $35^{\circ}C$  is equivalent to (273.15+35)308.15 *K*. So iron ball is at higher temperature and heat will flow from iron ball to the water.
- **10.** (c) Not Available
- **11.** (c): The cable wires break on contracting in winters.
- **12.** (c): Steel takes up heat quickly. It is a good conductor of heat. Ebonite does not get hot quickly. It is an insulator.
- **13.** (a): If we hold a thermometer by its bulb, the mercury in the bulb will expand due to out body temperature,
- 14. (a): In water, heat is transferred by the movement of molecules from hotter to colder region through convection. In X, heat is given at the one end of the test tube so heat goes to the another end. But in Y, heat is given at the middle so all water will not heat up.

- **15.** (d): At region X, both solidification and evaporation are taking place.
- **16.** (c): As both the thermometers show the same reading of temperature i.e.,  $-40^{\circ}$ . Relation between  ${}^{\circ}C$  and  ${}^{\circ}F$  is given by C = F 32

$$\frac{0}{100} = \frac{1}{180}$$

- **17.** (a): When heat is supplied to a liquid at room temperature, the temperature of the liquid increases. The liquid changes its state to gas at its boiling point. Hence, the average kinetic energy of the molecules changes (increases).
- **18.** (b): We have to cool the key and heat the lock since cooling causes contraction of key and heating causes expansion of the keyway of the lock.
- **19.** (b) Not Available
- **20.** (a) Not Available