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**PHYSICS TOPIC: Heat and Thermodynamics**

1. If there are no heat losses, the heat released by the condensation of *x* *gm* of steam at 100°*C* into water at 100°*C* can be used to convert *y* *gm* of ice at 0°*C* into water at 100°*C*. Then the ratio *y* : *x* is nearly

(a) 1 : 1 (b) 2.5 : 1

(c) 2 : 1 (d) 3 : 1

1. The figure shows a glass tube (linear co-efficient of expansion is *α*) completely filled with a liquid of volume expansion co-efficient *γ*. On heating length of the liquid column does not change. Choose the correct relation between *γ* and *α*

*l*0

*A*0

(a) *γ* = *α*

(b) *γ* = 2*α*

(c) *γ* = 3*α*

(d) 

1. Water falls from a height 500*m*. What is the rise in temperature of water at bottom if whole energy remains in the water

(a) 0.96°*C* (b) 1.02°*C*

(c) 1.16°*C* (d) 0.23°*C*

1. A steel ball of mass 0.1 *kg* falls freely from a height of 10 *m* and bounces to a height of 5.4*m* from the ground. If the dissipated energy in this process is absorbed by the ball, the rise in its temperature is

(Specific heat of steel)

(a) 0.01°*C* (b) 0.1°*C*

(c) 1°*C* (d) 1.1°*C*

1. 1*gm* of ice at 0°*C* is mixed with 1*gm* of water at 100°*C* the resulting temperature will be

(a) 5°*C* (b) 0°*C*

(c) 10°*C* (d) ∞

1. *P-V* diagram of an ideal gas is as shown in figure. Work done by the gas in process *ABCD* is

(a) 

*P*

2*P*0

*P*0

2*V*0

3*V*0

*V*0

*B*

*A*

*C*

*D*

*V*

(b) 

(c) 

(d) 

1. An engineer claims to have made an engine delivering 10 *kW* power with fuel consumption of . The calorific value of fuel is 2*k cal*/*g*. His claim

(a) Is non-valid (b) Is valid

(c) Depends on engine (d) Depends on load

1. An ideal gas heat engine operates in a Carnot cycle between 27°*C* and 127°*C*. It absorbs 6 *kcal* at the higher temperature. The amount of heat (in *kcal*) converted into work is equal to

(a) 3.5 (b) 1.6

(c) 1.2 (d) 4.8

1. A gas expands with temperature according to the relation  What is the work done when the temperature changes by 

(a) 10 *R* (b) 20 *R* (c) 30 *R* (d)40 *R*

1. An ideal gas  is expanded adiabatically. How many times has the gas to be expanded to reduce the root mean square velocity of molecules 2.0 times

(a) 4 times (b) 16 times (c) 8 times (d)2 times

1. Three samples of the same gas *A, B* and  have initially equal volume. Now the volume of each sample is doubled. The process is adiabatic for *A* isobaric for *B* and isothermal for *C*. If the final pressures are equal for all three samples, the ratio of their initial pressures are

(a)  (b)  (c)  (d)

1. Volume versus temperature graph of two moles of helium gas is as shown in figure. The ratio of heat absorbed and the work done by the gas in process 1-2 is

(a) 3

*V*

*T*

1

2

(b) 

(c) 

(d) 

1. In the *P-V* diagram shown in figure *ABC* is a semicircle. The work done in the process *ABC* is

(a) Zero

3

1

2

*V*(*litre*)

*P*(*atm*)

1

(b) 

(c) 

(d) 4 *atm*-*lt*

1. Heat is supplied to a diatomic gas at constant pressure. The ratio of is

(a) 5 : 3 : 2 (b) 5 : 2 : 3

(c) 7 : 5 : 2 (d) 7 : 2 : 5

1. A gas undergoes a change of state during which 100 *J* of heat is supplied to it and it does 20 *J* of work. The system is brought back to its original state through a process during which 20 *J* of heat is released by the gas. The work done by the gas in the second process is

(a) 60 *J* (b) 40 *J*

(c) 80 *J* (d) 20 *J*

1. *N* moles of an ideal diatomic gas are in a cylinder at temperature *T*. suppose on supplying heat to the gas, its temperature remain constant but *n* moles get dissociated into atoms. Heat supplied to the gas is

(a) Zero (b) 

(c)  (d) 

1. Three moles of an ideal gas  at pressure  and temperature is isothermally expanded to twice its initial volume. It is then compressed at constant pressure to its original volume. Finally the gas is compressed at constant volume to its original pressure  The correct *P-V* and *P-T* diagrams indicating the process are

*PA*

*PA*/2

*A*

*C*

*B*

*VA*

2*VA*

*V*

*P*

*PA*

*PA*/2

*C*

*A*

*B*

*VA*

2*VA*

*V*

*P*

(a) (b)

*PA*

*PA*/2

*B*

*A*

*C*

*TA*/2

*TA*

*T*

*P*

*PA*

*PA*/2

*B*

*A*

*C*

*TA*/2

*TA*

*T*

*P*

(c) (d)

1. A cylinder of mass 1*kg* is given heat of 20000 *J* at atmospheric pressure. If initially temperature of cylinder is 20°*C*, then work done by the cylinder will be (Given that Specific heat of cylinder = 400 *J* *kg*–1, Coefficient of volume expansion = 9 × 10–5 °*C*–1, Atmospheric pressure = 105 *N/m*2 and density of cylinder 9000 *kg/m*3)

(a) 0.02 *J* (b) 0.05 *J*

(c) 0.08 *J* (d) 0.1 *J*

1. In a thermodynamic process pressure of a fixed mass of a gas is changed in such a manner that the gas releases 30 *joules* of heat and 10 joules of work was done on the gas. If the initial internal energy of the gas was 30 *joules*, then the final internal energy will be

(a) 2 *J* (b) – 18 *J* (c) 10 *J* (d)58 *J*

1. In an adiabatic change, the pressure *P* and temperature *T* of a monoatomic gas are related by the relation , where *c* equals

(a) 5 / 3 (b) 2 / 5 (c) 3 / 5 (d)5 / 2

1. Five identical rods are joined as shown in figure. Point *A* and *C* are maintained at temperature 120°*C* and 20°*C* respectively. The temperature of junction *B* will be

*A*

*B*

*C*

20°*C*

120°*C*

(a) 100°*C*

(b) 80°*C*

(c) 70°*C*

(d) 0°*C*

1. Can we boil water inside the earth satellite by convection

(a) Yes

(b) No

(c) Nothing can be said

(d) In complete information is given

1. In the following figure, two insulating sheets with thermal resistances *R* and 3*R* as shown in figure. The temperature *θ* is

*Q*

20°*C*

100°*C*

3*R*

*R*

*Q*

*θ*

(a) 20°*C*

(b) 60°*C*

(c) 75°*C*

(d) 80°*C*

1. The top of insulated cylindrical container is covered by a disc having emissivity 0.6 and thickness 1 *cm*. The temperature is maintained by circulating oil as shown in figure. If temperature of upper surface of disc is 127°*C* and temperature of surrounding is 27°*C*, then the radiation loss to the surroundings will be (Take 

Oil

Oil

(a) 595 *J*/*m*2 × *sec* (b) 595 *cal*/*m*2 × *sec*

(c) 991.0 *J*/*m*2 × *sec* (d) 440 *J*/*m*2 × *sec*

1. The following figure shows two air-filled bulbs connected by a U-tube partly filled with alcohol. What happens to the levels of alcohol in the limbs *X* and *Y* when an electric bulb placed midway between the bulbs is lighted

Bulb

Black

Painted

Alcohol

## X

*Y*

(a) The level of alcohol in limb *X* falls while that in limb *Y* rises

(b) The level of alcohol in limb *X* rises while that in limb *Y* falls

(c) The level of alcohol falls in both limbs

(d) There is no change in the levels of alcohol in the two limbs

1. Two conducting rods *A* and *B* of same length and cross-sectional area are connected (i) In series (ii) In parallel as shown. In both combination a temperature difference of 100°*C* is maintained. If thermal conductivity of *A* is 3*K* and that of *B* is *K* then the ratio of heat current flowing in parallel combination to that flowing in series combination is

3*K*

*K*

*A*

*B*

*l*

*l*

(i)

0o*C*

100o*C*

(ii)

3*K*

*K*

0o*C*

100o*C*

(a) **** (b)  (c)  (d)

1. The area of the glass of a window of a room is and thickness 2*mm*. The outer and inner temperature are  and  respectively. Thermal conductivity of glass in MKS system is 0.2. The heat flowing in the room per second will be

(a)  (b)  (c)30 *joules* (d) 45 *joules*

1. The spectrum from a black body radiation is a

(a) Line spectrum (b)Band spectrum

(c) Continuous spectrum (d) Line and band spectrum both

1. The Wien’s displacement law express relation between

(a) Frequency and temperature

(b) Temperature and amplitude

(c) Wavelength and radiating power of black body

(d) Wavelength corresponding to maximum energy and temperature

1. A black body is heated from  to . The ratio of their energies of radiations emitted will be

(a) 3: 4 (b) 9 : 16 (c) 27 : 64 (d)81: 256