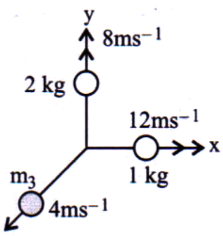
WEEKLY TEST MEDICAL PLUS -01 TEST - 14 RAJPUR SOLUTION Date 18-08-2019

[PHYSICS]

1.

The situation of the problem is as shown in the figure. According to law of conservation of linear momentum



$$\vec{p}_1 + \vec{p}_2 + \vec{p}_3 = 0$$

$$\therefore \quad \vec{p}_3 = -(\vec{p}_1 + \vec{p}_2)$$

Here,

$$\vec{p}_1 = (1\text{kg})\,(12\text{ ms}^{-1})\hat{i} = 12\,\hat{i}\text{ kg ms}^{-1}$$

$$\vec{p}_2 = (2\text{ kg})\,(8\text{ ms}^{-1})\,\hat{j} = 16\hat{j}\text{ kg ms}^{-1}$$

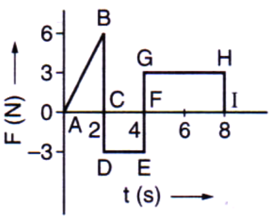
$$\therefore \quad \vec{p}_3 = -(12\,\hat{i} + 16\hat{j})\text{ kg ms}^{-1}$$

The magnitude of $\vec{p}_3$ is :

$$p_3 = \sqrt{(12)^2 + (16)^2} = 20\text{ kg ms}^{-1}$$

$$\therefore \quad m_3 = \frac{p_3}{v_3} = \frac{20\text{ kg ms}^{-1}}{4\text{ ms}^{-1}} = 5\text{kg}$$

2.



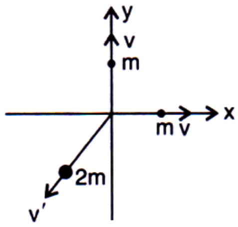
Change in momentum = Area under F-t graph in that interval

= Area of ΔABC – Area of rectangle $CDEF$ + Area of rectangle $FGHI$

$$= \frac{1}{2}\times 2\times 6 - 3\times 2 + 4\times 3 = 12\text{ N s}$$

3.

Let $\vec{v}'$ be velocity of third piece of mass $2m$. Initial momentum, $\vec{P}_i = 0$ (As the body is at rest). Final momentum,



$$\vec{P}_f = mv\hat{i} + mv\hat{j} + 2m\vec{v}'$$

According to law of conservation of momentum

$$\vec{p}_i = \vec{p}_f$$

$$0 = mv\hat{i} + mv\hat{j} + 2m\vec{v}'$$

$$\vec{v}' = -\frac{v}{2}\hat{i} - \frac{v}{2}\hat{j}$$

The magnitude of $\vec{v}'$ is

$$v' = \sqrt{\left(-\frac{v}{2}\right)^2 + \left(-\frac{v}{2}\right)^2} = \frac{v}{\sqrt{2}}$$

Total kinetic energy generated due to explosion

$$= \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + \frac{1}{2}(2m)v'^2$$

$$= \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + \frac{1}{2}(2m)\left(\frac{v}{\sqrt{2}}\right)^2 = mv^2 + \frac{mv^2}{2}$$

$$= \frac{3}{2}mv^2$$

4.

Given that,

$\vec{F} = (2t\hat{i} + 3t^2\hat{j})$ and $\vec{a} = 2t\hat{i} + 3t^2\hat{j}$

Hence, $v = \int_0^t a\,dt = t^2\hat{i} + t^3\hat{j}$

$\therefore \quad P = \vec{F}\cdot\vec{v} = 2t\cdot t^2 + 3t^2\cdot t^3 = 2t^3 + 3t^5$

5.

Power delivered in time T is,

$$P = F\cdot V = MaV$$

or $\quad P = MV\dfrac{dV}{dT}$

or $\quad PdT = MVdV$

or $\quad PT = \dfrac{MV^2}{2}$

or $\quad P = \dfrac{1}{2}\dfrac{MV^2}{T}$.

6.

Here, $m_1 = m, m_2 = 2m$

$u_1 = 2$ m/s, $u_2 = 0$

Coefficient of restitution, $e = 0.5$

Let v_1 and v_2 be their respective velocities after collision.

Applying the law of conservation of linear momentum, we get,

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$\therefore$ $$m \times 2 + 2m \times 0 = m \times v_1 + 2m \times v_2$$

or $$2m = mv_1 + 2mv_2$$

or $$2 = (v_1 + 2v_2) \quad \ldots(i)$$

By definition of coefficient of restitution,

$$e = \frac{v_2 - v_1}{u_1 - u_2}$$

or $$e(u_1 - u_2) = (v_2 - v_1)$$

$$0.5(2 - 0) = (v_2 - v_1)$$

$$1 = v_2 - v_1 \quad \ldots(ii)$$

Solving equations (i) and (ii), we get,

$$v_1 = 0 \text{ m/s}, v_2 = 1 \text{ m/s}$$

7.

According to conservation of momentum

$$m_1v_1 + m_2v_2 = (m_1 + m_2)v,$$

where v is common velocity of the two bodies.

$m_1 = 0.1$ kg, $m_2 = 0.4$ kg

$v_1 = 1$ m/s, $v_2 = -0.1$ m/s

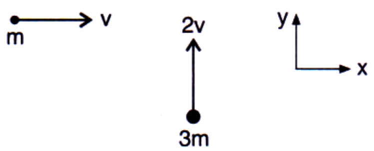
$\therefore$ $0.1 \times 1 + 0.4 \times (-0.1) = (0.1 + 0.4)v$

or $0.1 - 0.04 = 0.5v,$

$$v = \frac{0.06}{0.5} = 0.12 \text{ m/s.}$$

Hence, distance covered = 0.12 × 10 = 1.2 m

8.



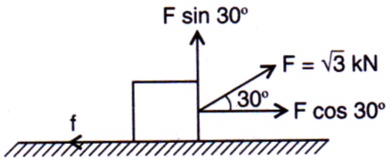
According to conservation of momentum, we get

$$mv\hat{i} + (3m)2v\hat{j} = (m + 3m)v'$$

where v' is the final velocity after collision

$$v' = \frac{1}{4}v\hat{i} + \frac{6}{4}v\hat{j} = \frac{1}{4}v\hat{i} + \frac{3}{2}v\hat{j}.$$

9.



The component of applied force F in the direction of motion is $F\cos 30^\circ$.
The work done by the applied force is,

$$W = (F\cos 30^\circ)S = \sqrt{3}\times 10^3 \times \frac{\sqrt{3}}{2}\times 10\,\text{J}$$

$$= 15\times 10^3\ \text{J} = 15\ \text{kJ}.$$

10.

Mass of water falling/second = 15 kg, $h = 60$ m

$g = 10\,\text{m/s}^2$, loss =10%, *i.e.*, 90% is used

Power generated $= 15\times 10\times 60\times 0.9 = 8100$ W $= 8.1$ kW

11.

$$mv = Mv' \quad \text{or} \quad v' = \left(\frac{m}{M}\right)v$$

Total KE of the bullet and the gun $= \frac{1}{2}mv^2 + \frac{1}{2}Mv'^2$

$$\text{Total KE} = \frac{1}{2}mv^2 + \frac{1}{2}M\cdot\frac{m^2}{M^2}v^2$$

$$\text{Total KE} = \frac{1}{2}mv^2\left[1+\frac{m}{M}\right]$$

or $$1.05\times 1000\ \text{J} = \left[\frac{1}{2}\times 0.2\right]\left[1+\frac{0.2}{4}\right]v^2$$

or $$v^2 = \frac{4\times 1.05\times 1000}{0.1\times 4.2} = (100)^2;$$

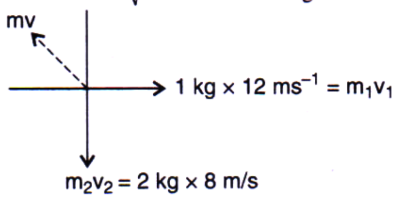
$\therefore$ $$v = 100\ \text{ms}^{-1}$$

12.

When an explosion breaks a rock, by the law of conservation of momentum, initial momentum which is zero, is equal to total momentum of three pieces.

Total momentum of the two pieces 1 kg and 2 kg

$$= \sqrt{12^2 + 16^2} = 20 \text{ kg m s}^{-1}$$



The third piece has the same momentum and in the direction opposite to the resultant of these two momenta.

$\therefore$ Momentum of the third piece $= 20 \text{ kg ms}^{-1}$;

Velocity $= 4 \text{ ms}^{-1}$

$\therefore$Mass of the 3rd piece $= \frac{mv}{v} = \frac{20}{4} = 5$ kg.

13.
14.
15.
16.
17.

Velocity of total mass $(u) = 0$ (because it is stationary). According to law of conservation of momentum

$$(m_1 + m_2)u = m_1 v_1 + m_2(-v_2)$$

or $$(m_1 + m_2) \times 0 = m_1 v_1 - m_2 v_2$$

or $$m_1 v_1 = m_2 v_2$$

or $$\frac{v_1}{v_2} = \frac{m_2}{m_1}$$

We also know that;

Kinetic energy, $(E) = \frac{1}{2} mv^2 \propto mv^2$

$\therefore$ $$\frac{E_1}{E_2} = \left(\frac{m_1}{m_2}\right) \times \left(\frac{v_1}{v_2}\right)^2$$

$$= \frac{m_1}{m_2} \times \left(\frac{m_2}{m_1}\right)^2 = \frac{m_2}{m_1}.$$

18.

When the mass attached to a spring fixed at the other end is allowed to fall suddenly, it extends the spring by x. Potential energy lost by the mass is gained by the spring,

$$Mgx = \frac{1}{2} kx^2$$

or $$x = \frac{2 Mg}{k}.$$

19.

Work done = area under $F - x$ curve

= area of trapezium

$= \frac{1}{2} \times (6 + 3) \times 3 = 13.5$ J.

20.
21.
22.

Given that $\frac{dW}{dt} = P = K$

or, $W = Pt = \frac{1}{2}mv^2$

or, $\sqrt{\frac{2Pt}{m}} = v$

Hence, $a = \frac{dv}{dt} = \sqrt{\frac{2P}{m}} \frac{1}{2\sqrt{t}}$

Hence, force $= ma = \sqrt{\frac{2Pm^2}{m}} \frac{1}{2\sqrt{t}}$

$= \left[\sqrt{\frac{mK}{2}}\right] t^{-1/2}$ $(\because P = K)$

23.

Because the collision is perfectly inelastic, hence the two blocks stick together. By conservation of linear momentum, $2mV = mv$ or $V = v/2$

By conservation of energy,

$$mgh = \frac{1}{2} mV^2 = \frac{1}{2} m \cdot \frac{v^2}{4} \quad \text{or} \quad h = \frac{v^2}{8g}.$$

24.

$u_1 = \sqrt{2gh_1}, \quad v_1 = \sqrt{2gh_2}$

$e = \frac{v_1 - v_2}{u_2 - u_1}$

Since, $u_2 = v_2 = 0$,

$\therefore \quad e = -\frac{v_1}{u_1} = \sqrt{\frac{h_2}{h_1}}.$

25.

Loss in potential energy $= mgh$

$= 2 \times 10 \times 10 = 200$ J

Gain in kinetic energy = Work done = 300 J

$\therefore$ Work done against friction $= 300 - 200 = 100$ J.

26.
27.

As the force is internal, $\vec{p}_{Th} + \vec{p}_{\alpha} = 0$

(as initially system was at rest)

$(\vec{p}_{Th})^2 = (-\vec{p}_{\alpha})^2$ or $p_{Th}^2 = p_{\alpha}^2$

or $K_{Th} m_{Th} = K_{\alpha} m_{\alpha}$ or $K_{Th} = \frac{4}{234} \times 4.1$

$= 0.07008$ MeV.

28.

Applying the law of conservation of momentum we get; $mv_0 + 0 = 2m \times v$ or $v = \frac{v_0}{2}$

$$KE = \frac{1}{2}(2m)v^2 = \frac{1}{2} \times 2m \times \left(\frac{v_0}{2}\right)^2 = \frac{mv_0^2}{4}$$

Let the system reach a height h.

Potential energy of the system = $2mgh$

Hence, $\frac{mv_0^2}{4} = 2mgh$ or $h = \frac{v_0^2}{8g}$.

29.

After collision if bullet gets embedded in the block and block rises to a height h, then initial velocity of bullet,

$$v = \frac{(M+m)}{m} \cdot \sqrt{2gh} \qquad \text{(Refer to question 104)}$$

$$\therefore \quad v = \sqrt{2 \times 980 \times 2.5}\left(\frac{5010}{10}\right) = 350.7 \text{ m/sec.}$$

30.

Power $\quad P = Fv = \frac{K}{v} \cdot v = K = \text{constant}$

$\therefore \quad W = Pt = Kt.$

31.

32.

As $\quad F_{ext.} = 0$

hence according to law of conservation of momentum,

$\vec{p}_s = \vec{p}_1 + \vec{p}_2 = \text{constant}$

However, initially both the blocks were at rest so,

$$\vec{p}_1 + \vec{p}_2 = 0, \quad i.e., \quad \vec{p}_2 = -\vec{p}_1$$

i.e., at any instant, the two blocks will have momentum equal in magnitude but opposite in direction (though they have different values of momentum in different positions).

33.

According to law of conservation of momentum

$$0 = m_1v_1 + m_2v_2 \qquad \ldots\text{(i)}$$

$$K_2 = \frac{1}{2}m_2v_2^2 = \frac{1}{2}\frac{m_2^2v_2^2}{m_2} = \frac{m_1^2v_1^2}{2m_2}$$

$$= \frac{(3)^2 \times (16)^2}{2 \times 6} = 192 \text{ J.}$$

34.

35.

$$\text{Stopping distance} = \frac{\frac{1}{2}mv^2}{\mu mg}$$

$$= \frac{\frac{1}{2m} \times m^2v^2}{\mu mg} = \frac{p^2}{2\mu m^2 g}.$$

36.

$dU = -dW$

dU = Change in potential energy

dW = Work done by conservative forces

Hence, work done by conservative forces on a system is equal to the negative of the change in potential energy.

37.

$\frac{3}{4}$th energy is lost, *i.e.*, $\frac{1}{4}$th kinetic energy is left.

Hence, its velocity becomes $\frac{v_0}{2}$ under a retardation of μg in time t_0.

$\therefore \quad \frac{v_0}{2} = v_0 - \mu g t_0$

$\therefore \quad \mu g t_0 = \frac{v_0}{2}$ or $\mu = \frac{v_0}{2gt_0}$.

38.

39.

$$P = Fv = M\frac{dv}{dt}v$$

Hence, $v\,dv = \frac{P}{M}dt$

On integration, we find

$$v \propto \sqrt{t}$$

40.

$$P = \frac{dW}{dt} = p\frac{dV}{dt}$$

Here, $P = hdg$

$= 10 \times 13.6 \times 980 = 1.3328 \times 10^5$ dyne/cm^2

and $\frac{dV}{dt}$ = pulse frequency × blood discharged per pulse

$\therefore \quad \frac{dV}{dt} = \frac{72}{60} \times 75 = 90$ cc/sec

$\therefore$ Power of heart $= 1.3328 \times 10^5 \times 90$ erg/sec

$= 1.19$ W

41.

$$P = Fv = m\frac{dv}{dt}v$$

or $v\frac{dv}{dt} = \frac{P}{m}$ or $v \cdot \frac{dv}{dx} \cdot \frac{dx}{dt} = \frac{P}{m}$

or $v^2\frac{dv}{dx} = \frac{P}{m}$ or $v^2\,dv = \frac{P}{m}dx$

On integration, we get;

$$\frac{v^3}{3} = \frac{Px}{m} \text{ or } v = \left(\frac{3xP}{m}\right)^{1/3}.$$

42.

Centripetal force $= \frac{mv^2}{r} = \frac{K}{r^2}$ (in magnitude)

$KE = \frac{1}{2}mv^2 = \frac{K}{2r}$ (since KE is always positive)

$PE = -\int_{\infty}^{r} F\,dr = -\int_{\infty}^{r} -\frac{K}{r^2}\,dr = -\frac{K}{r}$

$TE = PE + KE = -\frac{K}{r} + \frac{K}{2r} = -\frac{K}{2r}$.

43.

Work done against gravitational force $= mgh$

$= 1000 \times 9.8 \times 20 = 196 \times 10^3$ J

Work done to impart velocity to the body $= \frac{1}{2}mV^2$

$= \frac{1}{2} \times 10^3 \times 16 = 8 \times 10^3$ J

Work done against frictional force $= 500 \times 20 = 10 \times 10^3$ J

Total work done $= 214 \times 10^3$ J.

44.

Work done by man in one hour = power × time

$= 9.8 \times 1 \times 60 \times 60$ J

Work done by man in raising one brick

$= mgh = 2.5 \times 9.8 \times 3.6$ J

Number of bricks, $N = \frac{9.8 \times 1 \times 60 \times 60}{2.5 \times 9.8 \times 3.6} = 400$.

45.

$$\text{Power} = \left(\frac{mgh + \frac{1}{2}mV^2}{t}\right)$$

$$= \frac{1000 \times 10 \times 10 + \frac{1}{2} \times 1000 \times 10 \times 10}{60}$$

$= \frac{15{,}000}{6}$ watt

But 1 watt $= \frac{1}{746}$ HP

$\therefore$ Power $= \frac{15000}{6 \times 746} = 3.33$ HP

[CHEMISTR]

46. In an adiabatic change, no heat is exchanged between the system and the surroundings.

47. : State function

48. Based on the first law of thermodynamics,
$\Delta U = q + w$
Change in internal energy for a cyclic process is zero, *i.e.* $\Delta U = 0$.
$\therefore \quad q = -w$

49.

50. $\Delta E = q + W$, ΔE is a state function.

51. Since vessel is thermally insulated, i.e., the process is the process is adibatic hence, q = 0
Also, $P_{ext} = 0$, hence w = 0
From 1st law of thermodynamics, $\Delta E = q + w$
$\therefore \quad \Delta E = 0$ (for ideal gas)
$\therefore \quad \Delta T = 0$ or $T_2 = T_1$

[$\because$ Internal energy of an ideal gas is a function of temperature.]
Applying ideal gas equation, $PV = nRT$
where n, R and T are constant.
then $P_1V_1 = P_2V_2$
Equation, PV^{γ} = constant, is applicable only for ideal gas in reversible adiabatic process.
Hence, $P_2V_2^{\gamma} = P_1V_1^{\gamma}$ equation is not applicable.

52. As it absorbs heat, $q = +208$ J

$$w_{rev} = -2.303\,nRT\log_{10}\left(\frac{V_2}{V_1}\right)$$

$$w_{rev} = -2.303\times(0.04)\times 8.314\times 310\ \log_{10}\left(\frac{375}{50}\right)$$

$\therefore \quad w_{rev} = -207.76 \approx -208$ J

53. For isothermal reversible expansion of an ideal gas volume V_1 to V_2 the work done is given as :

54. $T_3 < T_1$ because cooling takes place on adibatic expansion. Hence, (b) is incorrect.

55. For adiabatic expansion, $\frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{\gamma-1}$

Here, for CO_2 (triatomic gas), $\gamma = 1.33$

$$\therefore \quad \left(\frac{150}{300}\right) = \left(\frac{10}{V_2}\right)^{0.33}$$

or $\left(\frac{1}{2}\right) = \left(\frac{10}{V_2}\right)^{0.33} \Rightarrow \left(\frac{1}{2}\right)^3 = \frac{10}{V_2} \Rightarrow \frac{1}{8} = \frac{10}{V_2} \Rightarrow V_2 = 80$ L

56 $$W = -2.303 nRT \log\frac{V_2}{V_1}$$

$= -2.303 \times 1 \times 8.314 \times 300 \times \log\frac{20}{10}$

$= -2.303 \times 8.314 \times 300 \times 0.3010 = -1729$ joules

Work done = – 1729 joules

57. Volume depends on the mass of the system.

58. Given : Standard heat of vaporisation,

$\Delta H_v^\circ = 40.79$ kJ mol^{-1}; Mass of water = 80 g

No. of moles of water $= \frac{80 \text{ g}}{18 \text{ g mol}^{-1}} = 4.44$ mol

Now, heat required to vaporise one mole of water = 40.79 kJ

∴ Heat required to vaporise 4.44 moles of water

$= 4.44 \times 40.79 = 1.81 \times 10^2$ kJ

59.

60. No work is done along the path AB because this process is isochoric (for isochoric process V = 0

∴ work done = PdV = 0).

Thus, the work done $dw = P_B(V_D - V_A)$

$= 8 \times 10^4 (5 \times 10^{-3} - 2 \times 10^{-3})$

$= 8 \times 10^4 \times 3 \times 10^{-3}$ J = 240 J

The energy absorbed by the system

$= (dq)_{AB} + (dq)_{BC} = 600 + 200 = 800$ J

The change in internal energy dE = dq – dw

dE = 800 – 240 = 560 J

61. $W = -\Delta 2.303\ \Delta nRT\ \log\frac{P_1}{P_2}$

$W = -2.303 \times 1 \times 0.082 \times 300 \text{lof} \frac{1}{10}$

W = –1381.9 cal

62. Latent heat $dQ = dE + P\Delta V$

or $dQ = dE + \Delta n_g RT$

Given, dQ = 10 kcal/mole

dE = ?

$\Delta n_g = 3$, T = 227 + 273 = 500K ,

$R = 2 \times 10^{-3}$ kcal/mole/K

∴ $dE = dQ - \Delta n_g RT$

⇒ $dE = 10 - 3 \times \frac{2}{1000} \times 500 = 7$ kcal

63. From first law of thermodynamics,

we have, dq = dE + PdV

or $dE = dq - PdV = 200 - 2 \times 10^5 \times 500 \times 10^{-6}$

dE = 200 – 100 = 100 J

64. As internal energy is a function of temperature, therefore $\Delta U = 0$

65.

66. For an adiabatic process neither heat enters or leaves the system

∴ q = 0 .

67.

ΔE and ΔH both are zero in case of cyclic process. [Also, for isothermal free or reversible expansion of ideal gas, ΔE and ΔH both are zero].

68.

69.

In case of thermodynamic equilibrium $\Delta V, \Delta P, \Delta T$ and Δn all have to be zero.

70.

71.

1 litre-atm = 24.2 calorie

1 calorie = 4.1868 joule

1 joule = 10^7 erg

72.

The minimum extra energy supplied to reactants to make their energy equal to threshold energy is called **activation energy.**

73.

$$W_{\text{expansion}} = -P\Delta V$$
$$= -(1\times 10^5 \text{Nm}^{-2})[(1\times 10^{-2} - 1\times 10^{-3})\text{m}^3]$$
$$= -10^5 \times (10\times 10^{-3} - 1\times 10^{-3})\text{Nm}$$
$$= -10^5 \times 9\times 10^{-3}\text{J} = -9\times 10^2\text{J} = \mathbf{-900\ J}$$

74.

$q = 300\,\text{calorie}$

$W = -P\,\Delta V = -1\times 10\,\text{litre-atm} = -10\times 24.2\,\text{cal} = -242\,\text{cal}$

$\Delta E = q + W = 300 - 242 = \mathbf{58\ cal}$

75.

$W_{\text{rev}} > W_{\text{irrev}}$; Thus, there will be more cooling in reversible process.

76.

For isothermal reversible expansion $W = -2.303\,nRT\log\frac{P_1}{P_2}$

For all factors being same, $W \propto \frac{1}{\text{Molecular weight}}$

NO and $\mathbf{C_2H_6}$ both have equal molecular weights 30 g mol^{-1}.

77.

$q = \mathbf{+200\ J}$

$W = -P\Delta V = -1\times(20-10) = -10\,\text{atm L}$

$= -10\times 101.3\,\text{J} = \mathbf{-1013\ J}$

$\Delta E = q + W = (200-1013)\,\text{J} = \mathbf{-813\ J}$

78.

79.

ΔH for isothermal free expansion is **zero.**

80.

$$W = -2.303 nRT \log \frac{V_2}{V_1}$$
$$= -2.303 \times 2 \times 8.314 \times 300 \times \log \frac{50}{5} \text{ joule}$$
$$= -11488.285 \text{ J} \simeq \mathbf{-11.5\ kJ}$$

81.

$$q = +40.65 \text{ kJ mol}^{-1}$$
$$W_{exp.} = -3.1 \text{ kJ}$$
$$\Delta E = q + W$$
$$= 40.65 - 3.1 = \mathbf{37.55\ kJ}$$

82.

In cyclic system, $\Delta E = 0,\ \Delta H = 0.$

Work done by the system = – 550 kJ.

$$\Delta E = q + W$$
$$\Rightarrow \quad 0 = q - 550 \quad \Rightarrow \quad q = \mathbf{550\ kJ}$$

83.

As the system starts from A and reaches to A again, whatever the stages may be net energy change is **zero**.

84.

$$\frac{V_2}{V_1} = \frac{1}{10}$$
$$W \text{ (on the system)} = -2.303 nRT \log \frac{V_2}{V_1} = -2.303 \times 1 \times 2 \times 500 \log \frac{1}{10} \text{ cal}$$
$$= +\frac{2.303 \times 2 \times 500}{1000} \text{ kcal} = \mathbf{+2.303\ kcal}$$

85

86

87. (c) During isothermal expansion of an ideal gas against vacuum is zero because expansion is isothermal. The reason, that volume occupied by the molecules of an ideal gas is zero, is false.

88. (a) it is fact that absolute values of internal energy of substances can not be determined. It is also true that to determine exact values of constituent energies of the substance is impossible.

89. (b) Mass and volume are extensive properties. mass/volume is also an extensive parameter. Here, both assertion and reason are true.