



1. (b)

**Sol.** By comparing the given equation with standard equation  $y = a \sin(\omega t + \phi)$

$$\omega = 100\pi \quad \text{so } T = \frac{2\pi}{\omega} = \frac{2\pi}{100\pi} = 0.02 \text{ sec}$$

2. (c)

**Sol.**  $x = a \sin(\omega t - \alpha)$

and  $y = b \cos(\omega t - \alpha) = b \sin(\omega t - \alpha + \pi/2)$

Now the phase difference =  $(\omega t - \alpha + \frac{\pi}{2}) - (\omega t - \alpha)$   
 $= \pi/2 = 90^\circ$

3. (c)

**Sol.**  $v = \omega \sqrt{a^2 - y^2} = 2\sqrt{(60)^2 - (20)^2} = 113$   
 mm/sec

4. (a)

**Sol.** By comparing with standard equation  $y = a \sin(\omega t + \phi)$  we get  $a = 0.30$ ;  $\omega = 220$

$$\therefore 2\pi n = 220 \Rightarrow n = 35 \text{ Hz}$$

$$\text{so } v_{\max} = a\omega = 0.3 \times 220 = 66 \text{ m/s}$$

5. (c)

**Sol.**  $v = \omega \sqrt{a^2 - y^2} \Rightarrow \frac{a\omega}{2} = \omega \sqrt{a^2 - y^2} \Rightarrow$

$$\frac{a^2}{4} = a^2 - y^2$$

$$\Rightarrow y = \frac{\sqrt{3}A}{2} \quad [\text{As } v = \frac{v_{\max}}{2} = \frac{a\omega}{2}]$$

6. (c)

**Sol.**  $v_{\max} = a\omega = a \frac{2\pi}{T} = 2 \frac{2\pi}{2} \Rightarrow v_{\max} = 2\pi$

7. (a)

**Sol.**  $\frac{\Delta T}{T} = \frac{1}{2} \alpha \Delta \theta = \frac{1}{2} \times 12 \times 10^{-6} \times (40 - 20);$

$$\Delta T = 12 \times 10^{-5} \times 86400 \text{ sec/day} = 10.3 \text{ sec/day.}$$

8. (b)

**Sol.**  $T = 2\pi \sqrt{l/g}$  hence  $T \propto \sqrt{l}$

Percentage increment in  $T = \frac{1}{2}$  (percentage increment in  $l$ )  
 $= 0.5\%$ .

9. (a)

**Sol.** Because the S.H.M. starts from extreme position so

$y = a \cos \omega t$  form of S.H.M. should be used.

$$\frac{A}{2} = A \cos \frac{2\pi}{T} t \Rightarrow \cos \frac{\pi}{3} = \cos \frac{2\pi}{T} t \Rightarrow t = T/6$$

10. (c)

**Sol.**  $v_{\max} = a\omega = 100 \text{ cm/sec}$  and  $a = 10 \text{ cm}$  so  
 $\omega = 10 \text{ rad/sec.}$

$$\therefore v = \omega \sqrt{a^2 - y^2} \Rightarrow 50 = 10 \sqrt{10^2 - y^2} \Rightarrow$$

$$y = 5\sqrt{3}$$

11. (b)

**Sol.**  $\frac{x}{a} = \sin \omega t \dots\dots(1)$

$\frac{y}{b} = \cos \omega t \dots\dots(2)$

square & add (1) and (2)

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ which shows ellipse.}$$

12. (c)

**Sol.**  $ke \frac{1}{2} m\omega^2 (x_0^2 - x^2)$

$$= \frac{1}{2} m\omega^2 (x_0^2 - x_0^2 \sin^2 \omega)$$

$$= \frac{1}{2} m\omega^2 x_0^2 \left( \frac{1 + \cos^2 \omega}{2} \right)$$

Note the frequency is  $2\omega$  or  $2f$

13. (d)

**Sol.**  $x = x_0 \sin(\omega t + \phi) = x_0 \sin \omega t + \cos \phi + x_0 \cos$   
 $\omega t \sin \phi = 3 \cos \omega t + 4 \sin \omega t$

Comparing we get  $x_0 \cos \phi = 4 \dots\dots(1)$

and  $x_0 \sin \phi = 3 \dots\dots(2)$

dividing (2) by (1)

$$\tan \phi = 3/4 \text{ or } \phi = 37^\circ.$$

Squaring and adding (1) and (2) we get

$$x_0 = 5.$$

14. (c)

**Sol.** The motion will be SHM only if acceleration

$$\left( \text{or } \frac{d^2 y}{dt^2} \propto -y \right)$$

This is true for (C)

15. (a)

**Sol.**  $F = -\frac{dU}{dx}$  For  $U(x) = \frac{k}{2} (x-a)^2$   $\frac{dU}{dx} = k(x-a)$

$$\Rightarrow F = -k(x-a)$$

This is the condition for SHM about point  $x = a$

Other functions do not satisfy this condition.

Hence Answer is (A)



16. (c)

**Sol.** Time to complete  $\frac{1}{4}$ th of the oscillations of

$$\frac{T}{4} \text{ s.}$$

Time to complete  $\frac{1}{8}$ th vibration means when the vibrating particle reaches from the extreme position to the half the amplitude

$$\Rightarrow y = \frac{A}{2} = A \sin\left(\omega t + \frac{\pi}{2}\right) = A \cos \omega t \Rightarrow t =$$

$$\frac{T}{6} \text{ s}$$

$$\therefore \text{Total time required } \frac{T}{4} + \frac{T}{6} = \frac{5T}{12}$$

17. (c)

**Sol.**  $y = a (\sin \omega t + \cos \omega t)$

$$= A \sqrt{2} \left\{ \frac{1}{\sqrt{2}} \sin \omega t + \frac{1}{\sqrt{2}} \cos \omega t \right\}$$

$$= a \sqrt{2} \sin\left(\omega t + \frac{\pi}{4}\right)$$

$\therefore$  The motion is S.H.M. in nature and has an amplitude  $a\sqrt{2}$ .

18. (c)

$$\text{Sol. K.E.} = \frac{1}{2} m \omega^2 (A^2 - y^2)$$

$$\text{P.E.} = \frac{1}{2} m \omega^2 y^2$$

$$\therefore \text{K.E.} = \text{P.E.}$$

$$\therefore \frac{m \omega^2}{2} (A^2 - y^2) = \frac{m \omega^2 y^2}{2}$$

$$\therefore 2y^2 = A^2 \text{ or } y = A/\sqrt{2}$$

19. (c)

$$\text{Sol. K.E.} = \frac{m \omega^2}{2} (A^2 - y^2)$$

$$= \frac{m \omega^2}{2} [A^2 - (A \sin(\omega t + \phi))^2]$$

$$= \frac{m \omega^2}{2} [A^2 - A^2 \sin^2(\omega t + \phi)]$$

$$= \frac{m \omega^2 A^2}{2} [\cos^2(\omega t + \phi)]$$

$$= \frac{m \omega^2 A^2}{4} [1 + \cos(2\omega t + 2\phi)]$$

$$\therefore \text{Frequency} = \frac{2\omega}{2\pi} = 2n$$

20. (d)

**Sol.** For small amplitude the time period is independent of the amplitude therefore there will be no change in its time period.

21. (c)

$$\text{Sol. } y_2 = 5 [\sin(3\pi t) + \sqrt{3} \cos(3\pi t)]$$

$$= 5 \times 2 \left[ \frac{1}{2} \sin(3\pi t) + \frac{\sqrt{3}}{2} \cos(3\pi t) \right]$$

$$= 10 \left[ \sin\left(3\pi t + \frac{\pi}{3}\right) \right]$$

$$A_2 = 10 \text{ and } A_1 = 10$$

$$A_1/A_2 = 1 \Rightarrow A_1 : A_2 = 1 : 1$$

22. (a)

**Sol.** Since the satellite is orbiting under the action of earth's gravitational force, inside a satellite an object experiences weightlessness.

$\Rightarrow$  Effective acceleration due to gravity is zero.

$\Rightarrow$  The period of simple pendulum =  $T = 2\pi$

$$\sqrt{\frac{\ell}{g}}$$

$$\text{when } g = 0 \Rightarrow T = \infty.$$

23. (a)

$$\text{Sol. } T = 2\pi \sqrt{\frac{\ell}{g}} = 2 \text{ sec.}$$

$$\text{Now, } L = 4\ell$$

$$\therefore T' = 2\pi \sqrt{\frac{4\ell}{g}} = 4 \text{ sec.}$$

24. (b)

$$\text{Sol. } y = 10 \sin(6t + \pi/3)$$

$$\text{At } t = 0,$$

$$y = 10 \sin \frac{\pi}{3} = \frac{10\sqrt{3}}{2} \text{ m.} = 5\sqrt{3} \text{ m}$$

$$v = \frac{dy}{dt} = 10 \times 6 \cos(6t + \frac{\pi}{3}) = 60 \cos(6t + \frac{\pi}{3})$$

$$\text{At } t = 0$$

$$v = 60 \cos \frac{\pi}{3} = \frac{60}{2} = 30 \text{ m/s}$$



25. (a)

**Sol.**  $0.5g = kx$

or,  $k = \frac{0.5 \times 10}{0.2} = 25 \text{ N/m}$

$T = 2\pi \sqrt{\frac{m}{k}} = 2\pi \sqrt{\frac{0.25}{25}} = \frac{\pi}{5} \text{ sec.}$

26. (b)

**Sol.**  $K_{av} = \frac{1}{T} \int_0^T \frac{1}{2} m \omega^2 A^2 \cos^2(\omega t + \phi) dt$

27. (d)

**Sol.** At the end of one complete vibration, the particle returns to the initial position.

28. (b)

**Sol.** Comparing with  $y = 2\pi \sqrt{\frac{\ell}{g}}$  ;

$$T' = 2\pi \sqrt{\frac{1}{g^2 + a^2}}$$

clearly,  $T' < T$

29. (b)

**Sol.** The time period is independent with its amplitude so again  $T = 5 \text{ sec}$

30. (d)

**Sol.**  $v = \omega \sqrt{a^2 - x^2} = \frac{2\pi}{T} \sqrt{a^2 - x^2} = \frac{2 \times 3}{3} \sqrt{25 - 16}$

$= 6 \text{ cm/s}$

31. (a)

**Sol.** Comparing with acceleration  $+\omega^2 x = 0$

$\omega^2 = 4\pi^2$  or  $\omega = 2\pi$

or  $2\pi v = 2\pi$  or  $v = 1 \text{ Hz}$

32. (a)

**Sol.** When the spring is fully compressed or fully extended is when the Hook's law forces are the greatest, and this indicates that the acceleration is the greatest.  $F = ma$ .

33. (a)

**Sol.** Time period does not depend on mass

$T \propto \sqrt{\ell} \dots (i), T' \propto \sqrt{9\ell} \dots (ii)$  or  $T' = 3 T$ .

34. (a)

**Sol.** Here,  $y_1 = 10 \sin \frac{\pi}{4} (12t + 1)$

Or  $y_1 = 10 \sin(3\pi t + \frac{\pi}{4}) \dots (i)$

And  $y_2 = 5(\sin 3\pi t + \sqrt{3} \cos 3\pi t)$

Or  $= 10(\sin 3\pi t \times \frac{1}{2} + \cos 3\pi t \times \frac{\sqrt{3}}{2})$

$\Rightarrow y_2 = 10 \sin(3\pi t + \frac{\pi}{3})$

Comparing equation (i) and (ii) with standard equation for SHM we get

$A_1 = 10$  and  $A_2 = 10 \therefore \frac{A_1}{A_2} = \frac{10}{10} = \frac{1}{1}$

35. (d)

**Sol.** The distance travelled by the particle in one time period is  $4A$ .

36. (d)

**Sol.** The phase of a particle executing SHM is defined as the state of a particle as regards to its position and direction of motion at any instant of time in the given curve phase is same when  $t = 1 \text{ s}$  and  $t = 5 \text{ s}$ . also phase is same when  $t = 2 \text{ s}$  and  $t = 6 \text{ s}$ .

37. (d)

**Sol.** In SHM, the acceleration of the particle is directed towards the mean position.

38. (a)

**Sol.** In SHM, Acceleration,

$$a = \frac{d^2x}{dt^2} = -\omega^2 x$$

39. (d)

**Sol.** The circular motion of a particle with constant speed is periodic but not simple harmonic motion as it not to and fro about a fixed point.

40. (d)

**Sol.** In SHM, acceleration  $a$  is related to displacement  $x$  by the relation  $a = -\omega^2 x$  which is for option (d).

41. (a)

**Sol.** In SHM, acceleration,  $a = -\omega^2 x$

$\therefore$  The graph between  $a$  and  $x$  is straight line.



42. (c)

**Sol.** The given equation of SHM is

$$x = 3 \sin\left(2\pi t + \frac{\pi}{4}\right)$$

Compare the given equation with standard equation of SHM

$$x = A \sin(\omega t + \phi)$$

We get

$$A = 3 \text{ m}, \omega = 2\pi \text{ s}^{-1}$$

$$\therefore \text{Maximum speed } v_{\max} = A\omega = 3\text{m} \times 2\pi \text{ s}^{-1}$$

$$= 6\pi \text{ m s}^{-1}$$

43. (b)

**Sol.** In SHM, the total energy is

$$E = \frac{1}{2} m\omega^2 A^2$$

Where the symbols have their usual meanings

$$E \propto A^2$$

44. (c)

**Sol.** Given

$$x = a \cos \omega t \quad \dots\dots (i)$$

$$y = a \sin \omega t \quad \dots\dots (ii)$$

Squaring and adding (i) and (ii) we get

$$x^2 + y^2 = a^2 \cos^2 \omega t + a^2 \sin^2 \omega t = a^2$$

It is equation of circle thus trajectory of motion will be circle

45. (d)

**Sol.** Given :  $x = a \sin \omega t + b \cos \omega t \dots (i)$

$$\text{Let } a = A \cos \phi \quad \dots (ii)$$

$$\text{And } b = A \sin \phi \quad \dots\dots (iii)$$

Squaring and adding (ii) and (iii) we get

$$a^2 + b^2 = A^2 \cos^2 \phi + A^2 \sin^2 \phi = A^2$$

Eq. (i) can be written as

$$x = A \cos \phi \sin \omega t + A \sin \phi \cos \omega t = A \sin(\omega t + \phi)$$

it is equation of SHM with amplitude

$$A = \sqrt{a^2 + b^2}$$



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## BPT # 04 (NEET) SOLUTIONS

46. (c)

**Sol.**  $\Delta E_v = E_p - E_R$ .

47. (d)

**Sol.** Heat is always flow from the higher to lower temperature.

48. (b)

**Sol.** Solid  $\longrightarrow$  Gas,  $\Delta S$  is maximum.

49. (d)

**Sol.** +ve  $\Delta H$  and -ve  $\Delta S$  both oppose the reaction.

50. (c)

**Sol.** Because solid  $\rightarrow$  solid,  $\Delta S$  is same and  $\Delta H$  is -ve.

51. (a)

**Sol.** For exothermic reactions  $H_p < H_R$ .

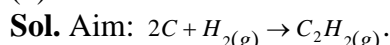
For endothermic reactions  $H_p > H_R$ .

52. (b)

**Sol.** 78g of benzene on combustion produces heat = - 3264.6 kJ

$$\therefore 39g \text{ will produce } = \frac{-3264.6}{2} = -1632.3 \text{ kJ}.$$

53. (d)



eq. (ii) + eq. (iii)  $\rightarrow$  eq. (iv) - eq. (i)

find the required result.

54. (c)

**Sol.** Enthalpy of formation of HCl.

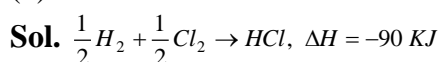
55. (a)

**Sol.**  $CH_4$  is the best fuel because its calorific

value =  $\frac{-212.8}{16} = -13.3 \text{ kcal/g}$  is higher among the

other gases.

56. (d)



$$\therefore \Delta H = \frac{1}{2}E_{H-H} + \frac{1}{2}E_{Cl-Cl}$$

$$\text{or } -90 = \frac{1}{2} \times 430 + \frac{1}{2} \times 240 - E_{HCl}$$

$$\therefore E_{H-Cl} = 425 \text{ kJ mol}^{-1}.$$

57. (b)

**Sol.** For spontaneous change  $\Delta G = -ve$ .

58. (a)

**Sol.**  $\Delta G = 0$  for equilibrium.

59. (b)

**Sol.**  $\Delta G = -2.303 RT \log K'$ , Here  $R = 2 \text{ cal}$ ,  $T = 300 \text{ K}$

$$K' = \frac{10 \times 15}{3 \times 5} = 10; \Delta G = -2.303 \times 2 \times 300 \times \log_{10} 10$$

$$= -2.303 \times 2 \times 300 \times 1 = -1381.8 \text{ cal}$$

60. (c)

**Sol.** An isolated system neither shows exchange of heat nor matter with surroundings.

61. (a)

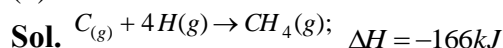
**Sol.**  $w = -2.303 nRT \log \frac{P_1}{P_2}$

$$= 2.303 \times 1 \times 2 \times 300 \log \frac{2}{10} = 965.84$$

At constant temperature  $\Delta E = 0$

$$\Delta E = q + w; q = -w = -965.84 \text{ cal}$$

62. (b)

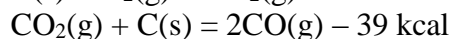
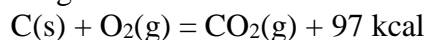


Bond energy for C - H

$$= -\frac{166}{4} = -41.5 \text{ kJ/mole}$$

63. (a)

**Sol.** Subtracting equation (ii) from equation (i), we get



or,  $-CO_2(g) + O_2(g) = CO_2(g) - 2CO(g) + 136 \text{ kcal}$

or,  $2CO(g) + O_2 = 2CO_2(g) + 136 \text{ kcal}$

or,  $CO(g) + 1/2 O_2(g) = CO_2(g) + 68 \text{ kcal}$

Required value = 68 kcal

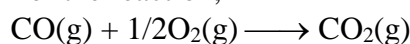
64. (b)

**Sol.** As we know,

$$\Delta H = \Delta E + \Delta nRT$$

Where  $\Delta n$  = Gaseous product moles - gaseous reactant moles

For the reaction,



$$\Delta n = 1 - (1 + 1/2) = -1/2$$

$$\therefore \Delta H = \Delta E - 1/2 RT$$

$$\therefore \Delta H < \Delta E$$



65. (d)  
**Sol.**  $O_3$  (g) is the allotropic form of oxygen and energy of  $O_3$  (g) is higher.
66. (a)  
**Sol.**  $\Delta H$  represents heat of reaction.
67. (c)  
**Sol.** Entropy is extensive property & others are intensive properties.
68. (a)  
**Sol.** We know that  $\Delta E = Q + W = 600 + (-300) = 300$  J  
 $W = -300$ , because the work done by the system.
69. (c)  
**Sol.** Some solids dissolves exothermically as LiCl ( $\Delta H = -ve$ ) and other dissolved endothermically as KCl ( $\Delta H = +ve$ ). solvent-solvent interaction and solute-solute interaction are endothermic while solvent-solute interaction is exothermic. The sum of the three interaction determines whether  $\Delta H_{sol}$  is endothermic or exothermic.
70. (c)  
**Sol.** Volume is not an intensive property.
71. (a)  
**Sol.** First law of thermodynamics is represented mathematically as  $\Delta E = q + W$ , where  $\Delta E$  is change in internal energy,  $q$  is heat absorbed and  $W$  is work does.
72. (b)  
**Sol.** Since the system is insulated, heat is not allowed to enter or leave the system.  
Thus,  $q = 0, \Delta E = q + W \Rightarrow \Delta E = W$
73. (a)  
**Sol.**  $\Delta H = \Delta E + \Delta n_g RT$   
$$\Delta n_g = 1 - \frac{3}{2} = -\frac{1}{2} \text{ or } -0.5$$
  
Hence  $\Delta H = \Delta E - 0.5RT$
74. (d)  
**Sol.** This is the statement of Hess's law of heat summation.
75. (d)  
**Sol.** Heat cannot flow a cold body to a hot body.
76. (b)  
**Sol.**  $\Delta S_{system} = \Delta S_{total} - \Delta S_{surrounding}$
77. (b)  
**Sol.** Reactants have less energy then products
78. (c)  
**Sol.** Thermodynamics is not concerned about how and at what rate chemical reactions are carried out, but is based on initial and final states of a system undergoing the change.
79. (d)  
**Sol.** The pressure (P), volume (V), temperature (T), amount (n) etc. are the state variables or state functions.
80. (d)  
**Sol.** There is no change in volume from  $A \rightarrow B$ .
81. (c)  
**Sol.**  $X \xrightarrow{\Delta H_1} Y$   
 $X \xrightarrow{\Delta H_1} P \xrightarrow{\Delta H_2} Q \xrightarrow{\Delta H_3} Y$   
$$\Delta H = \Delta H_1 + \Delta H_2 + \Delta H_3$$
82. (d)  
**Sol.**  $S + 3/2O_2 \rightarrow SO_3 + 2x \text{ kcal} \quad \dots(i)$   
 $SO_2 + 1/2O_2 \rightarrow SO_3 + y \text{ kcal} \quad \dots(ii)$   
Now, subtract eq. (ii) from (i), we get,  
 $S + O_2 \rightarrow SO_2 + 2x - y \text{ kcal}$   
 $\therefore$  Heat of formation of  $SO_2$  in equal to  $2x - y$  kcal.
83. (b)  
**Sol.** For an exothermic reaction,  $\Delta H_R > \Delta H_P$
84. (a)  
**Sol.** Average of two bond dissociation energies:  
$$\frac{497.8 + 428.5}{2} = 463.15 \text{ kJ mol}^{-1}$$



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## BPT # 04 (NEET) SOLUTIONS

85. (d)

**Sol.** Enthalpy of decomposition of HCl will be

$$\frac{44}{2} = 22 \text{ kcal/mol}$$

86. (c)

**Sol.**  $\Delta H^{\circ}_{\text{soln}} = \Delta H^{\circ}_{\text{lattice}} + \Delta H^{\circ}_{\text{hyd}}$

87. (a)

**Sol.**  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

$$\begin{aligned}\Delta H &= \Delta H(\text{N} \equiv \text{N}) + 3 \times \Delta H(\text{H}-\text{H}) - 2 \times 3 \Delta H(\text{N}-\text{H}) \\ &= 945.36 + 3 \times 435.0 - 6 \times 389.0 = -83.64 \text{ kJ}\end{aligned}$$

$$\text{Heat of formation of } \text{NH}_3 = \frac{-83.64}{2} = -41.82$$

kJ/mol

88. (a)

**Sol.**  $\Delta G = \Delta H - T\Delta S$ ,

At equilibrium,  $\Delta G = 0, \Delta H = T\Delta S$

$$30000 = T \times 100$$

$$T = 300 \text{ K or } 27 \text{ }^\circ\text{C}$$

89. (c)

**Sol.**  $\text{X} + 3\text{Y} \rightleftharpoons 2\text{Z}$

$$\Delta S = 2 \times 50 - (60 + 3 \times 40) = -80 \text{ kJ}$$

$$\Delta G = \Delta H - T\Delta S \text{ when } \Delta G = 0$$

$$T = \frac{\Delta H}{\Delta S} = -40 \times \frac{1000}{-80} = 500 \text{ K}$$

90. (c)

**Sol.** In eqn (i), no bond is being broken while in eqn (ii), 2H-H bonds are broken. So, in eqn (ii) some of the energy is used up to break up to break the bonds. Thus,  $x > y$ .



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## BPT # 04 (NEET) SOLUTIONS

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### Biology Answer key:

Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.
91	C	109	C	127	B	145	B	163	D
92	B	110	B	128	A	146	B	164	B
93	B	111	C	129	B	147	D	165	B
94	C	112	D	130	B	148	A	166	A
95	A	113	A	131	B	149	A	167	C
96	A	114	C	132	D	150	B	168	B
97	B	115	B	133	A	151	B	169	D
98	B	116	D	134	C	152	D	170	C
99	B	117	D	135	A	153	C	171	B
100	C	118	D	136	B	154	B	172	C
101	A	119	A	137	B	155	B	173	D
102	B	120	C	138	B	156	C	174	B
103	C	121	A	139	C	157	D	175	D
104	C	122	C	140	A	158	A	176	D
105	B	123	B	141	D	159	A	177	A
106	A	124	B	142	C	160	D	178	D
107	B	125	C	143	D	161	D	179	C
108	A	126	A	144	A	162	B	180	C