SOLUTIONS

PROGRESS TEST-3A

MRBA/MRB-1801,1802,1803 (G & B)

MRBK-1801,1802

NEET PATTERN

Test Date: 05-11-2017

Mentors Eduserv: Plot No.-136/137, Parus Lok Complex, Boring Road Crossing,
Patna-1, Ph. No. : 0612-3223680 / 81, 7781005550 / 51

PHYSICS

1. **(1)**

Area of a parallelogram = |a × b|

where, a and b are sides of parallelogram

Given, $a = p = 5\hat{i} - 4\hat{j} + 3\hat{k}$ and $b = q = 3\hat{i} + 2\hat{j} - \hat{k}$

$$a \times b = \begin{vmatrix} i & j & k \\ 5 & -4 & 3 \\ 3 & 2 & -1 \end{vmatrix}$$

$a \times b = \hat{i}(4-6) - \hat{j}(-5-9) + \hat{k}(10+12)$ $a \times b = 2\hat{i} + 14\hat{j} + 22\hat{k}$

Thus, area, $|a \times b| = \sqrt{(2)^2 + (14)^2 + (22)^1} = \sqrt{684}$

sq units

2. **(2)**

For two particles to collide, the direction of the relative velocity of one with respect to other should be directed towards the relative position of the other particle

i.e., $\frac{\vec{r}_1 - \vec{r}_2}{|\vec{r}_1 - \vec{r}_2|} \to$ direction of relative position of 1 w.r.t. 2.

and $\frac{\vec{v}_2 - \vec{v}_1}{|\vec{v}_2 - \vec{v}_1|} \to$ direction of velocity of 2 w.r.t. 1.

so for collision of A and B

$$\frac{\vec{r}_1 - \vec{r}_2}{|\vec{r}_1 - \vec{r}_2|} = \frac{\vec{v}_2 - \vec{v}_1}{|\vec{v}_2 - \vec{v}_1|}$$

3. **(1)**

For both cases $t = \sqrt{\frac{2h}{g}} = \text{constant.}$

Because vertical component of velocity will be zero for both the particles.

4. **(2)**

$$R = \frac{u^2 \sin 2\theta}{g} = \frac{2u^2 \sin\theta \cos\theta}{g} \Rightarrow H = \frac{u^2 \sin 2\theta}{2g}$$

$$\frac{H}{R} = \frac{u^2 \sin 2\theta}{2g} \times \frac{g}{2u^2 \sin\theta \cos\theta} = \frac{\sin\theta}{4\cos\theta}$$

$$\Rightarrow \quad \frac{H}{R} = \frac{4\cos\theta}{\sin\theta} \text{ or, } \frac{R}{H} = 4\cot\theta$$

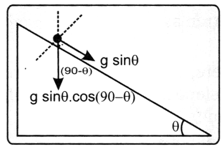
5. **(2)**

$\vec{v} = \hat{i} + 2\hat{j} \Rightarrow x = t \Rightarrow y = 2t - \frac{1}{2}(10t^2)$

From (i) and (ii), $y = 2x - 5x^2$

6. **(1)**

On the frictionless incline plane block has acceleration $a = g\sin\theta$ its vertical component as shown in figure is $a = g\sin^2\theta$



Hence relative vertical acceleration of A w.r.t. B is

$$a_{AB} = g[\sin^2\theta_1 - \sin^2\theta_2]$$

$$= g[\sin^2 60° - \sin^2 30°] = 9.8\left[\frac{3}{4} - \frac{1}{4}\right] = 4.9 m/s^2$$

7. **(3)**

Acceleration due to gravity along inclined

$$g' = g\cos(90° - \theta) = g\sin\theta$$

$\therefore$ Time taken, $t = \sqrt{\frac{2s}{g'}} = \sqrt{\frac{2l}{g\sin\theta}}$

But $\sin\theta = \frac{h}{l} \Rightarrow l = \frac{h}{\sin\theta}$

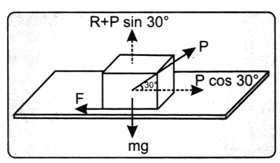
hence, $t = \sqrt{\frac{2}{2\sin\theta}.\frac{h}{\sin\theta}}$

$$t = \frac{1}{\sin\theta}\sqrt{\frac{2h}{g}}$$

8. **(3)**

Normal reaction $R = mg - P\sin 30° = mg - \frac{P}{2}$

R + P sin 30°



$\therefore$ Limiting friction between body and surface is given

by, $F = \mu R = \mu\left(mg - \frac{P}{2}\right)$

9. **(2)**

For smooth $d = \frac{1}{2(g\sin\theta}t_1,$

For rough plane $d = \frac{1}{2}(g\sin\theta - \mu g\cos\theta)t_2$

$t_1 = \sqrt{\frac{2d}{g\sin\theta}}$

$t_2 = \sqrt{\frac{2d}{g\sin\theta - \mu g\cos\theta}}$

According to question, $t_2 = nt_1$

$n\sqrt{\frac{2d}{g\sin\theta}} = \sqrt{\frac{2d}{g\sin\theta - \mu g\sin\theta}}$

μ, applicable here, is kinetic friction as the block moves over the inclined plane.

$n = \frac{1}{\sqrt{1-\mu_k}}$

$\left(\because \cos 45° = \sin 45° = \frac{1}{\sqrt{2}}\right)$

$n^2 = \frac{1}{1-\mu_k} \text{or} 1-\mu_k = \frac{1}{n^2}$

or $\mu_k = 1 - \frac{1}{n^2}$

10. (2)

According to question,

$mg(\sin\phi + \mu\cos\phi) = 2mg(\sin\phi - \mu\cos\phi)$

$\Rightarrow \quad \tan\phi = 3\mu$

As, $\quad \mu = \tan\theta$

Som $\quad \tan\phi = 3\tan\theta$

11. (4)

$S = \frac{u^2}{2\mu g} = \frac{m^2u^2}{2\mu g m^2} = \frac{P}{2\mu m^2 g}$

12. (1)

All blocks are moving with constant velocity so net force on all blocks are zero.

13. (1)

For equilibrium of system, $F_1 = \sqrt{F_2^2 + F_3^2}$

$[\text{As}\theta = 90°]$

In the absence of force F_1, Acceleration = $\frac{\text{Net force}}{\text{Mass}} = \sqrt{\frac{F_2^2 + F_3^2}{m}} = \frac{F_1}{m}$.

14. (1)

$W_{A\to B} = U_B - U_A = q(V_B - V_A) \Rightarrow V_B - V_A = \frac{W_{A-B}}{q}$

15. (4)

Net electric flux from a closed surface in uniform electric field is always zero.

16. (1)

Three capacitors are in series their resultant capacity is given by

$$\frac{1}{C_s}=\frac{1}{\left(\frac{\varepsilon_0 K_1 A}{d_1}\right)}+\frac{1}{\left(\frac{\varepsilon_0 K_2 A}{d_2}\right)}+\frac{1}{\left(\frac{\varepsilon_0 K_3 A}{d_3}\right)}$$

or $$\frac{1}{C_s}=\frac{1}{C_s}=\frac{d_1}{\varepsilon_0 K_1 A}+\frac{d_2}{\varepsilon_0 K_2 A}+\frac{d_3}{\varepsilon_0 K_3 A}$$

$$\frac{1}{C_s}=\frac{1}{C_s}=\frac{1}{\varepsilon_0 A}\left(\frac{d_1}{K_1}+\frac{d_2}{K_2}+\frac{d_3}{K_3}\right)$$

$$\therefore\ C_s=\frac{\varepsilon_0 A}{\left(\frac{d_1}{K_1}+\frac{d_2}{K_2}+\frac{d_3}{K_3}\right)}$$

17. (4)

Capacitors C_1 and C_2 are in series with C_3 in paralle with them.

Now, $C_1=\frac{K_1\varepsilon_0(A/2)}{(d/2)}=\frac{K_1\varepsilon_0 A}{d}$ $\quad C_2=\frac{K_2\varepsilon_0(A/2)}{(d/2)}=\frac{K_2\varepsilon_0 A}{d}$

and $C_3=\frac{K_3\varepsilon_0 A}{2d}$

$$C_{equivalent}=C_3+\frac{C_1C_2}{C_1+C_2}$$

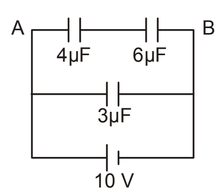
$$=\frac{K_3\varepsilon_0 A}{2d}+\frac{\left(\frac{K_1\varepsilon_0 A}{d}\right)\left(\frac{K_2\varepsilon_0 A}{d}\right)}{\frac{K_1\varepsilon_0 A}{d}+\frac{K_2\varepsilon_0 A}{d}}$$

$$=\frac{\varepsilon_0 A}{d}\left(\frac{K_3}{2}+\frac{K_1K_2}{K_1+K_2}\right)$$

So, none option is correct.

18. (2)

The circuit can be redrawn as



Here 4μF and 6μF are in series. So, charge is same on both.

Now equivalent capacity between A and B

$$C_{AB}=\frac{6\times 4}{6+4}=2.4\mu F$$

So, charge on 4 0¦F capacitor

$Q = C_{AB} \times 10$

$= 2.4 \times 10$

$= 24\ \mu c$

19. (4)

Area $= \frac{1}{2}QV =$ energy stored in the capacitor.

20. (2)

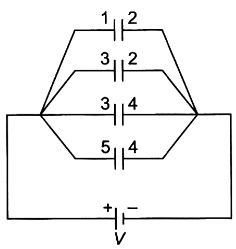
$U = \frac{1}{2}(2C)V^2 = CV^2 = \left(\frac{\varepsilon_0 A}{d}\right)(V^2)$

21. (2)

If ring is complete, net field at centre is zero. If small portion is cut, field opposite to this is not cancelled out.

22. (3)

Given circuit can be redrawn as shown



Capacity of each capacitor is $C = \frac{\varepsilon_0 A}{d}$

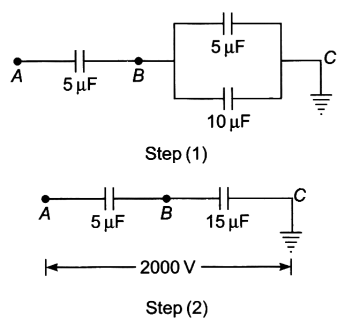
So, magnitude of charge on each capacitor = magnitude of charge on each plate $= \frac{\varepsilon_0 A}{d}V$

As plate 1 is connected with +ve terminal of battery, so charge on $= +\frac{\varepsilon_0 A}{d}.V$

Plante 4 comes twice and it is connected with -ve terminal of battery. So charge on plate $4 = -\frac{2\varepsilon_0 AV}{d}$

23. (3)

Given circuit can be redrawn as



Potential defference between A and B

i.e., $V_A - V_B = \left(\frac{15}{5+15}\right) \times 2000$

$\therefore \quad V_A - V_B = 1500V$

$\therefore \quad 2000 - V_B = 1500V$

$\therefore \quad V_B = 500\ V$

24. (1)

Here, $u = 0,\ a = \frac{qE}{m}$

s = l and v = ? $\Rightarrow$ $v^2 = u^2 + 2as$

$v^2 = 0 + 2\frac{qEl}{m} \Rightarrow v = \sqrt{\frac{2qEl}{m}}$

25. (4)

Electric field and electric potential at a general point at a distance r from the centre of the dipole is

$E_g = \frac{1}{4\pi\varepsilon_0}\frac{p}{r^3}\sqrt{(3\cos^2\theta + 1)}$ and $V_g = \frac{1}{4\pi\varepsilon_0}\frac{p\cos\theta}{r^2}$

26. (1)

Flux is due to charges enclosed per ε_0

$\therefore$ Total flux = (–14 × 78.85 – 56) nC/ ε_0

$= 8.85 \times 10^{-9} C \times \frac{4\pi}{4\pi\varepsilon_0}$

$= 8.85 \times 10^{-9} \times 9 \times 10^{9} \times 4\pi$

$= 1000.4\ Nm^2 / C$ i.e., $1000\ Nm^2C^{-1}$

27. (3)

Initial energy, $U_i = \frac{1}{2}C_0V_2$

Final energy, $U_f = \frac{1}{2}(KC_0)\left(\frac{V}{K}\right)^2$

or $U_f = \frac{1}{K}\left(\frac{1}{2}C_0V_2\right)$

Change in energy $= U_f - U_i = \frac{1}{2}C_0V_2\left(\frac{1}{K} - 1\right)$

28. (3)

Common potential, $V = \dfrac{\text{Total charge}}{\text{Total capacitance}}$

$$V = \frac{C_1V_1 + C_2V_2}{C_1 + C_2} = \frac{0 + CV_0}{KC + C} = \frac{CV_0}{C(1+K)}$$

$$V = \frac{V_0}{(1+K)} \Rightarrow K = \frac{V_0}{V} - 1 \Rightarrow K = \frac{V_0 - V}{V}$$

29. (1)

Electric field a point is equal to the negative gradient of the electrostatic potential at that point.

Potential gradient relates with electric field according to the following relation $E = \dfrac{-dV}{dr}$

$$E = -\frac{\partial V}{\partial r} = \left[-\frac{\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial x}\hat{k}\right]$$

$$= [\hat{i}(2xy + z^3) + \hat{j}x^2 + \hat{k}3xz^2]$$

30. (3)

$$V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$

Here, $V = 2V_{+ve} + 2V_{-ve}$

$$V = \frac{1}{4\pi\varepsilon_0}\left[\frac{2q}{L} - \frac{2q}{L\sqrt{5}}\right]$$

$$V = \frac{2q}{4\pi\varepsilon_0 L}\left(1 - \frac{1}{\sqrt{5}}\right)$$

31. (2)

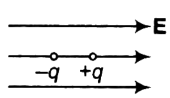
The system is in equilibrium means the force experienced by each charge is zero. It is clear that charge placed at centre would be in equilibrium for any value of q, so we are considering the equilibrium of charge placed at any corner.

32. (2)

$$E_r = \frac{F_a}{F_m} = \frac{mg}{(m - m_1)g} = \frac{\rho V}{(\rho - \sigma)V} = \frac{\rho}{(\rho - \sigma)}$$

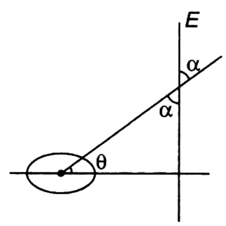
33. (3)

For stable, equilibrium, the angle θ should be 0°



34. (3)

Here, $\alpha + \theta = 90^\circ$



$$\tan\alpha = \frac{1}{2}\tan\theta$$

or $\tan\theta = 2\tan\alpha$

or $\tan\theta = 2\tan(90^\circ - \theta)$

or $\tan^2\theta = 2$

or $\tan\theta = \sqrt{2}$

$$\theta = \tan^{-1}\left(\sqrt{2}\right)$$

35. (1)

Resistance, $R = \rho\frac{l}{A}$

and Resistivity $\rho = \frac{m}{me^2\tau}$

$\therefore \quad R = \frac{ml}{ne^2\tau A}$

36. (1)

$R_1 = \rho_1\frac{l_1}{A} \Rightarrow R_2 = \rho_2\frac{l_2}{A}$

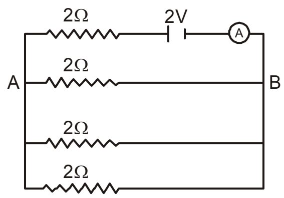
In series, $R_{eq} = R_1 + R_2$

$\therefore \quad \rho_{eq}\frac{(l_1 + l_2)}{A} = \rho_1\frac{l_1}{A} + \rho_2\frac{l_2}{A}$

$\therefore \quad \rho_{eq} = \frac{A(\rho_1 l_1 + \rho_2 l_2)}{A(l_1 + l_2)} = \frac{\rho_1 l_1 + \rho_2 l_2}{l_1 + l_2}$

37. (2)

The circuit can be redrawn as follows



Resistance across AB $\Rightarrow R_{AB} = \frac{2}{1+1+1} = \frac{2}{3}\Omega$

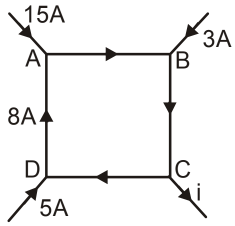
Total resistance of circuit

$$R_T = 2 + \frac{2}{3} = \frac{8}{3}\Omega$$

Current through ammeter

$$i = \frac{2}{(8/3)} = \frac{6}{8} = \frac{3}{4}A$$

38. (3)



Applying Kirchhoff's first law at junction A, B, C, D

at A, $i_{AB} = 23$ A

at B, $i_{BC} = 23 + 3 = 26$ A

at D, $i_{CD} = 8A - 5A = 3A$

at C, $i_{CD} + i = i_{Be}$

or $3 + i = 26$

$\therefore$ $i = 23$ A

39. (4)

40. (3)

When bulbs are in series

$$P = \frac{V^2}{3R} \qquad ....(1)$$

When bulbs are connected in parallel

$$P' = \frac{V^2}{(R/3)} = \frac{3V^2}{R} \begin{matrix} = 3 \times 3P \\ = 9P \end{matrix} \qquad \text{[From Eq. (ii)]}$$

41. (3)

$R_{40} > R_{100}$. In series potential difference distributes in direction ratio of resistance.

42. (3)

There are n rows each containing m cells

$\therefore$ Total cells = m × n = 24 ......(i)

For maximum current in the circuit, external resisrtance should be equal to net internal resistance should be equal to net internal resistance.

$$R = \frac{mr}{n} \Rightarrow \quad 3 = \frac{m}{n}(0.5)$$

$\therefore$ $m = 6n$

From Eqs. (i) and (ii), we get

m = 12, n = 2

43. (3)

$$i_1 = \frac{E}{r + R_1} \Rightarrow i_2 = \frac{E}{r + R_2}$$

From these two equations, we get $r = \frac{i_2R_2 - i_1R_1}{i_1 - i_2}$

44. (3)

Galvanometer current is given by

$$i_g = i\left(\frac{S}{S+G}\right)$$

$\therefore$ Shunt resistance, $S = \frac{i_gG}{(i - i_g)}$

$$\therefore \quad S = \frac{10 \times 99}{(100 - 10)} = 11\,\Omega$$

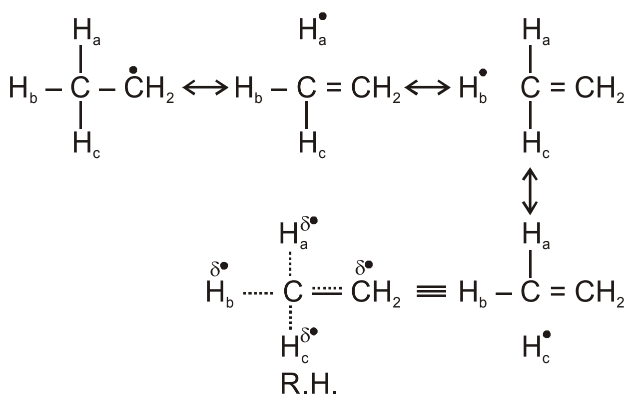
45. (4)

$$(2 \times 10^{-3})(50) = 10 \times i$$

$$i = 10 \times 10^{-3}\,A = 10\text{ mA}$$

CHEMISTRY

46. **(3)**



47. **(4)**

Carbanion in (I) is more stable than (II)

48. **(4)**

49. **(1)**

50. **(4)**

Ingold effect is also called inductive effect and it arises due to difference in electronegativity and hybridisation

51. **(1)**

52. **(4)**

1. is $\pi - \pi$ conjugation

2. is $\pi -$ l.p congugation

3. is $\pi -$ vacant p-orbital conjugation so I.e. why show resonance

53. **(4)**

54. **(4)**

l.p. and vacant p-orbital conjugation provide more stability

55. **(1)**

56. **(2)**

Neutral C.S. are more stable

57. **(3)**

$\overset{\alpha}{C}H_3 - \overset{\oplus}{C}H_2$ contain $\alpha - H$ so i.e. why show hyperjugation

58. (1) 59. (1) 60. (2)

61. (3)

K.E of n moles of N_2 gas $= \frac{3}{2}nRT$

Here $n = \frac{14}{28} = \frac{1}{2}$ moles

R=8.31 J/ mol/ K

T=127°C =400K

$\therefore \quad K.E = \frac{3}{2} \times \frac{1}{2} \times 8.314 \times 400$ J

$= 2493.0 \text{ J} = 2.493 \text{ kJ} \approx 2.5 \text{ kJ}$

62. (4)

According to Boyle's law at constant temperature,

$V \propto \frac{1}{P}$ or $PV =$ cosntant

63. (4)

According to Graham's law of diffusion,

$r \propto \sqrt{\frac{1}{M}}$

where r is rate of diffusion of gas and M is its molecular weight

So, $\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}} \Rightarrow \frac{r1}{r_2}\sqrt{\frac{81}{100}} = \frac{9}{10}$

$\Rightarrow \quad r_1 : r_2 = 9 : 10$

64. (1)

Rate of diffusion depend upon molecular weight

$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}} \Rightarrow r_1 = r_2$ if $M_1 = M_2$

Hence, compounds are N_2O and CO_2 as both have same molar mass.

65. (2)

Vandar Waal's equation is applicable for real (non-ideal) gases.

66. (2)

Because H_2 & Cl_2 gases may react with each other to produce HCl gas hence Dalton's law is not applicable.

67. (2)

Under identical conditions, $\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

As rate of diffusion is also inversely proportional to time, we will have, $\frac{t_2}{t_1} = \sqrt{\frac{M_2}{M_1}}$

(1) Thus, for He, $t_2 = \sqrt{\frac{4}{2}}(5s) = \sqrt{2}s \neq 10s;$

(2) For O_2, $t_2 = \sqrt{\frac{32}{2}}(5s) = 20s$

(3) For CO, $t_2 = \sqrt{\frac{28}{2}}(5s) \neq 25s;$

(4) For CO_2, $t_2 = \sqrt{\frac{44}{2}}(5s) \neq 55s;$

68. (1)

In van der Waal's equation 'b' is for volume correction

69. (4)

$\Delta H = \Delta E + P\Delta V$

For isochoric process, $\Delta V = 0$

$\therefore \quad \Delta H = \Delta E$

70. (4)

As $\Delta H = \Delta E + \Delta n_g RT$

if $n_p < n_r$; $\Delta n_g = n_p - n_r = -ve$

Hence, $\Delta H < \Delta E$

71. (2)

$\Delta n_g = 2 - 4 = -2,\ \Delta H = \Delta E - 2RT.$

72. (2)

For an isothermal process $\Delta E = 0$

73. (2)

$W = -p\Delta V = -3(6-4) = -6\ L,\ atm$

$= -6 \times 101.32 = -608\ J$

74. (2)

$A(g) + 2B(g) \longrightarrow 2C(g) + 3D(g)$

$\Delta n = 5 - 3 = 2$

$\Delta H = \Delta E + nRT \quad or \quad \Delta E = \Delta H - nRT$

$=19–2×2×10^{-3}–300=17.8$ kcal

75. (2)

M.W. of ehane (C_2H_2)=30 gm.

M.W. of acetylene (C_2H_2)=26 gm.

heat evolved per gm of ethene $= \frac{341}{30} = 11.36\ cal / gm.$

Heat evolved per gm of acetylene $= \frac{310}{26} = 11.92\ cal / gm$

So, acetylene is better fuel.

76 (4) 77. (4) 78. (3) 79. (2) 80. (1)

81. (4) 82. (2) 83. (3)

84. (1)

The screening effect follows the order s > p > d > f.

85. (3)

86. (3)

ns^2p^1 is the electronic configuration of III A period. Al_2O_3 is amphoteric oxide.

87. (2)

88. (3)

While moving down in a group, effective nuclear attraction decreases due to addition of new orbitals. As a result ionisation potential decreases. Hence, the correct order Li > K > Cs.

89. (1)

Species	Na^{+}	Mg^{2+}	Al^{3+}	Si^{4+}
Protons	11	12	13	14
Electrons	10	10	10	10

Size of isoelectronic cations decreases with increase in magnitude of nuclear charge

$\therefore$ Order of decreasing size is $Na^{+} > Mg^{2+} > Al^{3+} > Si^{4+}$

90. (3)

$(n-1)s^2p^6(n-1)d^{1-10}\ ns^{0-2}$ represents the correct electronic configuration of transition elements among the given choices.

BOTANY

91.	(2)	92.	(4)	93.	(1)	94.	(1)	95.	(1)	96.	(3)
97.	(3)	98.	(4)	99.	(2)	100.	(3)	101.	(3)	102.	(4)
103.	(3)	104.	(2)	105.	(2)	106.	(2)	107.	(2)	108.	(2)
109.	(2)	110.	(4)	111.	(2)	112.	(1)	113.	(3)	114.	(4)
115.	(2)	116.	(3)	117.	(2)	118.	(4)	119.	(1)	120.	(3)
121.	(1)	122.	(2)	123.	(3)	124.	(3)	125.	(4)	126.	(3)
127.	(1)	128.	(4)	129.	(1)	130.	(1)	131.	(3)	132.	(3)
133.	(3)	134.	(3)	135.	(4)						

ZOOLOGY

136.	(2)	137.	(4)	138.	(4)	139.	(1)	140.	(3)	141.	(1)
142.	(3)	143.	(2)	144.	(4)	145.	(4)	146.	(3)	147.	(4)
148.	(3)	149.	(2)	150.	(2)	151.	(3)	152.	(4)	153.	(2)
154.	(2)	155.	(3)	156.	(4)	157.	(3)	158.	(2)	159.	(2)
160.	(3)	161.	(2)	162.	(2)	163.	(1)	164.	(4)	165.	(3)
166.	(3)	167.	(3)	168.	(4)	169.	(4)	170.	(1)	171.	(4)
172.	(2)	173.	(1)	174.	(2)	175.	(3)	176.	(4)	177.	(2)
178.	(2)	179.	(3)	180.	(2)						