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ශ්‍රී ලංකා විවෘත විශ්වවිද්‍යාලය

රසායන විද්‍යා දෙපාර්තමේන්තුව

විද්‍යාවේදී/අධ්‍යාපනවේදී උපාධි පාඨමාලාව /තනි විද්‍යා පාඨමාලාව -3 වන මට්ටම

අවසාන පරීක්ෂණය - 2015/2016

CMU1220/CME3220- රසායන විද්‍යාවේ මූලික සංකල්ප

කාලය - පැය 03 යි.

දිනය - 2017 ජනවාරි 11 වේලාව - පෙ.ව. 09.30 - ප.ව.12.30 දක්වා

අපේක්ෂකයන් සඳහා උපදෙස් -

- මෙම ප්‍රශ්න පත්‍රය කොටස් දෙකකින් සමන්විත ය.
  - 1 කොටස - බහුවරණ ප්‍රශ්න 30 කින් සමන්විතයි. (නිර්දේශිත කාලය පැයකි.)
  - 11 කොටස- රචනා ප්‍රශ්න හයකින් සමන්විතය. (නිර්දේශිත කාලය පැය දෙකකි.)
- ප්‍රශ්න සියල්ලටම පිළිතුරු සපයන්න.
- 1 කොටස හා 11 කොටසෙහි පිළිතුරු පත්‍ර වෙන් වෙන් වශයෙන් බාර දෙන්න.
- ප්‍රතුමණය කල නොහැකි ගණක යන්ත්‍රයක් භාවිතා කිරීමට හැක.
- ජංගම දුරකථන ළඟ තබා ගැනීම තහනම්, ඒවා ක්‍රියා විරහිත කොට සුරක්ෂිත ස්ථානයක තබන්න.

වායු නියතය (R)	= 8.314 J $K^{-1}mol^{-1}$
ඇවගාඩ්‍රෝ අංකය	= 6.023×10^{23} mol^{-1}
ෆැරඩේ නියතය(F)	= 96,500 C mol^{-1}
ප්ලාන්ක් නියතය(h)	= 6.63×10^{-34} J s
ආලෝකයේ ප්‍රවේගය (c)	= 3.0×10^{8} m s^{-1}
සම්මත වායුගෝලීය පීඩනය	= 10^5 Pa (N m^{-2})
ඉලෙක්ට්‍රෝනයක ස්කන්ධය	= 9.1 x 10^{-31}kg
රිඩ්බර්ග් නියතය	= 1.097 x 10^{7} m^{-1}

1 වන කොටස - බහුවරණ ප්‍රශ්න 30

කාලය පැය 01 යි.

- මෙම කොටස බහුවරණ ප්‍රශ්න 30 කින් සමන්විතය.
- අදාල ප්‍රශ්නයට වඩාත්ම නිවැරදි පිලිතුර තෝරා සපයා ඇති උත්තර පත්‍රයේ අදාල කොටුව මත කතිරයකින් "X" ලකුණු කරන්න.

1.	2.	X	4.	5.

- අවසාන උත්තරය ලකුණු කිරීම සඳහා (පැන්සලක් නොව) පැනක් භාවිතා කරන්න.
- ප්‍රශ්නයකට පිලිතුරු ලෙස කතිර එකකට වඩා ලකුණු කර ඇත්නම් ඒවා ඇගයීමට සලකනු නොලැබේ.

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01. පරමාණුක අංකය 26 වන මූල ද්‍රව්‍යයේ 2+අයනයේ ඉලෙක්ට්‍රොනික වින්‍යාසය වනුයේ,

(1) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 4s^2\ 3d^4$

(2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$

(3) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^0\ 3d^6$

(4) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^4\ 4p^2$

(5) ඉහත පිළිතුරු (1), (2), (3) , (4)කිසිවක් නොවේ.

02. සම ඉලෙක්ට්‍රොනික පරමාණු සහ අයනවලට සමාන වනුයේ පහත දැක්වෙන ඒවායින් කුමක් ද?

(1) ඉලෙක්ට්‍රොනික බන්ධතාවය (electron affinity)

(2) අයනීකරණ එන්තැල්පිය.

(3) ඉලෙක්ට්‍රෝන සංඛ්‍යාව

(4) අරය

(5) සවිල නෂ්ෂ්ටික ආරෝපනය

03. භෞමික අවස්ථාවේ ඇති 3d ඉලෙක්ට්‍රෝනයක් සඳහා තිබිය හැකි ක්වන්ටම් අංක කුලකය වනුයේ

(1) n =3, l = 1, m = - 2 to +2 , s = +1/2

(2) n =3, l = 2, m = - 2 to +2 , s = - 1/2

(3) n =3, l = 2, m = 1 , s = + 1/2

(4) n =2, l = 2, m = -2 to + 2 , s = +1/2

(5) n =3, l = 0, m = -2 to + 2 , s = +1/2

04. පරමාණුව සම්බන්ධයෙන් වන ආකෘති (model)සඳහා නිවැරදි වගන්තිය තෝරන්න.

(1) තොම්සන් ආකෘතියේ නෂ්ෂ්ටිය ඝන පරමාණුවේ කිඳා බැස ඇත.

(2) රදර්ෆර්ඩ් ආකෘතියේ නෂ්ෂ්ටිය පරමාණුක අවකාශයේ අඩක ප්‍රමානයක් ප්‍රයෝජනයට ගනී.

(3) Na පරමාණුවේ (වාෂ්ප) වර්ණාවලිය සාර්ථකව විස්තර කිරීම සඳහා බෝර් ආකෘතිය යොදා ගත හැක.

(4) පරමාණුක ව්‍යුහය පිළිබඳ ඕනෑම ආකෘතියක් ස්වභාවයෙන්ම මන:කල්පිත වේ. (conceptual by nature.)

(5) රදර්ෆර්ඩ් සහ බෝර් ආකෘති **දෙකේම** ඉලෙක්ට්‍රෝන ස්ථාවර කක්ෂවල පවති.

05. පහත දැක්වෙනවගන්ති සලකන්න.

(a) Hපරමාණුවේ n=3 සිට n =1 අවස්ථාව දක්වා ඉලෙක්ට්‍රෝන සංක්‍රමණයන් Lyman ශ්‍රේණියේ රේඛාවක් ජනනය වේ.

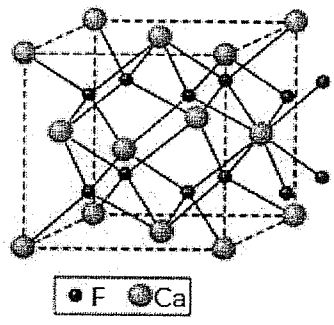
(b) කාක්ෂිකයක ඉලෙක්ට්‍රෝන ඝනත්වය වැඩිම ලක්ෂ්‍යය ගැටිත්ත (nodes), ලක්ෂ්‍යයක් ලෙස හැඳින්වේ.

(c) $(32)^{-1/2}\, r\, e^{-1/2} \cos\phi$ යනු S කාක්ෂිකයකට අදාල තරංග ශ්‍රිතයක් විය හැක.

ඉහත වගන්ති අතුරින් නිවැරදි වගන්ති/ය වනුයේ

(1) (a) පමණි. (2) (a) සහ (b) පමණි. (3) (a) සහ (c) පමණි.
(4) (b) සහ (c) පමණි. (5) (a) ,(b) සහ (c) සියල්ල

06. CaF_2 හි ඒකක සෛලයක් පහත දැක්වේ. Ca^{2+} හා F^- සඳහා සංගත අංකයන් වනුයේ



(1) 4, 6 (2) 4, 8 (3) 8, 4 (iv) 6, 6 (v) 4, 4

07. BCl_3 අණුව සඳහා නිවැරදි වගන්ති/ය වනුයේ පහත කුමක් ද?

(a) එය අෂ්ඨක නියමය පිළිපදී.
(b) එයට චතුස්තලීය ජ්‍යාමිතිය ඇත.
(c) එහි මධ්‍ය පරමාණුව sp^2 මුහුම් වේ.
(d) Cl-B-Cl හි බන්ධන කෝණය 120^o

නිවැරදි පිළිතුර වනුයේ

(1) (a)සහ (b) පමණි. (2) (b) සහ (c) පමණි. (3) (c) සහ (d) පමණි.
(4) (d) සහ (a) පමණි. (5) (a) ,(b) සහ (c) පමණි.

08. O_2^+සම්බන්ධයෙන් නිවැරදි වගන්ති/ය කුමක් ද?

(a) එහි බන්ධන පෙළ2.5 වේ.
(b) එය අණුක චුම්බක වේ.
(c) එහි අණුක කාක්ෂික ඉලෙක්ට්‍රෝනිය ව්‍යුහය
$\sigma_{1s}^2\, \sigma_{1s}^{*2}\, \sigma_{2s}^2\, \sigma_{2s}^{*2}\, \sigma_{2pz}^2 \pi_{2px}^2 = \pi_{2py}^2\, \pi_{2px}^{*1} = \pi_{2py}^*$
(d) O_2^+. හි බන්ධන ප්‍රබලතාවයO_2වල බන්ධන ප්‍රබලතාවයට වඩා දුර්වල වේ.

නිවැරදි පිළිතුර වනුයේ

(1) (a)සහ (b) පමණි. (2) (b) සහ (c) පමණි. (3) (c) සහ (d) පමණි.
(4) (d) සහ (a) පමණි. (5) (a) ,(b) සහ (c) පමණි.

09. පහත දැක්වෙන කුමන විශේෂයකට චතුස්තලීය ජ්‍යාමිතිය පවතී ද?

(1) ICl_3 (2) PCl_3 (3) SF_4 (4) ICl_5 (5) XeF

10. ශූන්‍ය නොවන ද්විධ්‍රැව ඝූර්ණයන් පවතින්නේ පහත කුමන අණු වලට ද?

(a) Cl_2CCH_2 (b) BF_3 (c) SO_3 (d) NF_3

නිවැරදි පිළිතුර වනුයේ

(1) (a)සහ (b) පමණි. (2) (b) සහ (c) පමණි. (3) (c) සහ (d) පමණි.

(4) (d) සහ (a) පමණි. (5) (a) ,(b) සහ (c) පමණි.

11. පහත දැක්වෙන ප්‍රකාශ අතුරින් කුමක් **සාවද්‍ය** ද?

(1) කාබීන, ඉලෙක්ට්‍රෝන ඌන ද්විසංයුජ කාබන් අතරමැදියන් වේ.

(2) කාබ්ඇනායනවලට, නියුක්ලියෝෆයිල ලෙස ප්‍රතික්‍රියා කල හැක.

(3) කාබොඇනායන sp^2 මුහුම්කරණය වූ පිරමිඩාකාර කාබන් අතරමැදියන්වේ.

(4) කාබොකැටායන sp^2 මුහුම්කරණය වූ තලීය කාබන් අතරමැදියන් වේ.

(5) කාබොකැටායන ඉලෙක්ට්‍රෝන ඌන ත්‍රිසංයුජ කාබන් අතරමැදියන් වේ.

12. පහත දැක්වෙන ප්‍රකාශ අතුරින් කුමක් **සාවද්‍ය** ද?

(1) ලූවිස් වාදයට අනුව බෝරෝන්ට්‍රයිෆ්ලෝරයිඩ් අම්ලයක් ලෙස සැලකිය හැක.

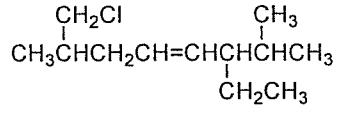
(2) බ්‍රොන්ස්ටඩ්-ලෝරි වාදයට අනුව ඇමෝනියා භෂ්මයක් ලෙස සැලකිය හැක.

(3) බ්‍රොන්ස්ටඩ්-ලෝරි වාදයට අනුව ජලය භෂ්මයක් ලෙස සැලකිය හැක.

(4) ලූවිස් වාදයට අනුව ජලය අම්ලයක් ලෙස සැලකිය හැක.

(5) බ්‍රොන්ස්ටඩ්-ලෝරි වාදයට අනුව ඇමෝනියා අම්ලයක් ලෙස සැලකිය හැක.

13. පහත දැක්වෙන සංයෝගයේ IUPAC නම කුමක් ද?



(1) 8-chloro-3-ethyl-2,7-dimethyl-4-octene

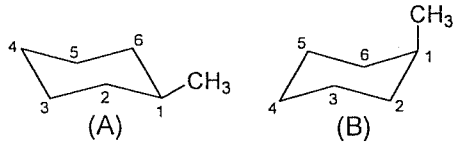
(2) 1-chloro-6-ethyl-2,7-dimethyl-4-octene

(3) 2-chloromethyl-6-ethyl-7-methyl-4-octene

(4) 1-chloro-2,7-dimethyl-6-ethyl-4-octene

(5) 7-chloromethyl-3-ethyl-2-methyl-4-octene

14. මෙතිල්සයික්ලෝහෙක්සේන් හි **A** සහ **B** යන සන්‍යාස පිළිබඳව කුමන ප්‍රකාශය නිවැරදි ද?



(1) **A** සන්‍යාසය වඩාත්ස්ථායි වන නිසා එය **B** ලෙසට පරිවර්තනය නොවේ.

(2) මෙතිල් කාණ්ඩය C-2 සහ C-6 අක්ෂිය H පරමාණු සමග 1-2 අන්තර්ක්‍රියා පෙන්වන බැවින් B සන්‍යාසය අස්ථායි වේ.

(3) මෙතිල් කාණ්ඩය C-3 සහ C-5 අක්ෂිය H පරමාණු සමග 1-3 අන්තර්ක්‍රියා පෙන්වන බැවින් B සන්‍යාසය අස්ථායි වේ.

(4) මෙතිල් කාණ්ඩයC-2 සහC-4 අක්ෂිය Hපරමාණු සමග1,2 අන්තර් ක්‍රියා පෙන්වන බැවින් A සන්‍යාසය අස්ථායිවේ.

(5) B සන්‍යාසය අස්ථායි නිසා එය නොපවතියි.

15. පහත දක්වා ඇති C සහ D සංයෝග දෙක එකම එතනෝල්හි සෝඩියම් එතොක්සයිඩ් ද්‍රාවණය සමග වන ප්‍රතික්‍රියාව සලකන්න. **නිවැරදි** ප්‍රකාශය තෝරන්න.

$CH_3CH_2CH_2Br$ (**C**) $CH_3CD_2CH_2Br$ (**D**)

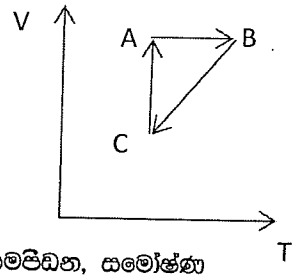
(1) **C**, E2 ආකාරයේ ඉවත්වීමක් සිදුකරන අතර **D**, E1 ආකාරයේ ඉවත්වීමක් සිදුකරයි.
(2) ප්‍රතික්‍රියා දෙකම E2 ආකාරයේ ඉවත්වීමේ ප්‍රතික්‍රියා බැවින් එකම වේගයෙන් සිදු වේ.
(3) ප්‍රතික්‍රියා දෙකම E1ආකාරයේ ඉවත්වීමේ ප්‍රතික්‍රියා බැවින් එකම වේගයෙන් සිදු වේ.
(4) ප්‍රතික්‍රියා දෙකම E1 ආකාරයේ ඉවත්වීම සිදුවන අතර **D** සමග ප්‍රතික්‍රියාව **C** සමග ප්‍රතික්‍රියාවට වඩා සෙමින් සිදුවේ.
(5) ප්‍රතික්‍රියා දෙකම E2 ආකාර ඉවත්වීම සිදුවන අතර **D** සමග ප්‍රතික්‍රියාව **C** සමග ප්‍රතික්‍රියාවට වඩා සෙමින් සිදුවේ.

16. වායුවක් පරිපූර්ණ වායුවක් ලෙස හැසිරෙන්නේ පහත දැක්වෙන කුමන තත්ව යටතේ ද?
(1) ඉහල පීඩනය හා අඩු උෂ්ණත්වයක
(2) ඉහල පීඩනය හා ඉහළ උෂ්ණත්වයක
(3) අඩු පීඩනය හා ඉහළ උෂ්ණත්වයක
(4) වායුගෝල පීඩනය හා ඉහළ උෂ්ණත්වයක
(5) අඩු පීඩනය හා අඩු උෂ්ණත්වය

17. 40 J තාප ශක්තියක් ලබා දුන්විට පද්ධතියක් මගින් 10 J කාර්යය ප්‍රමාණයක් කරන ලදී. පද්ධතියේ අභ්‍යන්තර ශක්ති වැඩිවීම කොපමණ ද?

(1) 30J (2) 50J (3) 40J (4) 20J (5) 0J

18. වායු මවුල 2 ක් පහත දක්වා ඇති වක්‍රිය ක්‍රියාවලියේදී වෙනස්කම් කිපයකට භාජනය වේ.
A→ B, B→ C, C→ Aවලින් දැක්වෙන ක්‍රියාවලින් පිළිවෙලින් මොනවාද?



(1) සමපරිමා, සමපීඩන, සමෝෂ්ණ
(2) සමපීඩන, සමපරිමා, සමෝෂ්ණ
(3) සමපරිමා, සමෝෂ්ණ, සමපරිමා
(4) සමපීඩන, සමෝෂ්ණ, සමපරිමා
(5) සමපරිමා, සවිරතාපී, සමපීඩන

19. පහත දැක්වෙන කුමක් විත්ති (extensive)ගුණයක් වේ ද?
(1) උෂ්ණත්වය (2) පීඩනය (3) ගිබ්ස් යෝජ්‍ය ශක්තිය
(4) මොලික පරිමාව (5) අභ්‍යන්තර ශක්තිය

20. පහත දැක්වෙන ඒවායින් කුමක් අවස්ථා ශ්‍රිතයන් නොවේ ද?

(a) $q + w$ (b) q (c) w (d) $H - TS$

නිවැරදි පිළිතුර වනුයේ

(1) (a), (b) සහ (c) පමණි. (2) (a) පමණි. (3) (b) පමණි.

(4) (c) පමණි. (5) (b), (c) සහ (d) පමණි.

21. පහත දැක්වෙන වගන්ති සලකන්න.

(a) Impressed ධාරා කැතෝඩ ආරක්ෂණයේදී, ආරක්ෂා කලයුතු ලෝහ වස්තුව විද්‍යුතය ලබා ගන්නා ප්‍රභවයේ සෘණ අග්‍රයට සම්බන්ධ කරයි.

(b) Impressed ධාරා කැතෝඩ ආරක්ෂණයේදී යොදා ගන්නා ඇනෝඩය නිරතුරුවම භුවමාරු කල යුත්තේ එය ආරක්ෂණ ක්‍රියාවලියේ දී උපයෝගී වන නිසා ය.

(c) ආරක්ෂණය කල යුතු ලෝහයේ වර්ග ප්‍රමාණය විශාල වන අවස්ථාවලදී sacrificial ඇනෝඩ ආරක්ෂණයට වඩා Impressed ධාරා කැතෝඩය ආරක්ෂණය වඩා හොඳ වේ.

ඉහත (a),(b),(c)වගන්ති අතුරින් නිවැරදි වනුයේ

(1) (a) සහ (b) පමණි. (2) (a) සහ (c) පමණි. (3) (b) සහ (c) පමණි.

(4) (a)(b) සහ (c) සියල්ල (5) (1) (2) (3) (4) කිසිවක් නිවැරදි නොවේ.

22. වායුගෝලයට නිරාවරණය වන කර්මාන්ත යෙදීමක් සඳහා විඛාදනය නොවන සින්ක් හෝ ක්‍රෝමියම් ආලේපනය කල අඩි 1 x අඩි 1 ප්‍රමාණයේ හතරැස් තුනී වානේ තහඩු අවශ්‍ය වී ඇත. ඉහත වානේ තහඩුව විශාල තහඩුවකින් කැපිය යුතු වේ.

පහත වගන්ති සලකන්න.(විඛාදන ආරක්ෂණය ගැන සැලකිමේ දී)

(a) ලෝහ ආලේපනය පළමුව විශාල තහඩුවේ ආලේපනය කර ඊට පසු අවශ්‍යතාවය අනුව කපා ගැනීම පළමුව කපා දෙවනුව ආලේපනය කිරීම හා වෙනසක් නොවේ.

(b) කර්මාන්ත යෙදීමේ දී හතරැස් තහඩුව හිරිමිවලට ලක්විය හැකි නිසා ක්‍රෝමියම් ආලේපනයට වඩා සින්ක් ආලේපනය වඩා සුදුසු වේ.

(c) කර්මාන්ත යේදීමේදී හතරැස් ලෝහ තහඩුව සිරීමට ලක් නොවන්නේ නම් සින්ක් හෝ ක්‍රෝමියම් ආලේපන දෙකෙන් කුමක් වුවද සුදුසු වේ.

ඉහත (a),(b),(c)වගන්ති අතුරින් නිවැරදි වනුයේ

(1) (a) සහ (b) පමණි. (2) (a) සහ (c) පමණි. (3) (b) සහ (c) පමණි.

(4) (a)(b) සහ (c) සියල්ල (5) (1) (2) (3) (4) කිසිවක් නිවැරදි නොවේ.

23. IUPAC සම්මුතිය අනුව කෝෂ සටහනට අදාල කෝෂ ප්‍රතික්‍රියාව

(a) වම් අත පැත්තේ ඉලෙක්ට්‍රෝඩයේ ඔක්සිකරණය සිදුවන ලෙස ලියනු ලැබේ.

(b) දකුණු අත පැත්තේ ඉලෙක්ට්‍රෝඩයේ කැතෝඩ අර්ධ ප්‍රතික්‍රියාව සිදුවන ලෙස ලියනු ලැබේ.

(c) ස්වයං සිද්ධව වීම අවශ්‍යතාවයක් <u>නොවේ.</u>

ඉහත (a),(b),(c)වගන්ති අතුරින් නිවැරදි වනුයේ

(1) (a) සහ (b) පමණි. (2) (a) සහ (c) පමණි. (3) (b) සහ (c) පමණි.

(4) (a)(b) සහ (c) පමණි. (5) (1) (2) (3) (4) කිසිවක් නිවැරදි නොවේ.

24. ද්‍රාවනයක ඇති X අයන විශේෂයක සක්‍රියන සංකීර්ණය γ_X

(a) X සාන්ද්‍රනය ශූන්‍ය විටදී ශූන්‍ය වේ.
(b) ඒකක නැති පරාමිතියකි.
(c) අයන විශේෂයේ සම්මත අවස්ථාවේ දී අගය එකිය වේ.
ඉහත (a),(b),(c) වගන්ති අතුරින් නිවැරදි වනුයේ

(1) (a) සහ (b) පමණි. (2) (a) සහ (c) පමණි. (3) (b) සහ (c) පමණි.
(4) (a),(b),(c) සියල්ල (5) (1), (2), (3), (4) කිසිවක් නිවැරදි නොවේ.

25. පහත දැක්වෙන කෝෂ සටහන සලකන්න.

$$Mg(s)\left|\ Mg^{2+}(aq)\left(a_{Mg^{2+}}=1\right)\right\|\ H^{+}(aq)\left(a_{H^{+}}=1\right)\left|\ H_2(g)\left(P_{H_2}(g)=1\ bar\right)\right|Pt(s)$$

298 K සහ 1 barහිදී මෙම කෝෂයේ Pt(s), Mg(s) සහ හයිඩ්‍රජන් අයන සඳහා ඉලෙක්ට්‍රෝඩ විභවය පිළිවෙලින් $\Phi_{Pt(s)}$, $\Phi_{Mg(s)}$ සහ $\Phi_{H^{+}(aq)}$,වේ.

පහත වගන්ති සලකන්න.

(a) 298 K දී $E^{0}_{Mg|Mg^{2+}}=\Phi_{Mg(s)}-\Phi_{Pt(s)}$

(b) සම්මත හයිඩ්‍රජන් ඉලෙක්ට්‍රෝඩයේ ඉලෙක්ට්‍රෝඩ විභවය ශූන්‍ය වුවත් $\left|\Phi_{Pt(s)}-\Phi_{H^{+}(aq)}\right|\neq 0$ වේ.

(c) මැග්නීසියම් අයන ද්‍රාවනයේ විද්‍යුත් විභවය = $\Phi_{H^{+}(aq)}$

ඉහත (a),(b),(c) වගන්ති අතුරින් නිවැරදි වනුයේ

(1) (a) සහ (b) පමණි. (2) (a) සහ (c) පමණි. (3) (b) සහ (c) පමණි.
(4) (a),(b),(c) සියල්ල (5) (1), (2), (3), (4) කිසිවක් නිවැරදි නොවේ.

26. A + 2B ------->P ප්‍රතික්‍රියාව සඳහා සීඝ්‍රතා සමීකරණය වනුයේ

1) $-\frac{d[A]}{dt}=k[A][B]^2$ (2) $-\frac{d[A]}{dt}=k[A]$ (3) $\frac{d[A]}{dt}=k[A][B]^2$

(4) $-\frac{d[B]}{dt}=k[B]^2$ (5) ඉහත කිසිවක් නොවේ.

27. k සීඝ්‍රතා නියතය 2.4×10^{-4} mol $^{-1}$dm^3 s^{-1} වේ. SI ඒකක වලින් k වල අගය වනුයේ

(1) 2.4×10^{-1} (2) 2.4×10^{-7} (3) 4.0×10^{-7} (4) 4.0×10^{-9} (5) 4.0×10^{-8}

28. $A \rightarrow P$ යනු පළමු පෙළ ප්‍රතික්‍රියාවක් වන අතර එහි සිඝ්‍රතා නියතය, $3.0 \times 10^{-4}\ s^{-1}$ද A හි ආරම්භක සාන්ද්‍රනය $A = 0.50\ mol\ dm^{-3}$ද වේ.මෙම ප්‍රතික්‍රියාවේ අර්ධ ආයු කාලය (මිනිත්තු වලින්) දළ වශයෙන්

(1) 35.0 (2) 38.7 (3) 77.4 (4) 111 (5) 2.33×10^{3}

29. (a) සක්‍රියන ශක්තිය අඩු කිරීමෙන් උත්ප්‍රේරකයන් මගින් ප්‍රතික්‍රියාවක සිඝ්‍රතාවය අඩු කරයි.

(b) ප්‍රතික්‍රියාවක අණුකතාවය සහ මුළු පෙළ සමාන විය හැක.

(c) ප්‍රතික්‍රියාවක අර්ධ ආයුකාලය සැමවිටම ආරම්භක සාන්ද්‍රණයෙන් ස්වායත්ත වේ.

ඉහත (a), (b) සහ (c) වගන්ති අතුරින් නිවැරදි වගන්ති වනුයේ

නිවැරදි පිළිතුර වනුයේ

(1) (a)සහ (b) පමණි. (2) (b) සහ (c) පමණි. (3) (c) සහ (a) පමණි.

(4) (a),(b),(c) සියල්ල වැරදිය. (5) (a),(b),(c) සියල්ල නිවැරදි වේ.

30. සිඝ්‍රතා නියතය k සහ උෂ්ණත්වය T අතර සම්බන්ධතාවය දක්වන පහත ප්‍රකාශය සලකන්න.

$k = Ae^{-\frac{Q}{T}}$ (Q and A are constants)(Q සහ A නියත වේ.)

ඉහත සමීකරණයට සමාන සමීකරණය වනුයේ

(1) $\ln k - \ln A = Q\left(\frac{1}{T}\right)$ (2) $\ln k = -Q\left(\frac{1}{T}\right) - \ln A$

(3) $\ln k = Q\left(\frac{1}{T}\right) - \ln A$ (4) $A = ke^{\frac{Q}{T}}$ (5) $k = \frac{1}{A}e^{\frac{Q}{T}}$

II වන කොටස - රචනා වර්ගයේ ප්‍රශ්න

කාලය - පැය දෙක (02) යි.

01. (a), (b), සහ (c) කොටස් **සියල්ලටම** පිළිතුරු සපයන්න.

(a) හයිඩ්‍රජන් පරමාණුවේ n^{th} මට්ටමේ ඇති ඉලෙක්ට්‍රෝනයක ශක්තිය දෙනු ලබන සමීකරණය හත දැක්වේ.

$$E = -\frac{13.6}{n^2}\ eV$$

ඉලෙක්ට්‍රෝනය n = 2 මට්ටමේ ඇති විට තරංග ආයාමය 332 nm වන ෆෝටෝනයක් පරමාණුව හා ගැටුනු විට කුමක් සිදුවිය හැකිදැයි පුරෝකථනය කරන්න.(1 eV = $1.602 \cdot 10^{-19}$ J) (ලකුණු 30)

(b) සාම්පලයක කිසියම් මූල ද්‍රව්‍යයක් පවති ද, යන්න නිශ්චය කර ගැනීම සඳහා විද්‍යාඥයන් විමෝචන තරංග ආයාමයක් යොදා ගනු ලැබේ. සමහර මූල ද්‍රව්‍යවලට විශේෂිත වූ තරංග ආයාමයන් සමහරක් පහත වගුවේ දැක්වේ.

මූල ද්‍රව්‍යය	තරංග ආයාම/nm
Ag	328.1
Au	267.6
Ba	455.4
Ca	422.7
Cu	324.8

මූලද්‍රව්‍යය	තරංග ආයාමය/nm
Fe	372.0
K	404.7
Mg	285.2
Na	589.6
Ni	341.5

(i) වර්ණාවලියේ දෘෂ්‍ය කොටසේ විකිරණ විමෝචනය කරන මූලද්‍රව්‍ය හඳුනා ගන්න.

(ii) වැඩිම ශක්තියක් සහ අඩුම ශක්තියක් සහිත ෆෝටෝන නිකුත් කරනුයේ කුමන මූල ද්‍රව්‍ය මගින් ද?

(iii) නොදන්නා ද්‍රව්‍යයක සාම්පලයක් දහනය කිරීමේ දී සංඛ්‍යාතය $9.23 \times 10^{14}\ s^{-1}$ වන ආලෝකයක් විමෝචනය විය. වගුවේ දක්වා ඇති කුමන මූල ද්‍රව්‍යයක් සාම්පලයේ පවති දැයි සැක කල හැකි ද? (ලකුණු 40)

(c) (i) ලිතියම්වල පළමු අයනීකරණ ශක්තිය සහ ක්ලෝරීන්හි ඉලෙක්ට්‍රෝන බන්ධුතාවය දක්වන රසායනික සමීකරණ ලියා දක්වන්න.

(ii) වායුමය Cl පරමාණු මවුල 1 කට ඉලෙක්ට්‍රෝන මවුල 1 ක් එක් කල විට දී පිටවන ශක්තියෙන් ලිතියම් පරමාණු කොපමණ ප්‍රමාණයක් අයනීකරණය කල හැකි ද?

ලිතියම් හි පළමු අයනීකරණ ශක්තිය = $5.2 \times 10^{-1}\ J\ mol^{-1}$

ක්ලෝරීන් හි ඉලෙක්ට්‍රෝන බන්ධුතාවය = $-349\ kJ\ mol^{-1}$

(iii) හයිඩ්‍රජන් ක්ලෝරයිඩ්වල සාමාන්‍ය තාපාංකය හයිඩ්‍රජන් ෆ්ලෝරයිඩ් හෝ හයිඩ්‍රජන් බ්‍රෝමයිඩ් වලට වඩා අඩු වන්නේ ඇයි දැයි පහදන්න. (ලකුණු 30)

02. (a), (b), (c) කොටස් තුනටම (03) පිළිතුරු සපයන්න.

(a) (i) 'දැලිස ශක්තිය'අර්ථ දක්වන්න.

(ii) MgO(s) උත්පාදනය සඳහා නම් කරන ලද සූර්ණ බෝන්-හේබර් රූප සටහනක් අඳින්න. එය සහ පහත දැක්වෙන දත්ත උපයෝගි කර ගනිමින් මෙම ඔක්සයිඩයේ දැලිස ශක්තිය ගණනය කරන්න.

	kJ mol^{-1}
MgO උත්පාදන එන්තැල්පිය	-602
Mg සඳහා විලයන ශක්තිය	148
Mg හි පළමු අයනීකරණ විභවය	738
Mg හි දෙවන අයනීකරණ විභවය	1451
O_2 හි වියෝජන ශක්තිය	498
ඔක්සිජන් හි පළමු ඉලෙක්ට්‍රෝන බන්ධුතාවය	-141
ඔක්සිජන් හි දෙවන ඉලෙක්ට්‍රෝන බන්ධුතාවය	798

(ලකුණු 35)

(b) (i) මුහුම්කරණ සංකල්පය උපයෝගි කර ගනිමින් SF_2 සහ SF_6සඳහා ජ්‍යාමිතීන් පුරෝකථනය කරන්න.

(ii) SO_4^{3-}සඳහා සම්ප්‍රයුක්ත ව්‍යුහයන් අඳින්න. (ලකුණු 30)

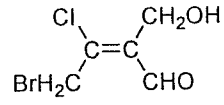
(c) (i) N_2සඳහා අණුක කාක්ෂික ශක්ති රූප සටහන අඳින්න.

(ii) p_xකාක්ෂික දෙකක් අතිව්‍යාදනය වීමෙන් සෑදෙන අණුක කාක්ෂික ඇඳ, නම් කරන්න. (z- යනු අන්තර් නෘෂ්ටික අක්ෂය වේ.) (ලකුණු 35)

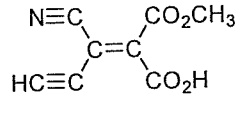
03. (a), (b) , (c) සියලු කොටස් සඳහා පිළිතුරු සපයන්න.

(a) Cahn-Ingold-Prelog නියමයන්ට අනුව ද්විත්ව බන්ධනයට සම්බන්ධ වී ඇති කාණ්ඩවල ප්‍රමුඛතා දක්වමින් පහත දී ඇති එක් එක් ඇල්කීනයේ ද්විත්ව බන්ධනයේ වින්‍යාසය *E* හෝ *Z* ලෙස නිර්ණය කරන්න.

(i)

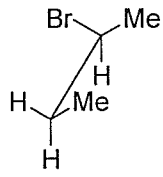


(ii)



(ලකුණු 20)

(b) 2-බ්‍රෝමොබියුටේන්වල පිහිත (eclipsed) සන්‍යාසයක් (C-2, C-3 බන්ධනය ඔස්සේ පහත දැක්වේ.



(i) 2-bromobutane වල විදැහි (staggered) සන්‍යාස තුන ඇඳ, ඒවා **X, Y,Z.** ලෙස නම් කරන්න.

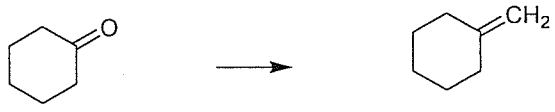
(ii) මධ්‍යසාරීය KOH සමග ඉවත්වීමේ ප්‍රතික්‍රියා සිදුවිය හැක්කේ කුමන සන්‍යාස/සන්‍යාසයන් දැයි හේතු දක්වමන් හඳුනා ගන්න.

(iii) හේතු දක්වමින් ඉහත (ii) ප්‍රතික්‍රියාවේ සෑදෙන ප්‍රධාන ඵලයේ ව්‍යුහය එහි ත්‍රිමාන රසායනය දක්වමින් අපෝහණය කරන්න. (ලකුණු 30)

(c) අවශ්‍ය ප්‍රතිකාර සහ තත්ත්ව සඳහන් කරමින් පහත දැක්වෙන ඕනෑම පරිවර්තන දෙකක් (02) සිදුකරන අයුරු ලියා දක්වන්න.

(i)

(ii)



(iii)

(ලකුණු 50)

4. (a), (b), (c) , (d) කොටස් සියල්ල සඳහා පිළිතුරු සපයන්න.

(a) පහත දැක්වෙන එක් එක් තාපගතිකව අපෝහනය කල හැකි ප්‍රකාශනයන් කුමන තත්ව යටතේ යෙදිය හැකිදැයි පැහැදිලිව සඳහන් කරන්න.

(i) $q = nRTln\frac{V_2}{V_1}$

(ii) $TV^{\gamma-1}$ = constant

(iii) $\Delta S = \int \frac{dq}{T}$

(iv) $dH = nC_{p,m}dT$

(v) $\Delta S = \frac{\Delta H}{T}$ (ලකුණු 25)

(b) 298 K හිදී බෝම්බ කැලරිමීටරයක් තුල ග්ලයිසීන් (NH_2CH_2COOH) දහනය කල විට සම්මත තත්ව යටතේ 969 kJ mol^{-1}තාප ප්‍රමාණයක් පිටවිය.

$$NH_2CH_2COOH_{(s)} + 9/4\ O_2 \rightarrow 2CO_{2(g)} + 5/2\ H_2O_{(l)} + ½\ N_{2(g)}$$

පරිපූර්ණ වායු හැසිරීම උපකල්පනය කර මෙලික දහන එන්තැල්පිය ගණනය කරන්න. (ලකුණු 25)

(c) (i) වැන්ඩවාල් සමීකරණයේ ගණිතමය ප්‍රකාශනය ලියා දක්වන්න.

(ii) 27^0C දී ඇමෝනියා වායු මෙල 2 ක් 5 dm^3 පරිමාවක් ගන්නා ලදී. වායුව වැන්ඩවාල් සමීකරණය පිළිපදී නම් වායුව මගින් ඇති කරන පීඩනය ගණනය කරන්න.

($a = 4.17\ atm\ L^2\ mol^{-2}$; $b = 0.0371\ L\ mol^{-1}$) (ලකුණු 25)

(d) මුල් උෂ්ණත්වය 727 ^0C සහ පීඩනය වායුගෝල 1000 හි ඇති වායුමය ඔක්සිජන් ($C_{v,m} = 5R/2$) මෙල 1000ක් ප්‍රත්‍යවර්ත ස්ථිරතාපී ප්‍රසාරණයක් හරහා අවසාන උෂ්ණත්වය 227 ^0C දක්වා සිසිල් කරන ලදී.

(i) පද්ධතියේ අවසාන පීඩනය

(ii) ප්‍රසාරණය සමඟ සිදු වූ එන්තැල්පි විපර්යාසය ΔH

(iii) ප්‍රසාරණය සමග සිදු වූ එන්ට්‍රොපි විපර්යාසය ΔS

(ලකුණු 25)

5. (a), (b), (c) කොටස් අතුරින් ඕනෑම කොටස් **දෙකකට (02)** පිළිතුරු සපයන්න.

පිළිතුරු දීම සඳහා පහත දැක්වෙන තොරතුරු උපයෝගී කර ගන්න.

$$\Delta G = -nFE, \quad \log(\gamma_{\pm}) = -A|Z_+Z_-|\sqrt{I}, \quad I = 0.5 \times \sum_j c_j Z_j^2, \quad \log(\gamma_{\pm}) = -\frac{A|Z_+Z_-|\sqrt{I}}{1 + aB\sqrt{I}}$$

$$E = E^0 - \frac{RT}{nF}\ln(Q)$$

$$\left[\text{Data: } F = 96500\ C\ mol^{-1}, \quad R = 8.314\ JK^{-1}mol^{-1}, \quad A = 0.509\ dm^{3/2}\ mol^{-1/2}\right]$$

(a) ද්‍රාවනයක pH අගය නිර්ණය කිරීම සඳහා බොහෝවිට ක්වින්හයිඩ්‍රෝන් quinhydrone ඉලෙක්ට්‍රෝඩය භාවිතා කරනු ලැබේ. එය සාදා ඇත්තේ ආම්ලික ජලීය ක්විනෝන් $(C_6H_4O_2)$ සහ $(C_6H_6O_2)$ හයිඩ්‍රොක්විනෝන් ද්‍රාවණයක ප්ලැටිනම් කුරක් ගිල්වා පැවතීමෙනි.

(i) සම්මත ආකාරයට ඉලෙක්ට්‍රෝඩ ප්‍රතික්‍රියාව ලියන්න.

(ii) සම්මත අංකනය යොදා ගනිමින් මෙම ඉලෙක්ට්‍රෝඩය නිරූපනය කිරීම සඳහා අර්ධ කෝෂ සටහන ලියන්න.

(iii) මෙම ඉලෙක්ට්‍රෝඩයේ ඝන/ද්‍රව අතුරු මුහුනතෙහි ඉලෙක්ට්‍රෝඩ විභවය තීරණය වන්නේ කුමන රසායනික විශේෂවල සාන්ද්‍රන මගින්දැයි හේතු දක්වමින් සඳහන් කරන්න.

(iv) මෙම ඉලෙක්ට්‍රෝඩයේ ඉලෙක්ට්‍රෝඩ විභවය සඳහා නන්ස්ට් සමීකරණය Nernest equation ලියා එහි සියලු පද හඳුනා ගන්න. (ලකුණු 50)

(b) විද්‍යාඥයෙකු විසින් බියුටේන් ඉන්ධන ලෙස යොදා ගන්නා ඉන්ධන කෝෂයක් සාදන ලදී. කෝෂයේ විද්‍යුත් විච්ඡේද්‍ය මාධ්‍ය ආම්ලික වේ.

ස්වයංසිද්ධ කෝෂ ප්‍රතික්‍රියාව $2\,CH_3CH_2CH_2CH_3 + 13\,O_2 \rightarrow 8\,CO_2 + 10\,H_2O$ වේ.

මෙම කෝෂ ප්‍රතික්‍රියාව සඳහා ගිබ්ස් යෝජ්‍ය ශක්තිය $-5,400\,kJ\,mol^{-1}$ වේ.

(i) ස්වයංසිද්ධ ඇනෝඩ ප්‍රතික්‍රියාව සහ ස්වයංසිද්ධ කැතෝඩ ප්‍රතික්‍රියාව ලියන්න.

(ii) මෙම ප්‍රතික්‍රියාව සඳහා ආරෝපන අංකය අපෝහනය කරන්න.

(iii) ඉන්ධන කෝෂයේ අග්‍ර දෙක හරහා නිරීක්ෂණය කල හැකි උපරිම විභව වෙනස ගණනය කරන්න.

(iv) කෝෂයෙන් 15 A ක ධාරාවක් ලබා ගන්නා අවස්ථාවේ දී බියුටේන් දහනය වීමේ වේගය $mol\,s^{-1}$ ඒකක වලින් ගණනය කරන්න. (ලකුණු 50)

(c) ජලීය $Pb(NO_3)_2$ $1.5\,mol\,dm^{-3}$ ද්‍රාවනයක් පිළියෙල කල ශිෂ්‍යයෙක් එය P ලෙස ද, ජලීය $Al(NO_3)_3$ $1.5\,mol\,dm^{-3}$ ද්‍රාවනය Q ලෙස ද නම් කලේ ය.

(i) ද්‍රාවනයක අයනික ප්‍රබලතාවය සහ එහි අයනවල සාන්ද්‍රනය අතර සම්බන්ධතාවය ලියා දක්වා එහි සියලු පරාමිතීන් හඳුනා ගන්න.

(ii) P සහ Q ද්‍රාවන වල අයනික ප්‍රබලතාවය ගණනය කරන්න.

(iii) P ද්‍රාවනයේ $NO_3^-(aq)$ වල සක්‍රියතා සංගුණකය Q ද්‍රාවනයේ $NO_3^-(aq)$ වල සක්‍රියතා සංගුණකයට වඩා වැඩි බව Debye-Huckel සීමාකාරී නියමය උපයෝගී කර ගනිමින් පෙන්වන්න. (ලකුණු 50)

6. (a), (b) , (c) කොටස් සියල්ලටම පිළිතුරු සපයන්න.

(a) මූලික ප්‍රතික්‍රියාවක සිඝ්‍රතා ප්‍රකාශනය

$A + B \longrightarrow$ වල ලෙස පෙන්වා ඇත.

(i) සම්මත සංකේත යොදා ගනිමින් ඉහත ප්‍රතික්‍රියාව සඳහා සිඝ්‍රතා ප්‍රකාශනය ලියන්න.

(ii) සිඝ්‍රතා නියතය සඳහා **SI** ඒකක නිර්ණය කරන්න.

(iii) Aට සාපේක්ෂව වැඩිපුර B ප්‍රමාණයක් යොදා ගනිමින් මෙම ප්‍රතික්‍රියාව සිදු කලා යයි සලකන්න. A වල සාන්ද්‍රනය ආරම්භක අවස්ථාවේ $[A_o]$ හා t කාලයක් ගිය පසු [A] ලෙස සලකා ප්‍රතික්‍රියාවේ "ව්‍යාජ" **(pseudo)** සිඝ්‍රතා නියතය (k^*) සඳහා ප්‍රකාශනයක් ව්‍යුත්පන්න කරන්න.

(ලකුණු 36)

(b) [A $\longrightarrow$ P]ප්‍රතික්‍රියාවේ සිඝ්‍රතාවය $-\frac{d[A]}{dt} = k$ ලෙස දැක්වේ.

(i) $[A_o]$, ආරම්භක සාන්ද්‍රනය වේ නම් ඉහත සමීකරණයේ අනුකලිත ආකාරය ව්‍යුත්පන්න කරන්න.

(ii) A හි ආරම්භක සාන්ද්‍රනය 2.0×10^3 mol m^{-3}වේ නම් සහ විනාඩි 30 කදී A වල 25% ක් ප්‍රතික්‍රියා කර ඇත්නම්, පැයකට පසු A වල සාන්ද්‍රණය කොපමණ ද?

(ලකුණු 36)

(c) $A + B \longrightarrow P$ ලබා දෙන ප්‍රතික්‍රියාවේ වේග සමීකරණය $-\frac{d[A]}{dt} = k\,[A]^p\,[B]^q$ ලෙස නිරූපනය වේ.

Aවලට සාපේක්ෂව ප්‍රතික්‍රියාවේ පෙළ නිර්ණය කිරීමේ දී ආරම්භක සිඝ්‍රතා ක්‍රමයේ මූලධර්ම යොදා ගනිමින් (ගණිතමය ප්‍රකාශන හා ප්‍රස්ථාර ඇතුලුව) කෙටියෙන් පැහැදිලි කරන්න. (පරීක්ෂණ ක්‍රියාවලින් අවශ්‍ය නැත.)

නිමිකම් ඇවිරිණි. (ලකුණු 28)

Section I – 30 Multiple Choice Questions

(Recommended time 1 hour)

- This section consists of 30 Multiple Choice Questions.
- Choose the most correct answer to each question and mark that answer with an "X" on the answer sheet.
- Use a **PEN** (not a pencil) to mark your answers.
- Any question with more than one answer marked will not be counted for grading.

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1. The electronic configuration of the 2+ ion of the element whose atomic number is 26 is:

   (1) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 4s^2\ 3d^4$ (2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$

   (3) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^0\ 3d^6$ (4) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^4\ 4p^2$

   (5) None of the answers (1), (2), (3) or (4)

2. Isoelectronic atoms and ions have identical

   (1) electron affinity (2) ionization enthalpy (3) number of electrons

   (4) radii (5) effective nuclear charge

3. Possible Quantum number set for a 3d electron of an atom in ground state is

   (1) n =3, l = 1, m = - 2 to +2 , s = +1/2

   (2) n =3, l = 2, m = - 2 to +2 , s = - 1/2

   (3) n =3, l = 2, m = 1 , s = +1/2

   (4) n =2, l = 2, m = -2 to + 2 , s = +1/2

   (5) n =3, l = 0, m = -2 to + 2 , s = +1/2

4. Select the correct statement regarding the model/s of the atom.

   (1) In Thompson model the nucleus is embedded in the solid atom.

   (2) In Rutherford model the nucleus occupies half of the atomic space.

   (3) Bohr model can be used successfully to explain the spectrum of Na atom (vapour).

   (4) Any model on atomic structure is conceptual by nature.

   (5) **Both** in Rutherford and Bohr model electron occupies stationary orbits.

5. Consider the following statements.

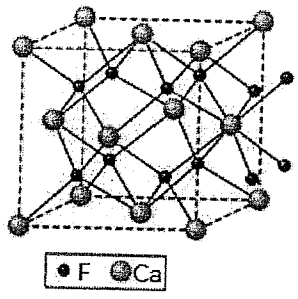
(a) An electron transition in H atom from n=3 to n =1 will give rise to a spectral line in Lyman series.
(b) In an orbital, nodes are points with maximum electron density.
(c) $(32)^{-1/2}\, r\, e^{-1/2} \cos\phi$ may be a wave function of s orbital.

The correct statement/s out of the above is/are,

(1) (a) only (2) (a) and (b) only (3) (a) and (c) only

(4) (b) and (c) only (5) All (a), (b), (c)

6. The unit cell of CaF_2 is given below. The coordination numbers ofCa^{2+} and F^- respectively are



(1) 4, 6 (2) 4, 8 (3) 8, 4 (iv) 6, 6 (v) 4, 4

7. Which of the following statement/s is/are true about BCl_3 molecule?

(a) It obeys the octet rule (b) It has tetrahedral geometry

(c) Its central atom is sp^2 hybridized (d) Cl-B-Cl bond angle is 120°

The answer is

(1) (a) and (b) only (2) (b) and (c) only (3) (c) and (d) only

(4) (d) and (a) only (5) (a), (b) and (c) only

8. Select the correct statement(s) about.

(a) Its bond order is 2.5 (b) It is paramagnetic

(c) Its molecular orbital electron configuration is $\sigma_{1s}^2\, \sigma_{1s}^{*2}\, \sigma_{2s}^2\, \sigma_{2s}^{*2}\, \sigma_{2pz}^2 \pi_{2px}^2 = \pi_{2py}^2\, \pi_{2px}^{*1} = \pi_{2py}^*$

(d) Bond strength of O_2^+. isweaker than that of O_2

The answer is

(1) (a) and (b) only (2) (b) and (c) only (3) (c) and (d) only

(4) (d) and (a) only (5) (a), (b) and (c) only

9. Which of the following species has tetrahedral geometry?

(1) ICl_3 (2) PCl_3 (3) SF_4 (4) ICl_5 (5) XeF_4

10. Which of the following molecules show non- zero dipole moment?

(a) Cl_2CCH_2 (b) BF_3 (c) SO_3 (d) NF_3

The answer is

(1) (a) and (b) only (2) (b) and (c) only (3) (c) and (d) only
(4) (d) and (a) only (5) (a), (b) and (c) only

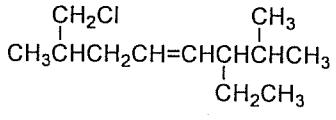
11. Which of the following statement is **incorrect**?

(1) Carbenes are electron deficient divalent carbon intermediates.
(2) Carbanions can react as nucleophiles.
(3) Carbanions are sp^2 hybridized pyramidal carbon intermediates.
(4) Carbocations are sp^2 hybridized planner carbon intermediates.
(5) Carbocations are electron deficient trivalent carbon intermediates.

12. Which of the following statement is **incorrect**?

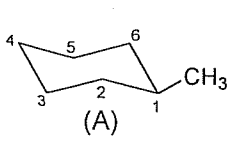
(1) Boron trifluoride can be considered as an acid according to the Lewis theory.
(2) Ammonia can be considered as a base according to the Brønsted-Lowry theory.
(3) Water can be considered as a base according to the Brønsted-Lowry theory.
(4) Water can be considered as an acid according to the Lewis theory.
(5) Ammonia can be considered as an acid according to the Brønsted-Lowry theory.

13. What is the IUPAC name of the following compound?

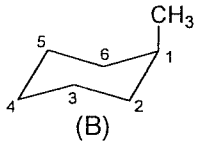


(1) 8-chloro-3-ethyl-2,7-dimethyl-4-octene
(2) 1-chloro-6-ethyl-2,7-dimethyl-4-octene
(3) 2-chloromethyl-6-ethyl-7-methyl-4-octene
(4) 1-chloro-2,7-dimethyl-6-ethyl-4-octene
(5) 7-chloromethyl-3-ethyl-2-methyl-4-octene

14. Which statement is correct with respect to the following conformations, **A** and **B** of methylcyclohexane.



(A)



(B)

(1) Conformations **A** is more stable therefore it does not converted to **B**.
(2) Conformation **B** is unstable because the methyl group shows 1,2- interactions with the axial H atoms at C-2 and C-6.
(3) Conformation **B** is unstable because the methyl group shows 1,3- interactions with the axial H atoms at C-3 and C-5.
(4) Conformation **A** is unstable because the methyl group shows 1,2-interactions with the axial H atoms at C-2 and C-4.
(5) Conformation **B** is unstable therefore it does not exist.

15. Consider the reaction of following two compounds **C** and **D** with the same solution of sodium ethoxide (EtO^-Na^+) in EtOH. Select the **correct** statement.

$CH_3CH_2CH_2Br$ (**C**) $\quad$ $CH_3CD_2CH_2Br$ (**D**)

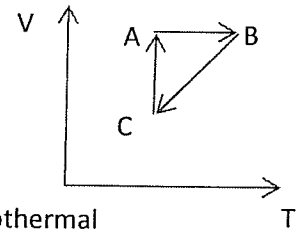
(1) **C** undergoes E2 type elimination while **D** undergoes E1 type elimination.
(2) Both reactions occur at the same rate because they are E2 elimination reactions.
(3) Both reactions occur at the same rate because they are E1 elimination reactions.
(4) Both undergo E1 elimination but the reaction with **D** is slower than that of C.
(5) Both undergo E2 elimination but the reaction with **D** is slower than that of C.

16. A gas behaves like an ideal gas under which of the following conditions,

(1) High pressure and low temperature
(2) High pressure and high temperature
(3) Low pressure and high temperature
(4) Atmospheric pressure and high temperature
(5) Low pressure and low temperature

17. The work done by a system is 10 J, when 40 J of heat energy is supplied to it calculate the increase in internal energy of the system.
(1) 30J (2) 50J (3) 40J (4) 20J (5) 0J

18. 2 moles of an ideal gas undergoes a series of changes in a cyclic process as shown in the figure. The processes A→ B, B→ C, C→ A are respectively,



(1) Isochoric, isobaric, isothermal
(2) Isobaric, isochoric, isothermal
(3) Isochoric, isothermal, isobaric
(4) Isobaric, isothermal, isochoric
(5) Isochoric, adiabatic, isobaric

19. Which is an extensive property,

(1) Temperature (2) Pressure (3) Gibbs free energy (4) Molar volume (5) Internal energy

20. Which of the following are not state functions?

(a) $q + w$ (b) q (c) w (d) $H - TS$

The correct answer is/are

(1) (a), (b) and (c) (2) (a) only (3) (b) only
(4) (c) only (5) (b), (c) and (d) only

21. Consider the following statements.

(a) In impressed current cathodic protection the metal object to be protected is connected to the negative terminal of a direct current source.

(b) The anode used in impressed current cathodic protection has to be replaced regularly since it gets used up in the protection process.

(c) Impressed current cathodic protection is preferred to sacrificial anode protection in cases where the surface area of the metal to be protected is large.

The correct statements, out of (a), (b) and (c) above, are

(1) (a) and (b) only (2) (a) and (c) only (3) (b) and (c) only
(4) All (a), (b) and (c) (5) None of the **answers** (1), (2), (3) or (4), is correct

22. One foot by one foot square thin steel sheets, which are made corrosion resistant using either zinc or a chromium coating, are required for an industrial application where they are exposed to the atmosphere. The said steel sheets must be cut from a bigger sheet. Consider the following statements.

As far as corrosion protection is concerned,

(a) application of the metallic coating first on the bigger sheet and then cutting it is the same as cutting first and then coating.

(b) Zinc coating is better than a chromium coating, if damage to the metallic coating of square sheets is a possibility, during the industrial application.

(c) both zinc and chromium coatings may be acceptable, if damage to the metallic coating of square sheets is **NOT** a possibility, during the industrial application.

The correct statements, out of (a), (b) and (c) above, are

(1) (a) and (b) only (2) (a) and (c) only (3) (b) and (c) only
(4) All (a), (b) and (c) (5) None of the **answers** (1), (2), (3) or (4), is correct

23. According to IUPAC conventions, the cell reaction corresponding to a cell diagram

(a) is written in such a way so that the oxidation takes place at the electrode on the left hand side.

(b) is written in such a way so that the cathodic half reaction takes place at the electrode on the right hand side.

(c) does <u>not</u> have to be spontaneous.

The correct statements, out of (a), (b) and (c) above, are

(1) (a) and (b) only. (2) (a) and (c) only. (3) (b) and (c) only.
(4) All (a), (b) and (c). (5) None of the **answers** (1), (2), (3) or (4), is correct.

24. Activity coefficient, γ_X, of an ionic species X in solution, is

(a) equal to zero at zero concentration of X.

(b) a unitless parameter.

(c) unity in the standard state of that ionic species.

The correct statements, out of (a), (b) and (c) above, are

(1) (a) and (b) only. (2) (a) and (c) only. (3) (b) and (c) only.
(4) All (a), (b) and (c). (5) None of the **answers** (1), (2), (3) or (4), is correct.

25. Consider the following cell diagram.

$$Mg(s)\left|Mg^{2+}(aq)\left(a_{Mg^{2+}}=1\right)\right\| H^{+}(aq)\left(a_{H^{+}}=1\right)\left|H_2(g)\left(P_{H_2}(g)=1\ bar\right)\right|Pt(s)$$

The electric potentials of Pt(s), Mg(s) and hydrogen ion solution for this cell are $\Phi_{Pt(s)}$, $\Phi_{Mg(s)}$ and $\Phi_{H^+(aq)}$, respectively, at 298 K and 1 bar.

Consider the following statements.

(a) $E^0_{Mg|Mg^{2+}} = \Phi_{Mg(s)} - \Phi_{Pt(s)}$ at 298 K.

(b) $\left|\Phi_{Pt(s)} - \Phi_{H^+(aq)}\right| \neq 0$ even though the electrode potential of the standard hydrogen electrode is zero.

(c) the electric potential of magnesium ion solution = $\Phi_{H^+(aq)}$

The correct statements, out of (a), (b) and (c) above, are

(1) (a) and (b) only. (2) (a) and (c) only. (3) (b) and (c) only.
(4) All (a), (b) and (c). (5) None of the **answers** (1), (2), (3) or (4), is correct.

26. The rate equation of the following reaction A + 2B -------> P is best represented by

1) $-\frac{d[A]}{dt} = k[A][B]^2$ (2) $-\frac{d[A]}{dt} = k[A]$ (3) $\frac{d[A]}{dt} = k[A][B]^2$

(4) $-\frac{d[B]}{dt} = k[B]^2$ (5) None of the above

27. Consider the rate constant, k= 2.4 x 10^{-4} mol $^{-1}$dm^3 s^{-1}. The value of the rate constant, k, in **SI units** is

(1) 2.4 x 10^{-1} (2) 2.4 x 10^{-7} (3) 4.0 x 10^{-7} (4) 4.0 x 10^{-9} (5) 4.0 x 10^{-8}

28. **A → P** is a first order reaction whose rate constant is 3.0 x 10^{-4} s^{-1} and the initial concentration of A = 0.50 mol dm^{-3}. The half – life of this reaction (**in min**) is, approximately,

(1) 35.0 (2) 38.7 (3) 77.4 (4) 111 (5) 2.33 x 10^3

29 (a) A catalyst increases the rate of a reaction by decreasing its activation energy.

(b) Molecularity and overall order of a reaction may be equal

(c) Half-life of a reaction is always independent of the initial concentration.

The correct statements, out of (a), (b) and (c) above, are

(1) (a) and (b) only (2) (b) and (c) only (3) (c) and (a) only

(4) None of (a), (b) and (c), is correct. (5) All of (a), (b) and (c) are correct

30. Consider the following expression giving the relationship between the two variables k (rate constant) and *T* (temperature)

$$k = Ae^{-\frac{Q}{T}}$$ (Q and A are constants)

The above equation is the same as

(1) $\ln k - \ln A = Q\left(\frac{1}{T}\right)$ (2) $\ln k = -Q\left(\frac{1}{T}\right) - \ln A$

(3) $\ln k = Q\left(\frac{1}{T}\right) - \ln A$ (4) $A = ke^{\frac{Q}{T}}$ (5) $k = \frac{1}{A}e^{\frac{Q}{T}}$

Section II – 6 Essay Type Questions

(Recommended time 2 hour)

01. Answer **all** parts (a), (b), and (c)

(a) The energy of the electron in the n^{th} level of a hydrogen atom is given by the equation,

$$E = -\frac{13.6}{n^2}\ eV$$

Predict what will happen if a photon with a wavelength 332 nm strikes the atom, when the electron is at n = 2 level. (1 eV = $1.602 \cdot 10^{-19}$ J)

(30 marks)

(b) Emission wavelengths of elements are used by chemists to find out whether specific elements are present in a sample. Characteristic wavelengths for some of the elements are given in the following table:

Element	Wavelength/nm
Ag	328.1
Au	267.6
Ba	455.4
Ca	422.7
Cu	324.8

Element	Wavelength/nm
Fe	372.0
K	404.7
Mg	285.2
Na	589.6
Ni	341.5

(i) Determine which elements emit radiation in the visible part of the spectrum.

(ii) Which element emits photons of highest energy? Of lowest energy?

(iii) When burned, a sample of an unknown substance is found to emit light of frequency $9.23 \times 10^{14}\ s^{-1}$. Which of these elements is suspected to be present in the sample?

(40 marks)

(c) (i) Write chemical equations to represent First ionization energy of lithium and Electron affinity of chlorine.

(ii) How many lithium atoms could be ionized form the energy released when 1 mol of electrons are added to 1 mol of gaseous Cl atoms?

The first ionization energy of Lithium = 5.2×10^{-1} J mol $^{-1}$

The electron affinity of Chlorine = - 349 kJ mol $^{-1}$

(iii) Explain why hydrogen chloride has a lower normal boiling point than either hydrogen fluoride or hydrogen bromide. (30 marks)

02. Answer **all** parts (a), (b) and (c).

(a) (i) Define the term, 'lattice energy'.

(ii) Draw a fully labeled Born- Haber cycle for the formation of MgO(s) and use the data given below to calculate the lattice energy of this oxide.

	kJ mol^{-1}
Enthalpy of formation of MgO	-602
Sublimation energy of Mg	148
1^{st} ionization potential of Mg	738
2^{nd} ionization potential of Mg	1451
Dissociation energy of O_2	498
1^{st} electron affinity of oxygen	-141
2^{nd} electron affinity of oxygen	798

(35 marks)

(b) (i) Using the concept of hybridization, predict the geometry of SF_2 and SF_6.

(ii) Draw the resonance structures for SO_4^{3-}

(30 marks)

(c) (i) Draw the molecular orbital energy diagram of N_2.

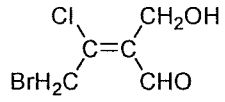
(ii) Draw and label the molecular orbitals formed by the overlap of two p_x orbitals. (z- axis is the inter- nuclear axis).

(35 marks)

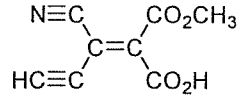
03. Answer **all** parts (a), (b) and (c).

(a) Indicating the priority of groups attached to the double bond according to Cahn-Ingold-Prelog rules determine the configuration of the double bond in each of the following alkenes as *E* or *Z*.

(i)

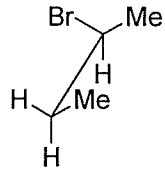


(ii)



(20 marks)

(b) One of the eclipsed conformation (along C-2, C-3 bond) of 2-bromobutaneis given below.



(i) Draw the **three** staggered conformations of 2-bromobutane and label them as **X**, **Y** and **Z**.

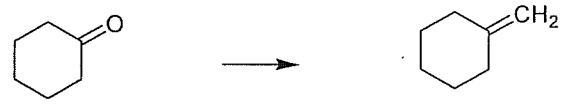
(ii) Giving reasons identify which conformation or conformations would undergo elimination reaction with alc. KOH?

(iii) Giving reasons postulate the structure of the **major product** with its stereochemistry.

(30 marks)

(c) Giving necessary reagents and conditions show how you would carry out any **TWO(02)** of the following conversion.

(i) 

(ii) 

(iii) 

(50 marks)

04. Answer **all** parts (a), (b), (c) and (d).

(a) State clearly the conditions under which the following thermodynamically deducible expressions can be applied

(i) $q = nRTln\frac{V_2}{V_1}$

(ii) $TV^{\gamma-1}$ = constant

(iii) $\Delta S = \int \frac{dq}{T}$

(iv) $dH = nC_{p,m}dT$

(v) $\Delta S = \frac{\Delta H}{T}$

(25 marks)

(b) At 298 K when glycine (NH_2CH_2COOH) is combusted in a bomb calorimeter 969 kJ mol^{-1} of heat is released under standard conditions according to,

$$NH_2CH_2COOH_{(s)} + 9/4\ O_2 \rightarrow 2CO_{2(g)} + 5/2\ H_2O_{(l)} + ½\ N_{2(g)}$$

Calculate the standard molar enthalpy of combustion. Assume ideal gas behavior. (25 marks)

(c) (i) Write down the mathematical expression of van der Waals equation.

(ii) 2 moles of ammonia gas occupied a volume of 5 dm^3 at 27^{0}C. If the gas obeyed van der Waals equation calculate the pressure exerted by the gas.

(a= 4.17 atm L^2 mol^{-2}; b = 0.0371 L mol^{-1}) (25 marks)

(d) 1000 moles of gaseous oxygen ($C_{v,m}$ = 5R/2) at an initial temperature of 727 ^{0}C and a pressure of 1000 atmospheres are cooled through a reversible adiabatic expansion to reach a final temperature of 227 ^{0}C. Calculate,

(i) the final pressure of the system

(ii) the change in enthalpy, ΔH accompanying the expansion

(iii) the change in entropy, ΔS accompanying the expansion

(25 marks)

05. Answer any **TWO (02)** parts out of (a), (b) and (c).

Use the following information to answer this question.

$$\Delta G = -nFE, \quad \log(\gamma_{\pm}) = -A|Z_+Z_-|\sqrt{I}, \quad I = 0.5 \times \sum_j c_j Z_j^2, \quad \log(\gamma_{\pm}) = -\frac{A|Z_+Z_-|\sqrt{I}}{1 + aB\sqrt{I}}$$

$$E = E^0 - \frac{RT}{nF}\ln(Q)$$

$$\left[\text{Data}: \quad F = 96500\ \text{C mol}^{-1}, \quad R = 8.314\ \text{J K}^{-1}\text{mol}^{-1}, \quad A = 0.509\ \text{dm}^{3/2}\ \text{mol}^{-1/2}\right]$$

(a) Often quinhydrone electrode is used in determining the pH of a solution. It is composed of an acidic aqueous solution of quinone $(C_6H_4O_2)$ and hydroquinone $(C_6H_6O_2)$ with a platinum wire dipped in it.

(i) Write down the electrode reaction in standard form.

(ii) Using standard notation, write down a half cell diagram to represent this electrode.

(iii) Giving reasons, state the chemical species whose concentrations determine the equilibrium potential difference at the solid/solution interface of this electrode.

(iv) Write down the Nernest equation for the electrode potential of this electrode and identify all the terms in it.

(50 marks)

(b) A scientist constructed a fuel cell which uses butane as the fuel. The electrolytic medium of the cell is acidic. The spontaneous cell reaction is

$$2\,CH_3CH_2CH_2CH_3 + 13\,O_2 \rightarrow 8\,CO_2 + 10\,H_2O\,.$$

He found out that the Gibbs free energy for this cell reaction to be $-5,400\ \text{kJ mol}^{-1}$.

(i) Write down the spontaneous anode reaction and spontaneous cathode reaction.

(ii) Deduce the charge number of this reaction.

(iii) Calculate the largest potential difference that may be observed across the two terminals of this fuel cell.

(iv) Calculate the rate of combustion of butane in units of mol s^{-1}, in this cell when a steady current of 15 A is drawn from it.

(50 marks)

(c) A student prepared a $1.5\ \text{mol dm}^{-3}$ aqueous solution of $Pb(NO_3)_2$, labeled as P,and a $1.5\ \text{mol dm}^{-3}$ aqueous solution of $Al(NO_3)_3$, labeled as Q.

(i) Write down the relationship between the ionic strength of a solution and concentration of ions in it and identify all the parameters in it.

(ii) Calculate the ionic strengths of P and Q.

(iii) Using Debye-Huckel limiting law show that the activity coefficient of $NO_3^-(aq)$ in P is larger than the activity coefficient of $NO_3^-(aq)$ in Q.

(50 marks)

06. Answer <u>all</u> parts (a), (b) and (c).

(a) The following represents the rate expression for an elementary reaction of the form

$$A + B \longrightarrow \text{products}$$

(i) Write down the rate expression for the above reaction using the standard symbols

(ii) Determine the **SI units** of the rate constant.

(iii) Assuming that this reaction is carried out with an excess amount of B relative to A, **derive** an expression for the **pseudo** rate constant (k^*) of the reaction in terms of the concentration of A, [A] at time, t and its initial concentration of $[A_o]$.

(36 marks)

(b) A certain reaction [A $\longrightarrow$ P] is found to follow the differential rate law,

$$-\frac{d[A]}{dt} = k$$

(i) Given that the initial concentration is $[A_o]$, derive the integrated form of the above equation.

(ii) If 25% of A undergoes reaction in 30 minutes, what would be the concentration of A at the end of one hour given that the initial concentration of A is 2.0×10^3 mol m^{-3}

(36 marks)

(c) $-\frac{d[A]}{dt} = k\,[A]^p\,[B]^q$ is the general expression that represents the rate equation for a reaction of the form A + B $\longrightarrow$ P

Briefly outline (including any associated mathematical expression and sketch of a graph) the principle of the **Initial Rate method** for the determination of the order with respect to A. (Experimental details are not necessary).

(28 marks)

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THE OPEN UNIVERSITY OF SRI LANKA

B.Sc Degree /Continuing Education Programme — Level 3

Final Examination — 2015/2016

CMU 1220/CME 3220

Basic Principles of Chemistry

MCQ Answer Sheet: Mark a cross $(\times)$ over the box that corresponds to the most suitable answer.

Index. No.

FOR EXAMINER'S USE ONLY		
Answers	No.	Marks
Correct		
Wrong		–
Unmarked		0.0
Total		

1	1	2	3	4	5	2	1	2	3	4	5	3	1	2	3	4	5	4	1	2	3	4	5
5	1	2	3	4	5	6	1	2	3	4	5	7	1	2	3	4	5	8	1	2	3	4	5
9	1	2	3	4	5	10	1	2	3	4	5	11	1	2	3	4	5	12	1	2	3	4	5
13	1	2	3	4	5	14	1	2	3	4	5	15	1	2	3	4	5	16	1	2	3	4	5
17	1	2	3	4	5	18	1	2	3	4	5	19	1	2	3	4	5	20	1	2	3	4	5
21	1	2	3	4	5	22	1	2	3	4	5	23	1	2	3	4	5	24	1	2	3	4	5
25	1	2	3	4	5	26	1	2	3	4	5	27	1	2	3	4	5	29	1	2	3	4	5
30	1	2	3	4	5																		

THE OPEN UNIVERSITY OF SRILANKA

B. Sc Degree / Continuing Education Programme – Level 3

Final Examination – 2015/2016

CMU1220 / CME3220 / – Basic Principles of Chemistry

(03 hours)

11th January 2017 **9.30 am – 12.30 am**

INSTRUCTIONS:

- This question paper consists of two sections.
- **Section I – 30 Multiple Choice Question** (MCQ) (Recommended time 1 hour).
- **Section II – Six (6) Essay Type Questions** (Recommended time 2 hour).
- Answer **all** questions in Section I and Section II.
- Submit the answer scripts for each section separately.
- The use of a **non-programmable** electronic calculator is permitted.
- You are **NOT allowed** to keep Mobile phones with you during the examination. Please **switch off** and leave them in a safe place.

Gas constant	$= 8.314\ J\ K^{-1}mol^{-1}$	Avogadro constant	$= 6.023 \times 10^{23}\ mol^{-1}$
Faraday constant (F)	$= 96{,}500\ C\ mol^{-1}$	Planck's constant (h)	$= 6.63 \times 10^{-34}\ J\ s$
Velocity of light (c)	$= 3.0 \times 10^{8}\ m\ s^{-1}$	Standard Atmospheric pressure	$= 10^{5}\ Pa\ (N\ m^{-2})$
Mass of an electron	$= 9.1 \times 10^{-31} kg$	Rydberg constant, R	$= 1.097 \times 10^{7}\ m^{-1}$

Section I – 30 Multiple Choice Questions

(Recommended time 1 hour)

- This section consists of 30 Multiple Choice Questions.
- Choose the most correct answer to each question and mark that answer with an "X" on the answer sheet.
- Use a **PEN** (not a pencil) to mark your answers.
- Any question with more than one answer marked will not be counted for grading.

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1. The electronic configuration of the 2+ ion of the element whose atomic number is 26 is:
   அணுவெண் 26 ஆகவுள்ள ஒரு மூலகத்தின் 2+ அயனினுடைய இலத்திரன் நிலையமைப்பானது:

   (1) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^4$
   (2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$
   (3) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^0\ 3d^6$
   (4) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^4\ 4p^2$
   (5) None of the answer (1), (2), (3) or (4)
   மேற்கூறியவற்றுள் எதுவுமன்று

2. Isoelectronic atoms and ions have identical
   (1) electron affinity (2) ionization enthalpy (3) number of electrons
   (4) radii (5) effective nuclear charge
   ஒத்த இலத்திரன் எண்ணிக்கையுடைய அணுக்களும் அயன்களும் ஒத்த ..... இனைக் கொண்டுள்ளன.
   (1) இலத்திரன் நாட்டம் (2) அயனாக்க வெப்பவுள்ளுறை (3) இலத்திரன் எண்ணிக்கை
   (4) ஆரை (5) பயன்படு கருவேற்றம்

3. Possible Quantum number set for a 3d electron of an atom in ground state is
   தரைநிலையிலுள்ள ஒரு அணுவின் 3d இலத்திரனுக்கு சாத்தியமான சக்திச் சொட்டெண்களின் தொகுதி

   (1) n =3, l = 1, m = - 2 to +2 , s = +1/2
   (2) n =3, l = 2, m = - 2 to +2 , s = - 1/2
   (3) n =3, l = 2, m = 1 , s = +1/2
   (4) n =2, l = 2, m = -2 to + 2 , s = +1/2
   (5) n =3, l = 0, m = -2 to + 2 , s = +1/2

4. Select the correct statement regarding the model/s of the atom.
   (1) In Thompson model the nucleus is embedded in the solid atom.
   (2) In Rutherford model the nucleus occupies half of the atomic space.
   (3) Bohr model can be used successfully to explain the spectrum of Na atom (vapour).
   (4) Any model on atomic structure is conceptual by nature.
   (5) **Both** in Rutherford and Bohr model electron occupies stationary orbits.

   அணுவின் மாதிரி/மாதிரிகள் தொடர்பான சரியான கூற்றைத் தெரிவு செய்க.
   (1) தொம்சன் மாதிரியில் கருவானது திண்ம அணுவில் பதிக்கப்பட்டிருக்கும்.
   (2) ருதவோட்டின் மாதிரியில் கருவானது அணுவின் வெளியில் அரைப்பங்கினைக் கொண்டிருக்கும்.
   (3) Na அணு (ஆவி) இன் நிறமாலையை விளக்குவதற்கு போரின் மாதிரி வெற்றிகரமாகப் பயன்படுத்தப்படமுடியும்.
   (4) அணுவமைப்பின் எந்த ஒரு மாதிரியும் இயற்கையில் எண்ணக்கரு சார்ந்தது.
   (5) போரின் மாதிரி மற்றும் ருதபோட்டின் மாதிரி ஆகிய இரண்டிலும் இலத்திரன்கள் நிலையான ஒழுக்கை கொண்டுள்ளன.

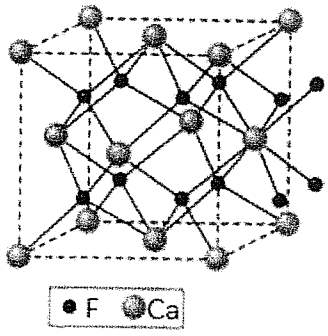
5. Consider the following statements.
   (a) An electron transition in H atom from n=3 to n =1 will give rise to a spectral line in Lyman series.
   (b) In an orbital, nodes are points with maximum electron density.
   (c) $(32)^{-1/2}\, r\, e^{-1/2} \cos\phi$ may be a wave function of s orbital.

   பின்வரும் கூற்றுகளைக் கருதுக.
   (a) H அணுவில் n = 3 இலிருந்து n = 1 இற்கான இலத்திரன் மாற்றம் லைமன் தொடரில் ஒரு நிறமாலைக் கோட்டினைத் தரும்.
   (b) ஒரு ஓபிற்றலில், கணுக்கள் என்பன இலத்திரன் அடர்த்தி கூடிய புள்ளிகளாகும்.
   (c) $(32)^{-1/2}\, r\, e^{-1/2} \cos ø$ என்பது s ஓபிற்றலின் ஒரு அலை செயற்பாடு ஆகலாம்.

   The correct statement/s out of the above is/are,
   மேற்தரப்பட்டவற்றுள் சரியான கூற்று/கூற்றுகள் ஆவது/ஆவன,

   (1) (a) only (2) (a) and (b) only (3) (a) and (c) only
   (4) (b) and (c) only (5) All (a), (b), (c)

6. The unit cell of CaF_2 is given below. The coordination numbers of Ca^{2+} and F^- respectively are,
   CaF_2 இன் அலகுக் கலம் (unit cell) கீழே தரப்பட்டுள்ளது. Ca^{2+} மற்றும் F^- இன் இணையி எண்கள் (coordination numbers) முறையே



(1) 4, 6 (2) 4, 8 (3) 8, 4 (iv) 6, 6 (v) 4, 4

7. Which of the following statement/s is/are true about BCl_3 molecule?
(a) It obeys the octet rule (b) It has tetrahedral geometry
(c) Its central atom is sp^2 hybridized (d) Cl-B-Cl bond angle is 120°

BCl_3 பற்றிய பின்வரும் கூற்றுக்களில் உண்மையானது / உண்மையானவை?
(a) இது அட்டக விதிக்கு அமையும்.
(b) இது நான்முகி வடிவத்தைக் கொண்டுள்ளது.
(c) இதன் மைய அணு sp^2 கலப்பினைக் கொண்டுள்ளது.
(d) Cl-B-Cl பிணைப்புக் கோணம் 120° ஆகும்.

nswer is
d (b) only (2) (b) and (c) only (3) (c) and (d) only
) only (5) (a), (b) and (c) only

ent(s) about O_2^+.
(b) It is paramagnetic
configuration is
$\pi_{2py}^2 \pi_{2px}^{*1} = \pi_{2py}^*$
hat of O_2

3. Pos
தரைந
சொட்டெ

(1) n =3,
(2) n =3, l
(3) n =3, l =
(4) n =2, l = 2,
(5) n =3, l = 0,

s of Ca^{2+} and F
Ca^{2+} மற்றும் F இன்
ப்பானது
$\rho x^{*1} = \pi 2py^*$
க நலிந்தது

The answer is

(1) (a) and (b) only (2) (b) and (c) only (3) (c) and (d) only

(4) (d) and (a) only (5) (a), (b) and (c) only

9. Which of the following species has tetrahedral geometry?
பின்வரும் எந்த இனம் நான்முகி வடிவத்தைக் கொண்டுள்ளது?

(1) ICl_3 (2) PCl_3 (3) SF_4 (4) ICl_5 (5) XeF_4

10. Which of the following molecules show non- zero dipole moment?
பின்வரும் எந்த மூலக்கூறுகள் பூச்சியமற்ற இருமுனைவுத் திருப்பத்தைக் காட்டுகின்றது?

(a) Cl_2CCH_2 (b) BF_3 (c) SO_3 (d) NF_3

The answer is

(1) (a) and (b) only (2) (b) and (c) only (3) (c) and (d) only

(4) (d) and (a) only (5) (a), (b) and (c) only

11. Which of the following statement is **incorrect**?

(1) Carbenes are electron deficient divalent carbon intermediates.
(2) Carbanions can react as nucleophiles.
(3) Carbanions are sp^2 hybridized pyramidal carbon intermediates.
(4) Carbocations are sp^2 hybridized planar carbon intermediates.
(5) Carbocations are electron deficient trivalent carbon intermediates.

பின்வரும் கூற்றுகளில் எது சரியானதன்று?

(1) காபீன்கள் இலத்திரன் குறைந்த ஈர் வலுவளவு காபன் இடைநிலைகளாகும்.
(2) காப்அன்னயன்கள் கருநாடிகளாகத் தொழிற்படமுடியும்.
(3) காப்அன்னயன்கள் sp^2 கலப்பு பிரமிட் காபன் இடைநிலைகளாகும்.
(4) காபோகற்றயன்கள் sp^2 கலப்பு தள காபன் இடைநிலைகளாகும்.
(5) காபோகற்றயன்கள் இலத்திரன் குறைந்த மூவலுவளவு காபன் இடைநிலைகளாகும்.

12. Which of the following statement is **incorrect**?

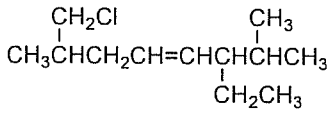
(1) Boron trifluoride can be considered as an acid according to the Lewis theory.
(2) Ammonia can be considered as a base according to the Brønsted-Lowry theory.
(3) Water can be considered as a base according to the Brønsted-Lowry theory.
(4) Water can be considered as an acid according to the Lewis theory.
(5) Ammonia can be considered as an acid according to the Brønsted-Lowry theory.

பின்வரும் கூற்றுகளில் எது சரியானதன்று?

(1) லூயியின் கொள்கைக்கிணங்க Boron trifluoride ஒரு அமிலமாகக் கருதப்படலாம்.
(2) புரோன்ஸ்டட்-லோரியின் கொள்கைக்கிணங்க அமோனியா ஒரு காரமாகக் கருதப்படலாம்.
(3) புரோன்ஸ்டட்-லோரியின் கொள்கைக்கிணங்க நீர் ஒரு காரமாகக கருதப்படலாம்.
(4) லூயியின் கொள்கைக்கிணங்க நீர் ஒரு அமிலமாகக் கருதப்படலாம்.
(5) புரோன்ஸ்டட்-லோரியின் கொள்கைக்கிணங்க அமோனியா ஒரு அமிரமாகக் கருதப்படலாம்.

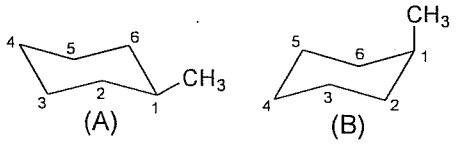
13. What is the IUPAC name of the following compound?

பின்வரும் சேர்வையின் IUPAC பெயர் என்ன?



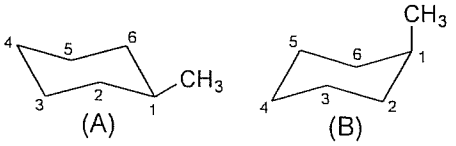
(1) 8-chloro-3-ethyl-2,7-dimethyl-4-octene
(2) 1-chloro-6-ethyl-2,7-dimethyl-4-octene
(3) 2-chloromethyl-6-ethyl-7-methyl-4-octene
(4) 1-chloro-2,7-dimethyl-6-ethyl-4-octene
(5) 7-chloromethyl-3-ethyl-2-methyl-4-octene

14. Which statement is correct with respect to the following conformations, **A** and **B** of methylcyclohexane.



(1) Conformations **A** is more stable therefore it does not converted to **B**.
(2) Conformation **B** is unstable because the methyl group shows 1,2- interactions with the axial H atoms at C-2 and C-6.
(3) Conformation **B** is unstable because the methyl group shows 1,3- interactions with the axial H atoms at C-3 and C-5.
(4) Conformation **A** is unstable because the methyl group shows 1,2-interactions with the axial H atoms at C-2 and C4.
(5) Conformation **B** is unstable therefore it does not exist.

methylcyclohexane இன் கட்டமைப்புகள் A மற்றும் B தொடர்பான பின்வரும் கூற்றுகளில் சரியானது எது?



(1) கட்டமைப்பு A அதிக உறுதியானது ஆகவே இது B ஆக மாற்றப்படுவதில்லை.

(2) கட்டமைப்பு B உறுதியற்றது. காரணம் மெதயில் கூட்டம் C-2 மற்றும் C-6 இலுள்ள அச்சு H அணுக்களுடன் 1,2- இடைவினைகளைக் காட்டுகின்றது.

(3) கட்டமைப்பு B உறுதியற்றது. காரணம் மெதயில் கூட்டம் C-3 மற்றும் C-5 இலுள்ள அச்சு H அணுக்களுடன் 1,3- இடைவினைகளைக் காட்டுகின்றது.

(4) கட்டமைப்பு A உறுதியற்றது. காரணம் மெதயில் கூட்டம் C-2 மற்றும் C-4 இலுள்ள அச்சு H அணுக்களுடன் 1,2- இடைவினைகளைக் காட்டுகின்றது.

(5) கட்டமைப்பு B உறுதியற்றது. ஆதலால் இது நிலைத்திருப்பதில்லை.

15. Consider the reaction of following two compounds **C** and **D** with the same solution of sodium ethoxide (EtO^-Na^+) in EtOH. Select the **correct** statement.

$CH_3CH_2CH_2Br$ (**C**) $CH_3CD_2CH_2Br$ (**D**)

(1) **C** undergoes E2 type elimination while **D** undergoes E1 type elimination.

(2) Both reactions occur at the same rate because they are E2 elimination reactions.

(3) Both reactions occur at the same rate because they are E1 elimination reactions.

(4) Both undergo E1 elimination but the reaction with **D** is slower than that of C.

(5) Both undergo E2 elimination but the reaction with D is slower than that of C.

பின்வரும் இரு சேர்வைகள் C, D யின் EtOH இலுள்ள கரைசல் sodium ethoxide (EtO^-Na^+) உடனான தாக்கத்தைக் கருதுக. சரியான கூற்றைத் தேர்ந்தெடுக்க.

$CH_3CH_2CH_2Br$ (**C**) $CH_3CD_2CH_2Br$ (**D**)

(1) D ஆனது E1 வகை நீக்கலிற்கு உள்ளாகின்ற அதேவேளை C ஆனது E2 வகை நீக்கலிற்கு உள்ளாகின்றது.

(2) இரு தாக்கங்களும் ஒரே வீதத்தில் நிகழ்கின்றன ஏனெனில் அவை E2 நீக்கல் தாக்கங்கள்.

(3) இரு தாக்கங்களும் ஒரே வீதத்தில் நிகழ்கின்றன ஏனெனில் அவை E1 நீக்கல் தாக்கங்கள்.

(4) இரண்டும் E1 நீக்கலிற்கு உள்ளாகின்றன எனினும் D உடனான தாக்கம் C உடனானதிலும் பார்க்க வேகம் குறைந்தது.

(5) இரண்டும் E2 நீக்கலிற்கு உள்ளாகின்றன எனினும் D உடனான தாக்கம் C உடனானதிலும் பார்க்க வேகம் குறைந்தது.

16. A gas behaves like an ideal gas under which of the following conditions,

(1) High pressure and low temperature

(2) High pressure and high temperature

(3) Low pressure and high temperature

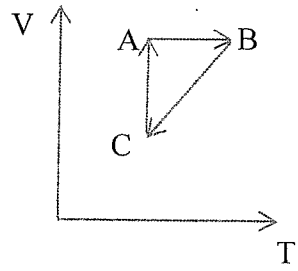
(4) Atmospheric pressure and high temperature
(5) Low pressure and low temperature

பின்வரும் எந்த நிபந்தனைகளின் கீழ் ஒரு வாயு இலட்சிய வாயுவாக நடந்துகொள்கிறது?
(1) உயர் அழுக்கம் மற்றும் தாழ் வெப்பநிலை
(2) உயர் அழுக்கம் மற்றும் உயர் வெப்பநிலை
(3) தாழ் அழுக்கம் மற்றும் உயர் வெப்பநிலை
(4) வளிமண்டல அழுக்கம் மற்றும் உயர் வெப்பநிலை
(5) தாழ் அழுக்கம் மற்றும் தாழ் வெப்பநிலை

17. The work done by a system is 10 J, when 40 J of heat energy is supplied to it calculate the increase in internal energy of the system.
ஒரு அமைப்பினால் செய்யப்படும் வேலை 10 J ஆகும். இதற்கு 40 J வெப்ப சக்தி வழங்கப்படும்போது, அமைப்பின் அகச்சக்தியில் ஏற்படும் மாற்றத்தினைக் கணிக்குக.

(1) 30J (2) 50J (3) 40J (4) 20J (5) 0J

18. 2 moles of an ideal gas undergoes a series of changes in a cyclic process as shown in the figure. The processes A→ B, B→ C, C→ A are respectively,
படத்தில் காட்டியவாறு, 2 mol வாயு ஒன்று ஒரு வட்டச் செயன்முறையில் ஒரு தொடர் மாற்றத்திற்கு உள்ளாகின்றது. செயன்முறைகள் A → B, B → C, C → A என்பன முறையே,



(1) Isochoric, isobaric, isothermal : மாறாக்கனவளவு, மாறாஅழுக்க, சமவெப்ப
(2) Isobaric, isochoric, isothermal: மாறாஅழுக்க, மாறாக்கனவளவு, சமவெப்ப
(3) Isochoric, isothermal, isobaric: மாறாக்கனவளவு, சமவெப்ப, மாறாஅழுக்க
(4) Isobaric, isothermal, isochoric: மாறாஅழுக்க, சமவெப்ப, மாறாக்கனவளவு
(5) Isochoric, adiabatic, isobaric: மாறாக்கனவளவு, சேறலில்லாத, மாறாஅழுக்க

19. Which is an extensive property,
(1) Temperature (2) Pressure (3) Gibbs free energy
(4) Molar volume (5) Internal energy

எது ஒரு விரிவானவியல்பு,

(a) வெப்பநிலை (b) அழுக்கம் (c) கிப்ஸ் சுயாதீன சக்தி (Gibbs free energy)

(d) மூலர் கனவளவு (e) அகச் சக்தி (உள்ளீட்டுச் சக்தி)

20. Which of the following are not state functions?

பின்வருவனவற்றில் எவை நிலைத்தொழிற்பாடு,

(a) $q + w$ (b) q (c) w (d) $H - TS$

The correct answer is/are : சரியான விடை/விடைகள்

(1) (a), (b) and (c) (2) (a) only (3) (b) only

(4) (c) only (5) (b), (c) and (d) only

21. Consider the following statements.

(a) In impressed current cathodic protection the metal object to be protected is connected to the negative terminal of a direct current source.

(b) The anode used in impressed current cathodic protection has to be replaced regularly since it gets used up in the protection process.

(c) Impressed current cathodic protection is preferred to sacrificial anode protection in cases where the surface area of the metal to be protected is large.

The correct statements, out of (a), (b) and (c) above, are

பின்வரும் கூற்றுகளைக் கருதுக.

(a) அழுத்திய மின் கதோட்டு பாதுகாப்பில், பாதுகாக்கப்பட வேண்டிய உலோகம் ஆனது நேரோட்ட மின் தோற்றுவாயின் மறை முனையுடன் இணைக்கப்பட்டிருக்கும்.

(b) அழுத்திய மின் கதோட்டு பாதுகாப்பில் பயன்படும் அனோட்டானது தொடர்ச்சியாக மாற்றப்படவேண்டும். ஏனெனில் இது பாதுகாப்பு முறையில் பயன்பாட்டிற்கு உள்ளாகின்றது.

(c) பாதுகாக்கப்பட வேண்டிய உலோகத்தின் மேற்பரப்பு பெரிதாக இருக்கும் பட்சத்தில், அழுத்திய மின் கதோட்டு பாதுகாப்பானது, அர்ப்பணிப்புள்ள அனோட்டு பாதுகாப்பினை விட அதிகமாக விரும்பப்படுகின்றது.

மேலே (a), (b) மற்றும் (c) ஆகியற்றுள் சரியான கூற்றுகள் ஆவன,

(1) (a) and (b) only (2) (a) and (c) only (3) (b) and (c) only

(4) All (a), (b) and (c) (5) None of the **answers** (1), (2), (3) or (4), is correct

22. One foot by one foot square thin steel sheets, which are made corrosion resistant using either zinc or a chromium coating, are required for an industrial application where they are exposed to the atmosphere. The said steel sheets must be cut from a bigger sheet. Consider the following statements.

As far as corrosion protection is concerned,

(a) application of the metallic coating first on the bigger sheet and then cutting it is the same as cutting first and then coating.

(b) Zinc coating is better than a chromium coating, if damage to the metallic coating of square sheets is a possibility, during the industrial application.

(c) both zinc and chromium coatings may be acceptable, if damage to the metallic coating of square sheets is **NOT** a possibility, during the industrial application.

The correct statements, out of (a), (b) and (c) above, are

ஒரு கைத்தொழில் பயன்பாட்டிற்கு, நாகம் அல்லது குரோமியத்தினால் பூச்சிடப்பட்டு துருப்பிடித்தல் தடைசெய்யப்பட்ட ஒரு அடிக்கு ஒரு அடி அளவுள்ள மெல்லிய உருக்குத் தகடுகள் தேவைப்படுகின்றன. இங்கு இவை வளிமண்டலத்திற்கு திறக்கப்பட்டுள்ளன. இவை ஒரு பெரிய தகட்டிலிருந்து வெட்டியெடுக்கப்படுகின்றன. பின்வரும் கூற்றுகளைக் கருதுக.
துருப்பிடித்தல் பாதுகாப்பினைப் பொறுத்தவரை,

(a) பெரிய தகட்டிற்கு முதலில் உலோகப் பூச்சிட்டு பின்னர் வெட்டியெடுப்பதும், முதலில் வெட்டியெடுத்து பின்னர் உலோகப் பூச்சிடுவதும் ஒத்த தன்மையுடையன.

(b) கைத்தொழில் பயன்பாட்டின்போது சதுரத் தகடுகளின் உலோகப் பூச்சிற்கு சேதம் உண்டாவதற்கான சாத்தியப்பாடு இருக்குமாயின், குரோமியம் பூச்சினை விட நாகப் பூச்சு சிறந்தது.

(c) கைத்தொழில் பயன்பாட்டின்போது சதுரத் தகடுகளின் உலோகப் பூச்சிற்கு சேதம் உண்டாவதற்கான சாத்தியப்பாடு இல்லாத பட்சத்தில், குரோமியம் பூச்சு, நாகப் பூச்சு ஆகிய இரண்டுமே ஏற்றுக் கொள்ளப்படத்தக்கன.

மேலே (a), (b) மற்றும் (c) ஆகியற்றுள் சரியான கூற்றுகள் ஆவன,

(1) (a) and (b) only (2) (a) and (c) only (3) (b) and (c) only
(4) All (a), (b) and (c) (5) None of the **answers** (1), (2), (3) or (4), is correct

23. According to IUPAC conventions, the cell reaction corresponding to a cell diagram

(a) is written in such a way so that the oxidation takes place at the electrode on the left hand side.

(b) is written in such a way so that the cathodic half reaction takes place at the electrode on the right hand side.

(c) does <u>not</u> have to be spontaneous.

The correct statements, out of (a), (b) and (c) above, are

IUPAC விதிப்படி, ஒரு கல வரைபடத்துடன் தொடர்புடைய கலத்தாக்கம்,

(a) ஒட்சியேற்றமானது இடதுபுற மின்வாயில் நிகழ்வதாக எழுதப்படும்.

(b) கதோட்டு அரைத்தாக்கமானது வலதுபுற மின்வாயில் நிகழ்வதாக எழுதப்படும்.

(c) சுயாதீனமாக இருக்கவேண்டிய அவசியமில்லை.

மேலே (a), (b) மற்றும் (c) ஆகியற்றுள் சரியான கூற்றுகள் ஆவன,

(1) (a) and (b) only. (2) (a) and (c) only. (3) (b) and (c) only.
(4) All (a), (b) and (c). (5) None of the **answers** (1), (2), (3) or (4), is correct.

24. Activity coefficient, γ_X , of an ionic species X in solution, is
(a) equal to zero at zero concentration of X.
(b) a unitless parameter.
(c) unity in the standard state of that ionic species.

The correct statements, out of (a), (b) and (c) above, are

ஒரு கரைசலிலுள்ள ஒரு அயனிக் இனம் X இன் செயற்பாட்டுக் குணகம் γ_X ஆனது,

(a) X இன் பூச்சிய செறிவில் பூச்சியத்திற்கு இணையானது.

(b) ஒரு அலகற்ற பரமானம்

(c) அவ் அயனியின் நியம நிலையில் இணைந்திருத்தல்.

மேலே (a), (b) மற்றும் (c) ஆகியற்றுள் சரியான கூற்றுகள் ஆவன,

(1) (a) and (b) only. (2) (a) and (c) only. (3) (b) and (c) only.
(4) All (a), (b) and (c). (5) None of the **answers** (1), (2), (3) or (4), is correct.

25. Consider the following cell diagram.

$$Mg(s)\left| Mg^{2+}(aq)\left(a_{Mg^{2+}}=1\right)\right\| H^+(aq)\left(a_{H^+}=1\right)\left| H_2(g)\left(P_{H_2}(g)=1\text{ bar}\right)\right|Pt(s)$$

The electric potentials of Pt(s), Mg(s) and hydrogen ion solution for this cell are $\Phi_{Pt(s)}$, $\Phi_{Mg(s)}$ and $\Phi_{H^+(aq)}$, respectively, at 298 K and 1 bar.

Consider the following statements.

(a) $E^0_{Mg|Mg^{2+}} = \Phi_{Mg(s)} - \Phi_{Pt(s)}$ at 298 K.

(b) $\left|\Phi_{Pt(s)} - \Phi_{H^+(aq)}\right| \neq 0$ even though the electrode potential of the standard hydrogen electrode is zero.

(c) the electric potential of magnesium ion solution = $\Phi_{H^+(aq)}$

The correct statements, out of (a), (b) and (c) above, are

பின்வரும் கலவரைபடத்தைக் கருதுக.

$$Mg(s)\left| Mg^{2+}(aq)\left(a_{Mg^{2+}}=1\right)\right\| H^{+}(aq)\left(a_{H^{+}}=1\right)\left| H_2(g)\left(P_{H_2}(g)=1\,bar\right)\right|Pt(s)$$

298 K இலும் 1 பார் அமுக்கத்திலும், இக் கலத்திற்கான Pt(s), Mg(s) மற்றும் ஐதரசன் அயன் கரைசலின் மின்னழுத்தங்களாவன முறையே $\phi_{Pt(s)}$, $\phi_{Mg(s)}$, $\phi_{H+(aq)}$ ஆகும்.

பின்வரும் கூற்றுகளைக் கருதுக.

(a) 298 K இல் $E^0_{Mg|Mg2+} = \phi_{Mg(s)} - \phi_{Pt(s)}$

(b) நியம ஐதரசன் மின்வாயின் அழுத்தம் 0 ஆக இருந்தபோதிலும், $|\phi_{Pt(s)} - \phi_{H+(aq)}| \neq 0$.

(c) மக்னீசியம் அயன் கரைசலின் மின்னழுத்தம் = $\Phi_{H^+(aq)}$

மேலே (a), (b) மற்றும் (c) ஆகியற்றுள் சரியான கூற்றுகள் ஆவன,

(1) (a) and (b) only. (2) (a) and (c) only. (3) (b) and (c) only.
(4) All (a), (b) and (c). (5) None of the **answers** (1), (2), (3) or (4), is correct.

26. The rate equation of the following reaction A + 2B $\longrightarrow$ P is best represented by

A + 2B $\longrightarrow$ P எனும் தாக்கத்திற்கான தாக்க வீத சமன்பாட்டை சிறப்பாக பிரதிநிதித்துவப்படுத்துவது,

1) $-\frac{d[A]}{dt} = k[A][B]^2$ (2) $-\frac{d[A]}{dt} = k[A]$ (3) $\frac{d[A]}{dt} = k[A][B]^2$

(4) $-\frac{d[B]}{dt} = k[B]^2$ (5) None of the above

27. Consider the rate constant, k = 2.4 x 10^{-4} mol $^{-1}$dm^3 s^{-1}. The value of the rate constant, k, in **SI units** is

k = 2.4 x 10^3 mol^{-1}dm^3 s^{-1} எனும் தாக்க மாறிலியைக் கருதுக. தாக்க மாறிலி k இன் பெறுமதி **SI அலகுகளில்,**

(1) 2.4 x 10^{-1} (2) 2.4 x 10^{-7} (3) 4.0 x 10^{-7} (4) 4.0 x 10^{-9} (5) 4.0 x 10^{-8}

28. **A → P** is a first order reaction whose rate constant is 3.0 x 10^{-4} s^{-1} and the initial concentration of A = 0.50 mol dm^{-3}. The half – life of this reaction (**in min**) is, approximately,

A → P என்பது தாக்க மாறிலி $3.0 \times 10^{-4}\ s^{-1}$ ஐயுடைய ஒரு முதல் வரிசைத் தாக்கமாகும். A யின் ஆரம்ப செறிவு = $0.50\ mol\ dm^{-3}$ ஆகும். இத் தாக்கத்தின் அரைவாழ்வுக் காலம் **(நிமிடங்களில்)** ஏறத்தாழ,

(1) 35.0 (2) 38.7 (3) 77.4 (4) 111 (5) 2.33×10^3

29 (a) A catalyst increases the rate of a reaction by decreasing its activation energy.
(b) Molecularity and overall order of a reaction may be equal
(c) Half-life of a reaction is always independent of the initial concentration.

The correct statements, out of (a), (b) and (c) above, are

(a) ஒரு ஊக்கியானது, தாக்கத்தின் ஏவற்சக்தியைக் குறைப்பதன் மூலம் அதன் தாக்க வீதத்தை அதிகரிக்கின்றது.

(b) ஒரு தாக்கத்தின் மூலர்திறன் அதன் மொத்தத் தாக்க வரிசை சமமாக இருக்கலாம்.

(c) ஒரு தாக்கத்தின் அரைவாழ்வுக் காலமானது, ஒருபோதும் அதன் ஆரம்ப செறிவில் தங்கியிருக்காது.

மேலே (a), (b) மற்றும் (c) ஆகியற்றுள் சரியான கூற்றுகள் ஆவன,

(1) (a) and (b) only (2) (b) and (c) only (3) (c) and (a) only
(4) None of (a), (b) and (c), is correct. (5) All of (a), (b) and (c) are correct

30. Consider the following expression giving the relationship between the two variables k (rate constant) and T (temperature)

$$k = Ae^{-\frac{Q}{T}}$$ (Q and A are constants)

The above equation is the same as

இரு மாறிகள் k (வீத மாறிலி), T (வெப்பநிலை) என்பவற்றிற்கு இடையிலான தொடர்பினைத் தரும் பின்வரும் வெளிப்பாடுகளைக் கருதுக.

$$k = Ae^{-\frac{Q}{T}}$$ (Q மற்றும் A ஆகியன மாறிலிகள்)

மேற்தரப்பட்ட சமன்பாடானது பின்வரும் எதற்கு சமமானது?

(1) $\ln k - \ln A = Q\left(\frac{1}{T}\right)$ (2) $\ln k = -Q\left(\frac{1}{T}\right) - \ln A$

(3) $\ln k = Q\left(\frac{1}{T}\right) - \ln A$ (4) $A = ke^{\frac{Q}{T}}$ (5) $k = \frac{1}{A}e^{\frac{Q}{T}}$

Section II – 6 Essay Type Questions

(Recommended time 2 hour)

1. Answer **all** parts (a), (b), (c)

(a) The energy of the electron in the n^{th} level of a hydrogen atom is given by the equation,

$$E = -\frac{13.6}{n^2}\ eV$$

Predict what will happen if a photon with a wavelength 332 nm strikes the atom, when the electron is at n = 2 level. ($1\ eV = 1.602 \cdot 10^{-19}\ J$)

(30 marks)

(b) Emission wavelengths of elements are used by chemists to find out whether specific elements are present in a sample. Characteristic wavelengths for some of the elements are given in the following table:

Element	Wavelength/nm
Ag	328.1
Au	267.6
Ba	455.4
Ca	422.7
Cu	324.8

Element	Wavelength/nm
Fe	372.0
K	404.7
Mg	285.2
Na	589.6
Ni	341.5

(i) Determine which elements emit radiation in the visible part of the spectrum.

(ii) Which element emits photons of highest energy? Of lowest energy?

(iii) When burned, a sample of an unknown substance is found to emit light of frequency $9.23 \times 10^{14}\ s^{-1}$. Which of these elements is suspected to be present in the sample?

(40 marks)

(c) (i) Write chemical equations to represent First ionization energy of lithium and Electron affinity of chlorine.

(ii) How many lithium atoms could be ionized form the energy released when 1 mol of electrons are added to 1 mol of gaseous Cl atoms?

The first ionization energy of Lithium = $5.2 \times 10^{-1}\ J\ mol^{-1}$

The electron affinity of Chlorine = $-349\ kJ\ mol^{-1}$

(iii)Explain why hydrogen chloride has a lower normal boiling point than either hydrogen fluoride or hydrogen bromide.

(30 marks)

1. எல்லா பகுதிகளுக்கும் விடையளிக்குக

(a) ஐதரசன் அணுவின் $n^{வது}$ மட்டத்திலுள்ள இலத்திரனின் சக்தி பின்வரும் சமன்பாட்டினால் தரப்படும்.

$$E = - \frac{13.6}{n^2} eV$$

இலத்திரன் n = 2 ஆம் மட்டத்தில் உள்ளபோது, அவ் அணுவினை அலைநீளம் 332 nm ஆகவுள்ள ஒரு போட்டோன் தாக்கும்போது என்ன நிகழும் என ஊகிக்குக.
($1 eV = 1.602 \times 10^{-19} J$)

(30 புள்ளிகள்)

(b) ஒரு மாதிரியில் குறிப்பிட்ட மூலகங்கள் உள்ளனவா எனக் கண்டறிவதற்கு இரசாயனவியலாளர்களால் அம் மூலகங்களின் காலல் அலைநீளங்கள் பயன்படுத்தப்படுகின்றன. சில மூலகங்களும் அவற்றிற்கே உரிய அலைநீளங்களும் கீழே அட்டவணையில் தரப்பட்டுள்ளன:

மூலகம்	அலைநீளம்/nm
Ag	328.1
Au	267.6
Ba	455.4
Ca	422.7
Cu	324.8

மூலகம்	அலைநீளம் /nm
Fe	372.0
K	404.7
Mg	285.2
Na	589.6
Ni	341.5

(i) நிறமாலையின் கட்புலன் பகுதியில் கதிர்ப்பினைக் காலும் மூலகங்களைத் தீர்மானிக்குக.

(ii) எம் மூலகம் மிக உயர் சக்தி போட்டோன்களைக் காலும்? மிக தாழ் சக்தி போட்டோன்களைக் காலும்?

(iii) ஒரு அறியப்படாத பதார்த்தத்தின் மாதிரி எரிக்கப்படும்போது, அது $9.23 \times 10^{14} s^{-1}$ எனும் மீடிறனில் ஒளியைக் காலுவதாக அறியப்பட்டது. இம் மாதிரியில் இருப்பதாக கருதப்படக்கூடிய மூலகங்கள் பின்வருவனவற்றுள் எவை?

(40 புள்ளிகள்)

(c) (i) இலிதியத்தின் முதலாம் அயனாக்க சக்தியையும், குளோரினின் இலத்திரன் நாட்டத்தினையும் பிரதிபலிக்கக்கூடிய இரசாயனத் தாக்கங்களை எழுதுக.

(ii) 1 மூல் வாயு Cl அணுக்களிற்கு 1 மூல் இலத்திரன்களை சேர்க்கும்போது உருவாகும் சக்தியைப் பயன்படுத்தி எத்தனை இலிதியம் அணுக்கள் அயனாக்கப்படமுடியும்?
இலிதியத்தின் முதலாம் அயனாக்க சக்தி $= 5.2 \times 10^{-1} J\ mol^{-1}$.

(iii) ஐதரசன் குளோரைட்டானது, ஐதரசன் புளோரைட்டினதோ அல்லது ஐதரசன் புரோமைட்டினதோ சாதாரண கொதிநிலையிலும் பார்க்கக் குறைந்த கொதிநிலையினைக் கொண்டுள்ளது. காரணத்தை விளக்குக.

குளோரினின் இலத்திரன் நாட்டம் $= -349\ kJ\ mol^{-1}$.

(30 புள்ளிகள்)

2. Answer **all** parts (a), (b) and (c).

(a) (i) Define the term, 'lattice energy'.

(ii) Draw a fully labeled Born- Haber cycle for the formation of MgO(s) and use the data given below to calculate the lattice energy of this oxide.

	kJ mol^{-1}
Enthalpy of formation of MgO	-602
Sublimation energy of Mg	148
1st ionization potential of Mg	738
2nd ionization potential of Mg	1451
Dissociation energy of O_2	498
1st electron affinity of oxygen	-141
2nd electron affinity of oxygen	798

(35 marks)

(b) (i) Using the concept of hybridization, predict the geometry of SF_2 and SF_6.

(ii) Draw the resonance structures for SO_4^{3-}

(30 marks)

(c) (i) Draw the molecular orbital energy diagram of N_2.

(ii) Draw and label the molecular orbitals formed by the overlap of two p_x orbitals. (z- axis is the inter- nuclear axis).

(35 marks)

2. எல்லா பகுதிகளுக்கும் விடையளிக்குக

(a) (i) 'சாலக சக்தி' எனும் பதத்தினை வரையறுக்குக.

(ii) $MgO_{(s)}$ இன் முழுமையான பெயரிடப்பட்ட போர்ன்-ஹார்பர் சக்கரத்தை (Born - Haber cycle) வரைந்து கீழே தரப்பட்ட தரவுகளைப் பயன்படுத்தி இவ் ஒட்சைட்டின் சாலக சக்தியைக் கணிக்குக.

	kJ mol^{-1}
MgO இன் தோன்றல் வெப்பவுள்ளுறை	-602
Mg இன் பதங்கமாதல் சக்தி	148
Mg இன் 1ம் அயனாக்க அழுத்தம்	738
Mg இன் 2ம் அயனாக்க அழுத்தம்	1451
O_2 இன் பிரிகை சக்தி	498
ஒட்சிசனின் 1ம் இலத்திரன் நாட்டம்	-141
ஒட்சிசனின் 2ம் இலத்திரன் நாட்டம்	798

(35 புள்ளிகள்)

(b) (i) கலப்புக் கொள்கையைப் பயன்படுத்தி, SF_2 மற்றும் SF_6 இன் வடிவத்தைக் கணிக்க.

(ii) SO_4^{3-} இற்கான பரிவுக் கட்டமைப்புகளை வரைக.

(30 புள்ளிகள்)

(c) (i) N_2 இன் மூலக்கூற்று ஓபிற்றல் சக்தி வரைபடத்தினை வரைக.

(ii) இரு p_x ஓபிற்றல்களின் மேற்பொருந்துகையினால் உருவாக்கப்படும் மூலக்கூற்று ஓபிற்றல்களை வரைந்து பெயரிடுக. (Z அச்சு கரு-இடை அச்சாகும்)

(35 புள்ளிகள்)

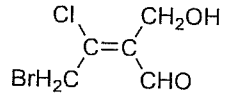
3. Answer **all** parts (a), (b) and (c).

(a) Indicating the priority of groups attached to the double bond according to Cahn-Ingold-Prelog rules determine the configuration of the double bond in each of the following alkenes as *E* or *Z*.

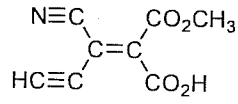
கான்-இன்கோல்ட்-புரோலொக் (Cahn-Ingold-Prelog) விதிகளின்படி இரட்டைப் பிணைப்புகளுடன் இணைந்துள்ள கூட்டங்களின் முதன்மை ஒழுங்கினைக் குறித்துக்காட்டி, பின்வரும் ஒவ்வொரு அற்கீன்களினதும் இரட்டைப் பிணைப்பு அமைப்பை E அல்லது Z என வரையறுக்குக.

(20 marks)

(i)

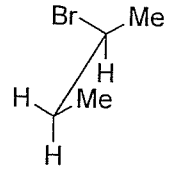


(ii)



(b) One of the eclipsed conformation (along C-2, C-3 bond) of 2-bromobutane is given below.

2-bromobutane கிரகண அமைப்பு (eclipsed conformation) (C-2, C-3 பிணைப்பு வழியே) கீழே தரப்பட்டுள்ளது.



(i) Draw the **three** staggered conformations of 2-bromobutane and label them as **X**, **Y** and **Z**.

2-bromobutane இன் மூன்று எதிரமைப்புகளை வரைந்து அவற்றை X, Y, Z எனப் பெயரிடுக.

(ii) Giving reasons identify which conformation or conformations would undergo elimination reaction with alc. KOH?

காரணங்கள் தந்து, எவ் அமைப்பு அல்லது அமைப்புகள் alc. KOH உடன் நீக்கற் தாக்கத்திற்கு உட்படும் என இனங்காண்க.

(iii) Giving reasons postulate the structure of the **major product** of the above reaction (ii) showing its stereochemistry.

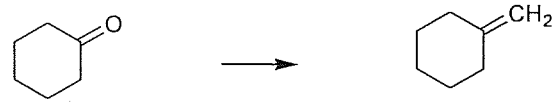
காரணங்கள் தந்து, மேற்கூறியதாக்கம் (ii) இன் பிரதான விளைவின் கட்டமைப்பினை அதன் முப்பரிமாண அமைப்புடன் அனுமானிக்க.

(30 marks)

(c) Giving necessary reagents and conditions show how you would carry out any **TWO (02)** of the following conversion.

அவசியமான தாக்குபொருட்கள் மற்றும் நிபந்தனைகளைத் தந்து, பின்வரும் மாற்றீடுகளில் ஏதேனும் இரண்டினை எவ்வாறு மேற்கொளிவீர் எனக் காட்டுக.

(i) 

(ii) 

(iii) 

(50 marks)

4. Answer **all** parts (a), (b), (c) and (d).

(a) State clearly the conditions under which the following thermodynamically deducible expressions can be applied

(i) $q = nRTln\frac{V_2}{V_1}$

(ii) $TV^{\gamma-1} = \text{constant}$

(iii) $\Delta S = \int \frac{dq}{T}$

(iv) $dH = nC_{p,m}dT$

(v) $\Delta S = \frac{\Delta H}{T}$

(25 marks)

(b) At 298 K when glycine (NH_2CH_2COOH) is combusted in a bomb calorimeter 969 kJ mol^{-1} of heat is released under standard conditions according to,

$NH_2CH_2COOH_{(s)} + 9/4\ O_2 \rightarrow 2CO_{2(g)} + 5/2\ H_2O_{(l)} + ½\ N_{2(g)}$

Calculate the standard molar enthalpy of combustion. Assume ideal gas behavior.

(25 marks)

(c) (i) Write down the mathematical expression of van der Waals equation.

(ii) 2 moles of ammonia gas occupied a volume of 5 dm^3 at 27^0C. If the gas obeyed van der Waals equation calculate the pressure exerted by the gas. (a= 4.17 atm L^2 mol^{-2}; b = 0.0371 L mol^{-1})

(25 marks)

(d) 1000 moles of gaseous oxygen ($C_{v,m}$ = 5R/2) at an initial temperature of 727 ^{0}C and a pressure of 1000 atmospheres are cooled through a reversible adiabatic expansion to reach a final temperature of 227 ^{0}C. Calculate,

(i) the final pressure of the system

(ii) the change in enthalpy, ΔH accompanying the expansion

(iii) the change in entropy, ΔS accompanying the expansion

(25 marks)

4. எல்லா பகுதிகளுக்கும் விடையளிக்குக

(a) பின்வரும் வெப்பவியக்கவியல் அடிப்படையில் உய்த்தறியப்படும் வெளிப்பாடுகள் எந்த நிபந்தனைகளின் கீழ் பிரயோகிக்கப்படமுடியும் எனத் தெளிவாகத் தருக.

(i) $q = nRTln\frac{V_2}{V_1}$

(ii) $TV^{\gamma-1}$ = constant

(iii) $\Delta S = \int \frac{dq}{T}$

(iv) $dH = nC_{p,m}dT$

(v) $\Delta S = \frac{\Delta H}{T}$

(25 புள்ளிகள்)

(b) 298 K இல் கிளைசீன் (NH_2CH_2COOH) ஆனது, குண்டுக் கலோரிமானியில் (bomb calorimeter) தகனம் செய்யப்படும்போது நியம நிபந்தனைகளின் கீழ் 969 kJ mol^{-1} சக்தி வெளிவிடப்படுகிறது.

நியம தகன வெப்பவுள்ளுறையைக் கணிக்குக.

(25 புள்ளிகள்)

(c) (i) வந்தர்வாலுசு சமன்பாட்டின் கணித வெளிப்பாட்டினை எழுதுக.

(ii) 27°C இல், 2 மூல் அமோனியா வாயு 5 dm^3 கனவளவை அடைக்கிறது. இவ் வாயு வந்தர்வாலுசு சமன்பாட்டினைப் பின்பற்றுகின்றதாயின், இவ் வாயுவினால் செலுத்தப்படும் அமுக்கத்தினைக் கணிக்குக. ($a = 4.17$ atm L^2 mol^{-2}; $b = 0.0371$ L mol^{-1})

(25 புள்ளிகள்)

(d) ஆரம்ப வெப்பநிலை 727°C இலும், 1000 வளிமண்டல அமுக்கத்திலும் உள்ள 1000 மூல் வாயு ஒட்சிசன் ($C_{v,m} = 5R/2$) ஆனது ஒரு மாறாவெப்ப விரிவாக்கத்தினூடாக இறுதி வெப்பநிலை 227°C இனை அடையும்வரை குளிர்த்தப்பட்டது.

(i) இவ் அமைப்பின் இறுதி அமுக்கம்

(ii) விரிவாக்கத்துடன் தொடர்புடைய வெப்பவுள்ளுறையிலான மாற்றம் ΔH

(iii) விரிவாக்கத்துடன் தொடர்புடைய எந்திரப்பியிலான மாற்றம் ΔS

(25 புள்ளிகள்)

5. Answer any **TWO (02)** parts out of (a), (b) and (c).

Use the following information to answer this question.

$$\Delta G = -nFE, \quad \log(\gamma_{\pm}) = -A|Z_+Z_-|\sqrt{I}, \quad I = 0.5 \times \sum_j c_j Z_j^2, \quad \log(\gamma_{\pm}) = -\frac{A|Z_+Z_-|\sqrt{I}}{1+aB\sqrt{I}}$$

$$E = E^0 - \frac{RT}{nF}\ln(Q)$$

$$\left[\text{Data: } F = 96500\ C\ mol^{-1},\ R = 8.314\ JK^{-1}\ mol^{-1},\ A = 0.509\ dm^{3/2}\ mol^{-1/2}\right]$$

(a) Often quinhydrone electrode is used in determining the pH of a solution. It is composed of an acidic aqueous solution of quinone $(C_6H_4O_2)$ and hydroquinone $(C_6H_6O_2)$ with a platinum wire dipped in it.

(i) Write down the electrode reaction in standard form.

(ii) Using standard notation, write down a half cell diagram to represent this electrode.

(iii) Giving reasons, state the chemical species whose concentrations determine the equilibrium potential difference at the solid/solution interface of this electrode.

(iv) Write down the Nernest equation for the electrode potential of this electrode and identify all the terms in it.

(50 marks)

(b) A scientist constructed a fuel cell which uses butane as the fuel. The electrolytic medium of the cell is acidic. The spontaneous cell reaction is $2\,CH_3CH_2CH_2CH_3 + 13\,O_2 \rightarrow 8\,CO_2 + 10\,H_2O$. He found out that the Gibbs free energy for this cell reaction to be $-5,400\ kJ\ mol^{-1}$.

(i) Write down the spontaneous anode reaction and spontaneous cathode reaction.

(ii) Deduce the charge number of this reaction.

(iii) Calculate the largest potential difference that may be observed across the two terminals of this fuel cell.

(iv) Calculate the rate of combustion of butane in units of $mol\ s^{-1}$, in this cell when a steady current of 15 A is drawn from it.

(50 marks)

(c) A student prepared a $1.5\ mol\ dm^{-3}$ aqueous solution of $Pb(NO_3)_2$, labelled as P, and a $1.5\ mol\ dm^{-3}$ aqueous solution of $Al(NO_3)_3$, labelled as Q.

(i) Write down the relationship between the ionic strength of a solution and concentration of ions in it and identify all the parameters in it.

(ii) Calculate the ionic strengths of P and Q.

(iii) Using Debye-Huckel limiting law show that the activity coefficient of $NO_3^-(aq)$ in P is larger than the activity coefficient of $NO_3^-(aq)$ in Q.

(50 marks)

5. (a), (b) மற்றும் (c) ஆகிய பகுதிகளில் ஏதாயினும் **இரண்டிற்கு** விடையளிக்குக.
இக் கேள்விக்கு விடையளிக்க கீழ்வரும் தகவல்களைப் பயன்படுத்தவும்.

$$\Delta G = -nFE,\quad \log(\gamma_\pm) = -A|Z_+Z_-|\sqrt{I},\quad I = 0.5\times\sum_j c_j Z_j^2,\quad \log(\gamma_\pm) = -\frac{A|Z_+Z_-|\sqrt{I}}{1+aB\sqrt{I}}$$

$$E = E^0 - \frac{RT}{nF}\ln(Q)$$

[Data: F = 96500C mol^{-1}, R = 8.314 J K^{-1} mol^{-1}, A = 0.509 $dm^{3/2}$ $mol^{-1/2}$]

(a) ஒரு கரைசலின் pH இனைத் தீர்மானிப்பதில் குயின்ஹைட்ரோன் மின்வாய் அடிக்கடி பயன்படுத்தப்படுகிறது. இது குயினோனின் ஒரு அமில நீர்க் கரைசல் ($C_6H_4O_2$) மற்றும் ஐதரோகுயினோன் ($C_6H_6O_2$) உடன் ஒரு பிளாட்டினம் வயர் இதனுள் அமிழ்த்தப்பட்டு உருவாக்கப்பட்டுள்ளது.

(i) மின்வாய்த் தாக்கத்தை நியம வடிவில் எழுதுக.

(ii) நியம குறியீடுகளைப் – பயன்படுத்தி, இம் மின்வாயினை பிரதிநிதித்துவப்படுத்துவதற்கான அரைக் கல வரைபடத்தினைத் தருக.

(iii) காரணங்கள் தந்து, இம் மின்வாயின் திண்ம / திரவ இடைமுகத்திலான சமநிலை அழுத்த வித்தியாசத்தினைத் தமது செறிவினூடாக தீர்மானிக்கக்கூடிய இரசாயன இனங்களைத் தருக.

(iv) இம் மின்வாய்க்கான நேர்னஸ்ட் (Nernest) சமன்பாட்டைத் எழுதி அதிலுள்ள அனைத்து பதங்களையும் இனங்காண்க.

(50 புள்ளிகள்)

(b) ஒரு விஞ்ஞானி, பியூட்டேனை எரிபொருளாகப் பயன்படுத்தும் ஒரு எரிபொருள் கலத்தினை கட்டமைத்தார். அக் கலத்தின் மின்பகு ஊடகம் ஒரு அமிலமாகும். அக் கலத்தின் சுயாதீன தாக்கமானது,

$$2\ CH_3CH_2CH_2CH_3 + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O.$$

இக் கலத்திற்கான கிப்ஸ் சுயாதீன சக்தி (Gibbs free energy) ஆனது -5,400 kJ mol^{-1} ஆக இருப்பதாக அவர் கண்டறிந்தார்.

(i) சுயாதீன அனோட்டு தாக்கத்தினையும் சுயாதீன கதோட்டு தாக்கத்தினையும் எழுதுக.

(ii) இத் தாக்கத்தின் ஏற்ற எண்ணை உய்த்தறிக.

(iii) அவ் எரிபொருள் கலத்தின் இரு முனைகளுக்கிடையே அவதானிக்கப்படக்கூடிய மிகக்கூடிய அழுத்த வேறுபாட்டைக் கணிக்க.

(iv) இக் கலத்திலிருந்து 15 A நிலையான மின்சாரம் பெறப்படும்போது, பியூட்டேனின் தகன வீதத்தை mol s^{-1} இல் கணிக்குக.

(50 புள்ளிகள்)

(c) ஒரு மாணவன் 1.5 mol dm^{-3} செறிவுள்ள $Pb(NO_3)_2$ இன் நீர்க் கரைசலைத் தயாரித்து P எனப் பெயரிட்டான், $Al(NO_3)_3$ இன் நீர்க் கரைசலைத் தயாரித்து Q எனப் பெயரிட்டான்,

(i) ஒரு கரைசலின் அயன்வலிமைக்கும் அதிலுள்ள அயன் செறிவிற்கும் இடையிலான தொடர்பை எழுதி, அதிலுள்ள எல்லா பரமானங்களையும் இனங்காண்க.

(ii) P மற்றும் Q இன் அயன் வலிமைகளைக் கணிக்குக.

(iii) டிபை - ஹக்கிள் (Debye - Huckel) இன் வரம்பு விதியினைப் பயன்படுத்தி P யிலுள்ள $NO_3^-(aq)$ இன் செயற்பாட்டுக் குணகம் ஆனது Q இலுள்ள $NO_3^-(aq)$ இன் செயற்பாட்டுக் குணகத்திலும் பார்க்கப் பெரியது எனக் காட்டுக.

(50 புள்ளிகள்)

6. Answer **all** parts (a), (b) and (c).

(a) The following represents the rate expression for an elementary reaction of the form

$$A + B \longrightarrow \text{products}$$

(i) Write down the rate expression for the above reaction using the standard symbols

(ii) Determine the **SI units** of the rate constant.

(iii) Assuming that this reaction is carried out with an excess amount of B relative to A, **derive** an expression for the **pseudo** rate constant (k^*) of the reaction in terms of the concentration of A, [A] at time, t and its initial concentration of $[A_o]$.

(36 marks)

(b) A certain reaction [A $\longrightarrow$ P] is found to follow the differential rate law,

$$-\frac{d[A]}{dt} = k$$

(i) Given that the initial concentration is $[A_o]$, derive the integrated form of the above equation.

(ii) If 25% of A undergoes reaction in 30 minutes, what would be the concentration of A at the end of one hour given that the initial concentration of A is 2.0×10^3 mol m^{-3}

(36 marks)

(c) $-\frac{d[A]}{dt} = k\,[A]^p\,[B]^q$ is the general expression that represents the rate equation for a reaction of the form A + B $\longrightarrow$ P

Briefly outline (including any associated mathematical expression and sketch of a graph) the principle of the **Initial Rate method** for the determination of the order with respect to A. (Experimental details are not necessary).

(28 marks)

6. (a), (b) மற்றும் (c) ஆகிய எல்லாப் பகுதிகளுக்கும் விடையளிக்குக.

(a) பின்வருவது ஒரு முதன்மைத் தாக்கத்தின் வீத வெளிப்பாட்டினைப் பிரதிபலிக்கின்றது.

$$A + B \rightarrow \text{Products}$$

(i) நியம குறியீடுகளைப் பயன்படுத்தி, மேலே தரப்பட்ட தாக்கத்திற்கான தாக்க வீத வெளிப்பாட்டினை எழுதுக.

(ii) தாக்க வீத மாறிலிக்கான **SI அலகினைத்** துணிக.

(iii) இத் தாக்கமானது ஒப்பீட்டளவில் A யிலும் பார்க்கக் கூடிய மிகை B யுடன் மேற்கொள்ளப்படுவதாகக் கருதி, செறிவு A, நேரம் t யில் [A] மற்றும் $[A_0]$ இன் ஆரம்ப செறிவு என்பவற்றின் அடிப்படையில் இத்தாக்கத்தின் **போலி** தாக்கவீத மாறிலி (k*) இற்கான வெளிப்பாட்டினைத் **தருவிக்குக.**

(36 புள்ளிகள்)

(b) ஒரு குறித்த தாக்கம் [A $\longrightarrow$ P] வகையீட்டு தாக்க விதியைப் பின்பற்றுவதாக அறியப்பட்டுள்ளது.

(i) ஆரம்ப செறிவு $[A_0]$ என்பதாகக் கருதி மேற்படி சமன்பாட்டின் ஒருங்கிணைந்த வடிவத்தினைத் தருவிக்க.

(ii) A யின் ஆரம்ப செறிவு 2.0×10^3 mol m^{-3} எனத் தரப்பட்டுள்ளது. 30 நிமிடத்தில் A யின் 25% தாக்கத்திற்கு உள்ளாகுமாயின், ஒரு மணித்தியால முடிவில் A யின் செறிவு யாது?

(36 புள்ளிகள்)

(c) $-\frac{d[A]}{dt} = k[A]^p [B]^q$ என்பது A + B $\longrightarrow$ P எனும் அமைப்பிலுள்ள தாக்கத்திற்கான தாக்க சமன்பாட்டை பிரதிநிதித்துவப்படுத்தும் பொது வெளிப்பாடாகும்.

A தொடர்பான தாக்க வரிசையைக் கணிப்பதற்குரிய **ஆரம்ப தாக்க முறை**யின் (பரிசோதனை விபரங்கள் அவசியமல்ல) தத்துவத்தை (தொடர்பான கணித வெளிப்பாடுகள், வரைபு இனை உள்ளடக்கி) சுருக்கமாக விளக்குக.

(28 புள்ளிகள்)

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THE OPEN UNIVERSITY OF SRI LANKA

B.Sc Degree /Continuing Education Programme — Level 3

Final Examination — 2015/2016

CMU 1220/CME 3220

Basic Principles of Chemistry

MCQ Answer Sheet: Mark a cross $(\times)$ over the box that corresponds to the most suitable answer.

Index. No.

FOR EXAMINER'S USE ONLY		
Answers	**No.**	**Marks**
Correct		
Wrong		–
Unmarked		0.0
Total		

1	1	2	3	4	5	2	1	2	3	4	5	3	1	2	3	4	5	4	1	2	3	4	5
5	1	2	3	4	5	6	1	2	3	4	5	7	1	2	3	4	5	8	1	2	3	4	5
9	1	2	3	4	5	10	1	2	3	4	5	11	1	2	3	4	5	12	1	2	3	4	5
13	1	2	3	4	5	14	1	2	3	4	5	15	1	2	3	4	5	16	1	2	3	4	5
17	1	2	3	4	5	18	1	2	3	4	5	19	1	2	3	4	5	20	1	2	3	4	5
21	1	2	3	4	5	22	1	2	3	4	5	23	1	2	3	4	5	24	1	2	3	4	5
25	1	2	3	4	5	26	1	2	3	4	5	27	1	2	3	4	5	29	1	2	3	4	5
30	1	2	3	4	5																		