

ΠΑΓΚΥΠΡΙΑ ΕΝΩΣΗ ΕΠΙΣΤΗΜΟΝΩΝ ΧΗΜΙΚΩΝ (ΠΕΕΧ)



19^η ΠΑΓΚΥΠΡΙΑ ΟΛΥΜΠΙΑΔΑ ΧΗΜΕΙΑΣ

Για την Α΄ Τάξη Λυκείων

ΥΠΟ ΤΗΝ ΑΙΓΙΔΑ ΤΟΥ ΥΠΟΥΡΓΕΙΟΥ ΠΑΙΔΕΙΑΣ ΚΑΙ ΠΟΛΙΤΙΣΜΟΥ

ΚΥΡΙΑΚΗ 7 ΑΠΡΙΛΙΟΥ 2019

ΔΙΑΡΚΕΙΑ: 2 ΩΡΕΣ (10:00 – 12:00)

ΟΔΗΓΙΕΣ ΠΡΟΣ ΤΟΥΣ ΔΙΑΓΩΝΙΖΟΜΕΝΟΥΣ

1. Το εξεταστικό δοκίμιο αποτελείται από δύο (2) μέρη:
Μέρος Α΄ : Τριάντα (30) ερωτήσεις πολλαπλής επιλογής (30 μονάδες)
Μέρος Β΄ : Εννέα (9) ερωτήσεις ανοικτού τύπου (70 μονάδες)
2. Να γράφετε ΜΟΝΟ με μπλε μελάνι.
3. Απαγορεύεται η χρήση διορθωτικού υγρού ή ταινίας.
4. Επιτρέπεται η χρήση μη προγραμματιζόμενης υπολογιστικής μηχανής.
5. Για τις ερωτήσεις πολλαπλής επιλογής:
 - Η ορθή απάντηση να σημειώνεται με μαύρισμα στο κυκλάκι που αντιστοιχεί στο γράμμα της απάντησης (Α, Β, Γ, Δ, Ε) που επιλέγετε. π.χ. **E**
 - Σε περίπτωση λάθους να διαγράψετε την απάντηση σας και να κάνετε νέα επιλογή. π.χ. ~~B~~
 - Υπάρχει ΜΟΝΟ ΜΙΑ ορθή απάντηση και βαθμολογείται με μια (1) μονάδα.
 - Για κάθε λανθασμένη απάντηση θα αφαιρούνται 0,25 της μονάδας.
 - Ερώτηση για την οποία δίνονται δύο (2) ή περισσότερες απαντήσεις θεωρείται λανθασμένη, οπότε θα αφαιρούνται 0,25 της μονάδας.
 - Κάθε αναπάντητη ερώτηση βαθμολογείται με μηδέν (0) μονάδες.
6. Δεν επιτρέπεται η χρήση σημειώσεων σε οποιαδήποτε μορφή.
7. Να γράφετε ΚΑΘΑΡΑ και ΕΥΑΝΑΓΝΩΣΤΑ.
8. Να μελετήσετε με προσοχή την εκφώνηση των ασκήσεων και να απαντήσετε με σαφήνεια. ΔΕΝ ΘΑ ΔΟΘΟΥΝ ΣΥΜΠΛΗΡΩΜΑΤΙΚΕΣ ΟΔΗΓΙΕΣ Η΄ ΔΙΑΣΑΦΗΝΙΣΕΙΣ.
9. Το Α΄ Μέρος του εξεταστικού δοκιμίου αποτελείται από δεκατρείς (13) σελίδες, συμπεριλαμβανομένων των οδηγιών και του περιοδικού πίνακα.
10. Το Τετράδιο Απαντήσεων αποτελείται από δέκα (10) σελίδες, συμπεριλαμβανομένης της 1^{ης} σελίδας, στην οποία θα συμπληρώσετε τα στοιχεία σας και θα σημειώσετε τις απαντήσεις σας για το Α΄ Μέρος των ερωτήσεων πολλαπλής επιλογής. Στη συνέχεια αναγράφονται οι ερωτήσεις ανοικτού τύπου (Β΄ Μέρος).
11. Οι απαντήσεις για τις ερωτήσεις ανοικτού τύπου να καταγράφονται στον χώρο που παρατίθεται κάτω από κάθε ερώτηση.

ΠΕΡΙΟΔΙΚΟΣ ΠΙΝΑΚΑΣ

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<td colspan="15">Λανθανίδες:</td> </tr> <tr> <td></td> <td colspan="15">Ακτινίδες:</td> </tr> </table> </td> </tr> </table> | | | | | | | | | | | | | | | | | | | 5 | 6 | 7 | 8 | 9 | | | | | | | | | | | | | | B | C | N | O | F | | | | | | | | | | | | | | 11 | 12 | 14 | 16 | 19 | | | | | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | | | | | | | | | | | | | | Al | Si | P | S | Cl | | | | | | | | | | | | | | 27 | 28 | 31 | 32 | 35,5 | | | | | | | | | | | | | | 31 | 32 | 33 | 34 | 35 | | | | | | | | | | | | | | Ga | Ge | As | Se | Br | | | | | | | | | | | | | | 70 | 72,6 | 75 | 79 | 80 | | | | | | | | | | | | | | 49 | 50 | 51 | 52 | 53 | | | | | | | | | | | | | | In | Sn | Sb | Te | I | | | | | | | | | | | | | | 112 | 119 | 122 | 128 | 127 | | | | | | | | | | | | | | 81 | 82 | 83 | 84 | 85 | | | | | | | | | | | | | | Tl | Pb | Bi | Po | At | | | | | | | | | | | | | | 204 | 207 | 209 | [209] | [210] | | | | | | | | | | | | | | 113 | 114 | 115 | 116 | 117 | | | | | | | | | | | | | | Nh | Fc | Mc | Lv | Ts | | | | | | | | | | | | | | [286] | [289] | [289] | [293] | [294] | | | | | | | | | | | | | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td></td> <td>29</td> <td>30</td> <td>31</td> <td>32</td> <td>33</td> <td>34</td> <td>35</td> <td>36</td> <td>37</td> <td>38</td> <td>39</td> <td>40</td> <td>41</td> <td>42</td> <td>43</td> <td>44</td> <td>45</td> <td>46</td> <td>47</td> <td>48</td> <td>49</td> <td>50</td> <td>51</td> <td>52</td> <td>53</td> <td>54</td> <td>55</td> <td>56</td> <td>57</td> <td>58</td> <td>59</td> <td>60</td> <td>61</td> <td>62</td> <td>63</td> <td>64</td> <td>65</td> <td>66</td> <td>67</td> <td>68</td> <td>69</td> <td>70</td> <td>71</td> </tr> <tr> <td></td> <td>Cu</td> <td>Zn</td> <td>Ga</td> <td>Ge</td> <td>As</td> <td>Se</td> <td>Br</td> <td>Kr</td> <td>Rb</td> <td>Sr</td> <td>Y</td> <td>Zr</td> <td>Nb</td> <td>Mo</td> <td>Tc</td> <td>Ru</td> <td>Rh</td> <td>Pd</td> <td>Ag</td> <td>Cd</td> <td>In</td> 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91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 100 | 101 | 102 | 103 | 104 | 106 | 108 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | | 108 | 112 | 115 | 119 | 122 | 127 | 131 | 133 | 137 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | | 105,4 | 108 | 112 | 119 | 122 | 128 | 131 | 133 | 137 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | | 192 | 201 | 204 | 207 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | | 281 | 285 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td></td> <td>* 57</td> <td>58</td> <td>59</td> <td>60</td> <td>61</td> <td>62</td> <td>63</td> <td>64</td> <td>65</td> <td>66</td> <td>67</td> <td>68</td> <td>69</td> <td>70</td> <td>71</td> </tr> <tr> <td></td> <td>La</td> <td>Ce</td> <td>Pr</td> <td>Nd</td> <td>Pm</td> <td>Sm</td> <td>Eu</td> <td>Gd</td> <td>Tb</td> <td>Dy</td> <td>Ho</td> <td>Er</td> <td>Tm</td> <td>Yb</td> <td>Lu</td> </tr> <tr> <td></td> <td>139</td> <td>140</td> <td>141</td> <td>144</td> <td>[145]</td> <td>150</td> <td>152</td> <td>157</td> <td>159</td> <td>162,5</td> <td>165</td> <td>167</td> <td>169</td> <td>173</td> <td>175</td> </tr> <tr> <td></td> <td># 89</td> <td>90</td> <td>91</td> <td>92</td> <td>93</td> <td>94</td> <td>95</td> <td>96</td> <td>97</td> <td>98</td> <td>99</td> <td>100</td> <td>101</td> <td>102</td> <td>103</td> </tr> <tr> <td></td> <td>Ac</td> <td>Th</td> <td>Pa</td> <td>U</td> <td>Np</td> <td>Pu</td> <td>Am</td> <td>Cm</td> <td>Bk</td> <td>Cf</td> <td>Es</td> <td>Fm</td> <td>Md</td> <td>No</td> <td>Lr</td> </tr> <tr> <td></td> <td>[227]</td> <td>232</td> <td>231</td> <td>238</td> <td>[237]</td> <td>[244]</td> <td>[243]</td> <td>[247]</td> <td>[247]</td> <td>[251]</td> <td>[252]</td> <td>[257]</td> <td>[258]</td> <td>[259]</td> <td>[260]</td> </tr> </table> | | | | | | | | | | | | | | | | | | | * 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | 139 | 140 | 141 | 144 | [145] | 150 | 152 | 157 | 159 | 162,5 | 165 | 167 | 169 | 173 | 175 | | # 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | | Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | [227] | 232 | 231 | 238 | [237] | [244] | [243] | [247] | [247] | [251] | [252] | [257] | [258] | [259] | [260] | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td></td> <td colspan="15">Λανθανίδες:</td> </tr> <tr> <td></td> <td colspan="15">Ακτινίδες:</td> </tr> </table> | | | | | | | | | | | | | | | | | | | Λανθανίδες: | | | | | | | | | | | | | | | | Ακτινίδες: | | | | | | | | | | | | | | |
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| | 31 | 32 | 33 | 34 | 35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | 49 | 50 | 51 | 52 | 53 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | 113 | 114 | 115 | 116 | 117 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | [286] | [289] | [289] | [293] | [294] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td></td> <td>29</td> <td>30</td> <td>31</td> <td>32</td> <td>33</td> <td>34</td> <td>35</td> <td>36</td> <td>37</td> <td>38</td> <td>39</td> <td>40</td> <td>41</td> <td>42</td> <td>43</td> <td>44</td> <td>45</td> <td>46</td> <td>47</td> <td>48</td> <td>49</td> <td>50</td> <td>51</td> <td>52</td> <td>53</td> <td>54</td> <td>55</td> <td>56</td> <td>57</td> <td>58</td> <td>59</td> <td>60</td> <td>61</td> <td>62</td> <td>63</td> <td>64</td> <td>65</td> <td>66</td> <td>67</td> <td>68</td> <td>69</td> <td>70</td> <td>71</td> </tr> <tr> <td></td> <td>Cu</td> <td>Zn</td> <td>Ga</td> <td>Ge</td> <td>As</td> <td>Se</td> <td>Br</td> <td>Kr</td> <td>Rb</td> <td>Sr</td> <td>Y</td> <td>Zr</td> <td>Nb</td> <td>Mo</td> <td>Tc</td> <td>Ru</td> <td>Rh</td> <td>Pd</td> <td>Ag</td> <td>Cd</td> <td>In</td> <td>Sn</td> <td>Sb</td> <td>Te</td> <td>I</td> <td>Xe</td> <td>Ba</td> <td>La</td> <td>Ce</td> <td>Pr</td> <td>Nd</td> <td>Pm</td> <td>Sm</td> <td>Eu</td> <td>Gd</td> <td>Tb</td> <td>Dy</td> <td>Ho</td> <td>Er</td> <td>Tm</td> <td>Yb</td> <td>Lu</td> </tr> <tr> <td></td> <td>63,5</td> <td>65</td> <td>70</td> <td>72,6</td> <td>75</td> <td>79</td> <td>80</td> <td>84</td> <td>85</td> <td>86</td> <td>88</td> <td>90</td> <td>91</td> <td>92</td> <td>93</td> <td>94</td> <td>95</td> <td>96</td> <td>97</td> <td>98</td> <td>100</td> <td>101</td> <td>102</td> <td>103</td> <td>104</td> <td>106</td> <td>108</td> <td>110</td> <td>111</td> <td>112</td> <td>113</td> <td>114</td> <td>115</td> <td>116</td> <td>117</td> <td>118</td> <td>119</td> <td>120</td> <td>121</td> <td>122</td> <td>123</td> <td>124</td> <td>125</td> <td>126</td> </tr> <tr> <td></td> <td>108</td> <td>112</td> <td>115</td> <td>119</td> <td>122</td> <td>127</td> <td>131</td> <td>133</td> <td>137</td> <td>140</td> <td>141</td> <td>142</td> <td>143</td> <td>144</td> <td>145</td> <td>146</td> <td>147</td> <td>148</td> <td>149</td> 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<td>296</td> <td>297</td> <td>298</td> <td>299</td> <td>300</td> <td>301</td> <td>302</td> <td>303</td> <td>304</td> <td>305</td> <td>306</td> <td>307</td> <td>308</td> <td>309</td> <td>310</td> <td>311</td> <td>312</td> <td>313</td> <td>314</td> <td>315</td> <td>316</td> <td>317</td> <td>318</td> <td>319</td> <td>320</td> <td>321</td> <td>322</td> </tr> </table> | | | | | | | | | | | | | | | | | | | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | | Cu | Zn | Ga | Ge | As | Se | Br | Kr | Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | Ba | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | 63,5 | 65 | 70 | 72,6 | 75 | 79 | 80 | 84 | 85 | 86 | 88 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 100 | 101 | 102 | 103 | 104 | 106 | 108 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | | 108 | 112 | 115 | 119 | 122 | 127 | 131 | 133 | 137 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | | 105,4 | 108 | 112 | 119 | 122 | 128 | 131 | 133 | 137 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | | 192 | 201 | 204 | 207 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | | 281 | 285 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 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| | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cu | Zn | Ga | Ge | As | Se | Br | Kr | Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | Ba | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 63,5 | 65 | 70 | 72,6 | 75 | 79 | 80 | 84 | 85 | 86 | 88 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 100 | 101 | 102 | 103 | 104 | 106 | 108 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 108 | 112 | 115 | 119 | 122 | 127 | 131 | 133 | 137 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 105,4 | 108 | 112 | 119 | 122 | 128 | 131 | 133 | 137 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 266 | 272 | 281 | 285 | 285 | 286 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td></td> <td>* 57</td> <td>58</td> <td>59</td> <td>60</td> <td>61</td> <td>62</td> <td>63</td> <td>64</td> <td>65</td> <td>66</td> <td>67</td> <td>68</td> <td>69</td> <td>70</td> <td>71</td> </tr> <tr> <td></td> <td>La</td> <td>Ce</td> <td>Pr</td> <td>Nd</td> <td>Pm</td> <td>Sm</td> <td>Eu</td> <td>Gd</td> <td>Tb</td> <td>Dy</td> <td>Ho</td> <td>Er</td> <td>Tm</td> <td>Yb</td> <td>Lu</td> </tr> <tr> <td></td> <td>139</td> <td>140</td> <td>141</td> <td>144</td> <td>[145]</td> <td>150</td> <td>152</td> <td>157</td> <td>159</td> <td>162,5</td> <td>165</td> <td>167</td> <td>169</td> <td>173</td> <td>175</td> </tr> <tr> <td></td> <td># 89</td> <td>90</td> <td>91</td> <td>92</td> <td>93</td> <td>94</td> <td>95</td> <td>96</td> <td>97</td> <td>98</td> <td>99</td> <td>100</td> <td>101</td> <td>102</td> <td>103</td> </tr> <tr> <td></td> <td>Ac</td> <td>Th</td> <td>Pa</td> <td>U</td> <td>Np</td> <td>Pu</td> <td>Am</td> <td>Cm</td> <td>Bk</td> <td>Cf</td> <td>Es</td> <td>Fm</td> <td>Md</td> <td>No</td> <td>Lr</td> </tr> <tr> <td></td> <td>[227]</td> <td>232</td> <td>231</td> <td>238</td> <td>[237]</td> <td>[244]</td> <td>[243]</td> <td>[247]</td> <td>[247]</td> <td>[251]</td> <td>[252]</td> <td>[257]</td> <td>[258]</td> <td>[259]</td> <td>[260]</td> </tr> </table> | | | | | | | | | | | | | | | | | | | * 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | 139 | 140 | 141 | 144 | [145] | 150 | 152 | 157 | 159 | 162,5 | 165 | 167 | 169 | 173 | 175 | | # 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | | Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | [227] | 232 | 231 | 238 | [237] | [244] | [243] | [247] | [247] | [251] | [252] | [257] | [258] | [259] | [260] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | * 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 139 | 140 | 141 | 144 | [145] | 150 | 152 | 157 | 159 | 162,5 | 165 | 167 | 169 | 173 | 175 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | # 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | [227] | 232 | 231 | 238 | [237] | [244] | [243] | [247] | [247] | [251] | [252] | [257] | [258] | [259] | [260] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td></td> <td colspan="15">Λανθανίδες:</td> </tr> <tr> <td></td> <td colspan="15">Ακτινίδες:</td> </tr> </table> | | | | | | | | | | | | | | | | | | | Λανθανίδες: | | | | | | | | | | | | | | | | Ακτινίδες: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Λανθανίδες: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ακτινίδες: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Μέρος Α΄: Δοκίμιο ερωτήσεων πολλαπλής επιλογής

1. Στο παρόν εξεταστικό δοκίμιο αναγράφονται οι τριάντα (30) ερωτήσεις πολλαπλής επιλογής.
2. Συστήνεται όπως απαντήσετε όλες τις ερωτήσεις πάνω στο παρόν εξεταστικό δοκίμιο και αφού βεβαιωθείτε ότι οι απαντήσεις σας είναι οι τελικές, τότε να τις μεταφέρετε στο ειδικό Έντυπο Απαντήσεων των Ερωτήσεων Πολλαπλής Επιλογής, που βρίσκεται στην 1^η σελίδα του Τετραδίου Απαντήσεων των ερωτήσεων πολλαπλής επιλογής και ανοικτού τύπου.

ΜΕΡΟΣ Α΄

Αποτελείται από τριάντα (30) ερωτήσεις πολλαπλής επιλογής.

1. Δίνονται οι πιο κάτω δηλώσεις:
 - I. Σε κάθε άτομο ενός στοιχείου ο αριθμός πρωτονίων είναι ίσος με τον αριθμό ηλεκτρονίων.
 - II. Στο άτομο του λιθίου, ${}_{3}\text{Li}$ και τα τρία (3) ηλεκτρόνια χαρακτηρίζονται με την ίδια ενέργεια.
 - III. Ο αριθμός ηλεκτρονίων της εξωτερικής στιβάδας κάθε στοιχείου είναι οκτώ (8).
 - IV. Τα άτομα των στοιχείων ${}^{24}\text{Na}$ και ${}^{24}\text{Mg}$ είναι ισότοπα.
 - V. Όλα τα στοιχεία, τα οποία βρίσκονται στην ίδια περίοδο του περιοδικού πίνακα έχουν παρόμοιες ιδιότητες.
 - VI. Το άτομο του οξυγόνου όταν ενώνεται με άλλο άτομο οξυγόνου δημιουργεί διπλό ομοιοπολικό δεσμό.

Να επιλέξετε τον συνδυασμό των ορθών δηλώσεων:

- A. I και VI μόνο
 - B. I, II και VI μόνο
 - Γ. II και V μόνο
 - Δ. II, III, IV και VI μόνο
 - E. I, II, IV και VI μόνο
-
2. Ο αριθμός των ηλεκτρονίων της εξωτερικής στιβάδας του ιόντος ${}_{16}^{32}\text{S}^{2-}$ είναι:
 - A. 2
 - B. 8
 - Γ. 16
 - Δ. 18
 - E. 32

3. Κατά την εκτέλεση πειράματος, μεταφέρθηκαν σε δοκιμαστικό σωλήνα 2 mL κίτρινου διαλύματος χρωμικού καλίου, K_2CrO_4 και στη συνέχεια, προστέθηκε 1 mL διαλύματος θειικού οξέος, H_2SO_4 , με συνεχή ανάδευση. Παρατηρήθηκε αλλαγή στο χρώμα του διαλύματος από κίτρινο σε πορτοκαλί.

Το συμπέρασμα, στο οποίο μας οδηγεί η παρατήρηση, είναι ότι οι δύο (2) χημικές ενώσεις K_2CrO_4 και H_2SO_4 :

- A. δεν αντέδρασαν μεταξύ τους
- B. αντέδρασαν και σχηματίστηκε ίζημα
- Γ. αντέδρασαν και ελευθερώθηκε αέριο
- Δ. αντέδρασαν και σχηματίστηκε νέα ουσία
- E. αντέδρασαν και ελευθερώθηκε ενέργεια

4. Δίνονται οι πιο κάτω πληροφορίες:

- Το στοιχείο X βρίσκεται στην 3^η περίοδο και II_A ομάδα του Περιοδικού Πίνακα.
- Το στοιχείο Ψ βρίσκεται στην 3^η περίοδο και VI_A ομάδα του Περιοδικού Πίνακα.

Για τα στοιχεία X και Ψ δίνονται οι πιο κάτω δηλώσεις:

- I. Σχηματίζουν μεταξύ τους ιοντικό δεσμό.
- II. Σχηματίζουν μεταξύ τους ομοιοπολικό πολικό δεσμό.
- III. Σχηματίζουν μεταξύ τους ομοιοπολικό απολικό δεσμό.
- IV. Ο χημικός τύπος της ένωσης που σχηματίζουν είναι $X_2\Psi$.
- V. Ο χημικός τύπος της ένωσης που σχηματίζουν είναι $X\Psi$.
- VI. Ο χημικός τύπος της ένωσης που σχηματίζουν είναι $X\Psi_2$.

Να επιλέξετε τον συνδυασμό των ορθών δηλώσεων:

- A. I και IV
- B. I και V
- Γ. II και VI
- Δ. II και V
- E. III και IV

5. Η σχετική ατομική μάζα του χλωρίου, Cl , προσδιορίστηκε με μεγάλη ακρίβεια και βρέθηκε ίση με 35,453. Αυτό οφείλεται στο ότι:
- A. Δεν έχουν όλα τα άτομα του Cl τον ίδιο ατομικό αριθμό.
 - B. Κατά τον υπολογισμό της σχετικής ατομικής μάζας του Cl λαμβάνεται υπόψη και ο αριθμός των ηλεκτρονίων.
 - Γ. Το στοιχείο του Cl υπάρχει στη φύση ως μίγμα ισοτόπων.
 - Δ. Κατά τον υπολογισμό της σχετικής ατομικής μάζας του Cl λαμβάνεται υπόψη ο αριθμός όλων των σωματιδίων του ατόμου του Cl .
 - E. Κατά τον υπολογισμό της σχετικής μοριακής μάζας λαμβάνεται υπόψη ο αριθμός των διαφορετικών ισοτόπων.
6. Η σχετική ατομική μάζα του αζώτου είναι 14. Η σχετική μάζα του μορίου του αζώτου, N_2 , είναι:
- A. 14 φορές μεγαλύτερη από το $1/12$ της μάζας ενός ατόμου ^{12}C
 - B. 28 φορές μεγαλύτερη από τη μάζα ενός ατόμου C
 - Γ. 28 φορές μεγαλύτερη από τη μάζα ενός ατόμου ^{12}C
 - Δ. 28 φορές μεγαλύτερη από το $1/12$ της μάζας ενός ατόμου C
 - E. 28 φορές μεγαλύτερη από το $1/12$ της μάζας ενός ατόμου ^{12}C
7. Οι πυροσβεστήρες $\text{Ha}\lambda\omicron\text{n}$ δεν χρησιμοποιούνται πλέον γιατί περιέχουν τη χημική ουσία τριχλωροφθοράνθρακα, CFCl_3 , η οποία είναι υπεύθυνη για την καταστροφή του όζοντος της ατμόσφαιρας. Σε πυροσβεστήρα $\text{Ha}\lambda\omicron\text{n}$ περιέχονται 1,12 L του CFCl_3 , σε κανονικές συνθήκες.
- Η ποσότητα αυτή αντιστοιχεί σε:
- I. 0,5 N_A μόρια CFCl_3
 - II. 0,05 moles CFCl_3
 - III. 2,5 N_A συνολικά άτομα
 - IV. 0,05 N_A άτομα χλωρίου
 - V. 0,05 N_A άτομα άνθρακα
- Να επιλέξετε τον ορθό συνδυασμό:
- A. II, IV και V μόνο
 - B. I, III και V μόνο
 - Γ. II και V μόνο
 - Δ. I και III μόνο
 - E. II, III και IV μόνο

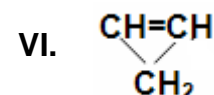
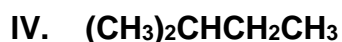
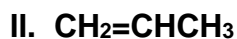
8. Δίνεται ότι, το στοιχείο του ιωδίου είναι στην VIIA ομάδα και στην 5^η περίοδο του Περιοδικού Πίνακα.

Το ιώδιο έχει:

- A. 5 ηλεκτρόνια στην εξωτερική στιβάδα και 7 στιβάδες
- B. 7 ηλεκτρόνια στην εξωτερική στιβάδα και 5 στιβάδες
- Γ. 7 ηλεκτρόνια στην εξωτερική στιβάδα και 7 στιβάδες
- Δ. 17 ηλεκτρόνια στην εξωτερική στιβάδα και 5 στιβάδες
- E. 17 ηλεκτρόνια στην εξωτερική στιβάδα και 7 στιβάδες

9. Δίνεται ότι, η οργανική ένωση Φ είναι άκυκλη και έχει Γ.Μ.Τ. C_nH_{2n-2} .

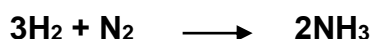
Ποιος/οι από τους πιο κάτω συντακτικούς τύπους μπορεί να ανήκει/ουν στην ένωση Φ;



Να επιλέξετε την ορθή απάντηση:

- A. II και V μόνο
- B. I, III, V και VI μόνο
- Γ. I και III μόνο
- Δ. I, III και VI μόνο
- E. IV μόνο

10. Όταν σε αέριο υδρογόνο, H_2 , επιδράσει περίσσεια αερίου αζώτου, N_2 , στις κατάλληλες συνθήκες, τότε ελευθερώνεται αμμωνία, NH_3 , σύμφωνα με τη χημική εξίσωση:



Η ποσότητα του αερίου H_2 που απαιτείται για την παρασκευή 2,24 L αμμωνίας, σε κανονικές συνθήκες είναι:

- A. 0,03 g
- B. 0,06 g
- Γ. 0,60 g
- Δ. 0,15 mol
- E. 0,30 mol

11. Ο χημικός τύπος του οξειδίου του χαλκού (I) είναι:

- A. Cu_2O
- B. CuO_2
- Γ. CuO
- Δ. Cu_2O_2
- E. Cu_3O_2

12. Δίνεται ότι:

- Ο μαζικός αριθμός (A) του στοιχείου X είναι διπλάσιος από τον ατομικό του αριθμό (Z).
- Το στοιχείο X έχει τον ίδιο αριθμό νετρονίων με το στοιχείο του Καλίου.

Για το στοιχείο X ισχύει:

- A. $Z=10$ και $A=20$
- B. $Z=19$ και $A=38$
- Γ. $Z=19$ και $A=39$
- Δ. $Z=20$ και $A=39$
- E. $Z=20$ και $A=40$

13. Ποιο από τα επόμενα ιόντα έχει την ίδια ηλεκτρονιακή δομή με το ανιόν ${}^{19}_9\text{F}^-$;

- A. ${}^{32}_{16}\text{S}^{2-}$
- B. ${}^{35}_{17}\text{Cl}^-$
- Γ. ${}^{40}_{20}\text{Ca}^{2+}$
- Δ. ${}^{27}_{13}\text{Al}^{3+}$
- E. ${}^7_3\text{Li}^+$

14. Κατά την πραγματοποίηση μιας χημικής αντίδρασης παρατηρείται θόλωμα όταν:

- A. Παράγεται ευδιάλυτη ουσία.
- B. Παράγεται δυσδιάλυτη ουσία.
- Γ. Μεταβάλλεται το χρώμα του διαλύματος.
- Δ. Παράγεται ενέργεια.
- E. Παρατηρείται βίαιη αντίδραση.

15. Η ένωση MgO είναι ιοντική γιατί:

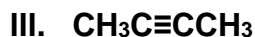
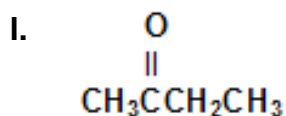
- A. Σχηματίζεται με μεταφορά ηλεκτρονίων από το άτομο του οξυγόνου στο άτομο του μαγνησίου.
- B. Σχηματίζεται με μεταφορά ηλεκτρονίων από το άτομο του μαγνησίου στο άτομο του οξυγόνου.
- Γ. Σχηματίζεται με αμοιβαία συνεισφορά ηλεκτρονίων από τα δύο άτομα.
- Δ. Αποτελείται από άτομα μαγνησίου και άτομα οξυγόνου με ανόμοιους πόλους.
- E. Αποτελείται από ιόντα μαγνησίου και ιόντα οξυγόνου με ίδιο φορτίο.

16. Ένα παραδοσιακό λικέρ, μετά από εργαστηριακό έλεγχο βρέθηκε να είναι 18 % v/v.

Αυτό σημαίνει ότι:

- A. σε 100 mL λικέρ περιέχονται 18 g οινόπνευμα
- B. σε 100 g διάλυμα περιέχονται 18 g λικέρ
- Γ. σε 200 mL νερού περιέχονται 36 mL οινόπνευμα
- Δ. σε 50 mL λικέρ περιέχονται 9 mL οινόπνευμα
- E. σε 50 mL νερού περιέχονται 9 mL λικέρ

17. Δίνονται οι άκυκλες οργανικές ενώσεις:



Ακόρεστες ενώσεις είναι:

- A. I, III και IV μόνο
- B. I και II μόνο
- Γ. III και IV μόνο
- Δ. I, II και III μόνο
- E. όλες

18. Η χημική ένωση που προκύπτει από τον σχηματισμό δεσμού μεταξύ ασβεστίου και φθορίου έχει χημικό τύπο:

- A. CaF
- B. Ca₂F
- Γ. Ca₂F₂
- Δ. CaF₂
- E. CaF₃

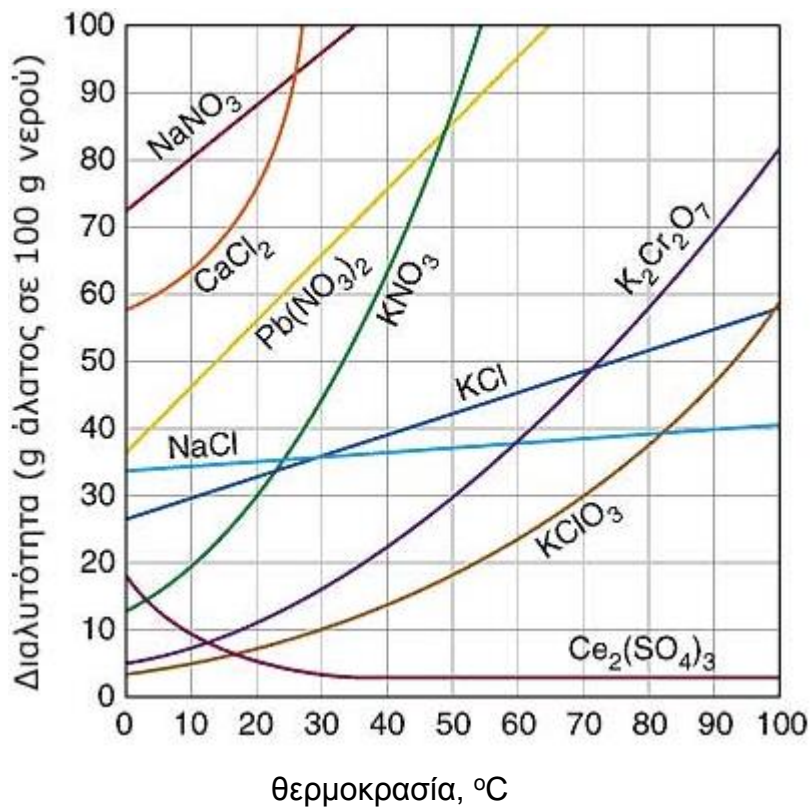
19. Οι δηλώσεις που ακολουθούν αναφέρονται σε μια ομοιοπολική ένωση.

- I. Στα κρυσταλλικά πλέγματά της υπάρχουν αντίθετα φορτισμένα άτομα.
- II. Ασκούνται μεταξύ των ατόμων που την αποτελούν ελκτικές δυνάμεις ηλεκτροστατικής φύσης.
- III. Ασκούνται μεταξύ των ατόμων που την αποτελούν ελκτικές δυνάμεις ηλεκτρομαγνητικής φύσης.
- IV. Στις συνηθισμένες συνθήκες η φυσική της κατάσταση μπορεί να είναι είτε υγρή είτε αέρια.
- V. Στα κρυσταλλικά πλέγματά της υπάρχουν όμοια ή αντίθετα φορτισμένα άτομα.

Να επιλέξετε την ορθή απάντηση:

- A. I, II και V μόνο
- B. I, II, IV και V μόνο
- Γ. II και IV μόνο
- Δ. III μόνο
- E. III και IV μόνο

Να απαντήσετε στις Ερωτήσεις 20 έως 25, αξιοποιώντας τα δεδομένα της πιο κάτω γραφικής παράστασης.



20. Υδατικό διάλυμα χλωρικού καλίου, KClO_3 , περιέχει 25 g άλατος σε 200 g νερού, στους 70 °C. Η ποσότητα του άλατος σε γραμμάρια που απαιτείται ώστε το διάλυμα να γίνει κορεσμένο είναι:

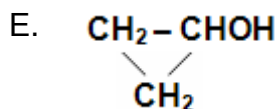
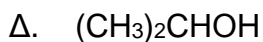
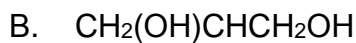
- A. 5 g
- B. 10 g
- Γ. 25 g
- Δ. 35 g
- E. 50 g

21. Πόσα γραμμάρια νιτρικού νατρίου, NaNO_3 , μπορούν να διαλυθούν σε 50 g νερού σε θερμοκρασία 10 °C, ώστε να προκύψει κορεσμένο διάλυμα;

- A. 30 g
- B. 40 g
- Γ. 50 g
- Δ. 80 g
- E. 160 g

22. Σε ποια περίπου θερμοκρασία, η διαλυτότητα του χλωριούχου νατρίου, NaCl , είναι ίση με τη διαλυτότητα του διχρωμικού καλίου, $\text{K}_2\text{Cr}_2\text{O}_7$;
- A. $30\text{ }^\circ\text{C}$
 - B. $50\text{ }^\circ\text{C}$
 - Γ. $60\text{ }^\circ\text{C}$
 - Δ. $70\text{ }^\circ\text{C}$
 - E. $80\text{ }^\circ\text{C}$
23. Ποιο άλας είναι το λιγότερο διαλυτό σε θερμοκρασία $50\text{ }^\circ\text{C}$;
- A. KNO_3
 - B. $\text{K}_2\text{Cr}_2\text{O}_7$
 - Γ. $\text{Ce}_2(\text{SO}_4)_3$
 - Δ. KClO_3
 - E. NaCl
24. Ποιοι παράγοντες επηρεάζουν τη διαλυτότητα του χλωριούχου ασβεστίου, CaCl_2 ;
- A. πίεση και θερμοκρασία μόνο
 - B. φύση διαλύτη, πίεση και θερμοκρασία μόνο
 - Γ. θερμοκρασία μόνο
 - Δ. φύση διαλύτη και θερμοκρασία μόνο
 - E. πυκνότητα και θερμοκρασία μόνο
25. Πόση είναι περίπου η % κ.μ. περιεκτικότητα κορεσμένου διαλύματος νιτρικού καλίου, KNO_3 , στους $30\text{ }^\circ\text{C}$;
- A. $20\text{ } \%$ κ.μ.
 - B. $30\text{ } \%$ κ.μ.
 - Γ. $40\text{ } \%$ κ.μ.
 - Δ. $45\text{ } \%$ κ.μ.
 - E. $50\text{ } \%$ κ.μ.

26. Ποια από τις πιο κάτω οργανικές ενώσεις είναι άκυκλη κορεσμένη μονοσθενής αλκοόλη;



27. Ποιος από τους πιο κάτω μοριακούς τύπους υδρογονανθράκων είναι λανθασμένος;



Οι ερωτήσεις 28 και 29 αφορούν στην εκτέλεση, σε σχολικό εργαστήριο, πειράματος για την ανίχνευση του άνθρακα και του υδρογόνου, σε μια οργανική ένωση.

28. Δίνονται τα όργανα I έως VIII:

I. ογκομετρικός σωλήνας,

II. απαγωγός σωλήνας,

III. ογκομετρική φιάλη,

IV. λύχνος Bunsen,

V. δοκιμαστικός σωλήνας μεγάλος,

VI. ύαλος υρολογίου,

VII. ποτήρι ζέσεως,

VIII. δοκιμαστικός σωλήνας μικρός

Να επιλέξετε τον συνδυασμό που δίνει τα καταλληλότερα όργανα τα οποία είναι απαραίτητα για την ανίχνευση του άνθρακα και του υδρογόνου, σε μια οργανική ένωση:

A. I, II, IV και VI μόνο

B. II, IV, V, VI και VIII μόνο

Γ. I, IV, V, VI και VII μόνο

Δ. II, IV, V, VI και VII μόνο

E. III, IV, V, VI και VIII μόνο

29. Δίνονται τα πιο κάτω αντιδραστήρια:

- I. διάλυμα Ca(OH)_2 , II. στερεό CaCO_3 , III. άνυδρο CuSO_4 ,
IV. στερεό CuO , V. στερεό CaO VI. ένυδρο CuSO_4

Να επιλέξετε τον συνδυασμό που δίνει τα καταλληλότερα αντιδραστήρια, τα οποία είναι απαραίτητα, για την εκτέλεση του πιο πάνω πειράματος:

- A. I και V μόνο
B. I, III και IV μόνο
Γ. I, III και VI μόνο
Δ. II, V και VI μόνο
E. II, IV και VI μόνο

30. Δίνονται δύο (2) στοιχεία Ψ και Χ, των οποίων ο ατομικός αριθμός διαφέρει κατά τρεις (3) μονάδες. Το στοιχείο Ψ έχει στην εξωτερική στιβάδα επτά (7) ηλεκτρόνια.

Οι δηλώσεις που ακολουθούν αναφέρονται στο στοιχείο Χ:

- I. ανήκει στην II_A ομάδα και σχηματίζει ιοντική ένωση με χημικό τύπο $\text{X}\Psi_2$
II. ανήκει στην IV_A ομάδα και σχηματίζει ομοιοπολική ένωση με χημικό τύπο $\text{X}\Psi_2$
III. ανήκει στην II_A ομάδα και σχηματίζει ιοντική ένωση με χημικό τύπο $\text{X}\Psi_4$
IV. ανήκει στην IV_A ομάδα και σχηματίζει ομοιοπολική ένωση με χημικό τύπο $\text{X}\Psi_4$
V. ανήκει στην III_A ομάδα και σχηματίζει ιοντική ένωση με χημικό τύπο $\text{X}\Psi_3$
VI. ανήκει στην III_A ομάδα και σχηματίζει ομοιοπολική ένωση με χημικό τύπο $\text{X}\Psi_3$

Να επιλέξετε την ορθή απάντηση:

- A. I μόνο
B. II και III μόνο
Γ. III και V μόνο
Δ. I και IV μόνο
E. V μόνο

ΤΕΛΟΣ Α΄ ΜΕΡΟΥΣ

ΜΕΡΟΣ Β΄: ΔΟΚΙΜΙΟ ΕΡΩΤΗΣΕΩΝ ΑΝΟΙΧΤΟΥ ΤΥΠΟΥ

Αποτελείται από εννέα (9) ερωτήσεις ανοικτού τύπου.

Ερώτηση 1 (μονάδες 5)

Μια οικογένεια αγόρασε βαφή, σε μορφή σκόνης, για τα πασχαλινά αυγά.

Οδηγίες χρήσης της βαφής, για καλύτερα αποτελέσματα, αναφέρουν:

- Προσθέστε σε ένα (1) λίτρο νερού, 20 mL λευκό ξίδι περιεκτικότητας 5 % κ.ό. (% w/v) σε οξικό οξύ (CH_3COOH).
- Στη συνέχεια, προσθέστε ένα (1) φακελάκι βαφής (ο όγκος της σκόνης σε κάθε φακελάκι θεωρείται αμελητέος).
- Αναδεύσετε καλά το μίγμα που προκύπτει και τοποθετήστε τα αυγά σε αυτό.
- Αφήστε τα αυγά στο διάλυμα της βαφής για τουλάχιστον 10 λεπτά.

(α) Να υπολογίσετε:

i. τη μάζα του οξικού οξέος, η οποία βρίσκεται στα 20 mL ξιδιού.

ii. τον συνολικό όγκο του διαλύματος που προκύπτει, αφού αναμιχθεί το νερό, το ξίδι και η σκόνη της βαφής.

iii. την % κ.ό. περιεκτικότητα σε οξικό οξύ του διαλύματος βαφής που προκύπτει.

Όταν τα αυγά τοποθετήθηκαν στο διάλυμα της βαφής που ετοιμάστηκε, παρατηρήθηκαν φυσαλίδες άχρωμου αερίου να διαφεύγουν από την επιφάνεια των αυγών. Η κόρη της οικογένειας (μαθήτριά της Α΄ Λυκείου), θυμήθηκε ότι στο τσόφλι του αυγού υπάρχει η ίδια χημική ουσία που συναντούμε στα κοχύλια και τα μάρμαρα.

(β) Να γράψετε:

i. το όνομα της χημικής ουσίας που συναντούμε στα μάρμαρα, τα κοχύλια και το τσόφλι αυγού.

ii. την επίδραση των οξέων σε αυτή τη χημική ουσία.

iii. σε τι οφείλονται οι φυσαλίδες άχρωμου αερίου που διαφεύγουν από την επιφάνεια των αυγών.

Ερώτηση 2 (μονάδες 8)

Για την ένωση X δίνεται ότι:

- αποτελείται από τα στοιχεία άνθρακα και υδρογόνο μόνο.
- 0,9 g της καταλαμβάνουν όγκο 672 mL, σε κανονικές συνθήκες (Κ.Σ.).

(α) Να υπολογίσετε τη σχετική μοριακή μάζα της ένωσης X.

(β) Να υπολογίσετε τον αριθμό των ατόμων του υδρογόνου, τα οποία περιέχονται σε ένα (1) μόριο της ένωσης X, εάν δίνεται ότι στα 0,9 g της ένωσης περιέχεται ο ίδιος αριθμός ατόμων υδρογόνου με ποσότητα 1,02 g NH₃.

(γ) Να γράψετε:

i. τον μοριακό τύπο της ένωσης X.

ii. τον αναπτυγμένο συντακτικό τύπο της ένωσης X.

iii. τον ηλεκτρονιακό τύπο της X, χρησιμοποιώντας τα ηλεκτρόνια της εξωτερικής στιβάδας (σύμβολα Lewis).

iv. το όνομα της ομόλογης σειράς στην οποία ανήκει η ένωση X.

v. τον γενικό μοριακό τύπο της ομόλογης σειράς στην οποία ανήκει η ένωση X.

Ερώτηση 3 (μονάδες 10)

Διαθέτουμε τις ακόλουθες τέσσερις (4) αέριες ουσίες, στις ίδιες συνθήκες θερμοκρασίας και πίεσης:

I. 2 mol H_2

II. 4 mol CO

III. 3 mol NH_3

IV. 1 mol H_2S

Να γράψετε, δείχνοντας όλους τους υπολογισμούς και τον τρόπο σκέψης σας, ποια από τις ουσίες I έως IV:

(α) έχει τη μεγαλύτερη μάζα

(β) καταλαμβάνει τον μεγαλύτερο όγκο, σε Κ.Σ.

(γ) περιέχει τον μεγαλύτερο συνολικά αριθμό ατόμων

Ερώτηση 4 (μονάδες 6,5)

Καθηγήτρια Χημείας έδωσε σε ομάδα μαθητών της Α΄ Λυκείου τέσσερα (4) δοχεία Α, Β, Γ και Δ, χωρίς ετικέτες.

Παράλληλα, έδωσε στους μαθητές της, τις πιο κάτω πληροφορίες:

- Το κάθε δοχείο περιέχει μια από τις πιο κάτω στερεές ουσίες:



- Η διαλυτότητα στο νερό και το σημείο τήξεως των ουσιών που περιέχονται στα δοχεία Α, Β, Γ και Δ, αναφέρονται στον πιο κάτω πίνακα:

| Ουσία δοχείου | Διαλύεται στο νερό | Σημείο τήξεως, °C |
|---------------|--------------------|-------------------|
| Α | ΟΧΙ | 44 |
| Β | ΝΑΙ | 938 |
| Γ | ΝΑΙ | 711 |
| Δ | ΝΑΙ | 190 |

- Με την προσθήκη μικρής ποσότητας διαλύματος υδροχλωρικού οξέος στην ουσία του δοχείου Β, ελευθερώνεται αέριο υδρόθειο, H_2S .

Η καθηγήτρια της Χημείας ζήτησε από τους μαθητές της να γράψουν, σε ετικέτες, τον χημικό τύπο που αντιστοιχεί στο περιεχόμενο κάθε δοχείου Α, Β, Γ και Δ, αξιοποιώντας όλα τα δεδομένα και καταγράφοντας όλους τους συλλογισμούς τους.

Ερώτηση 5 (μονάδες 10)

(α) Να δείξετε τον σχηματισμό των χημικών δεσμών μεταξύ των πιο κάτω στοιχείων χρησιμοποιώντας τα ηλεκτρόνια της εξωτερικής στιβάδας (σύμβολα Lewis):

i. στο διατομικό μόριο του χλωρίου

ii. μεταξύ λιθίου και οξυγόνου

iii. μεταξύ υδρογόνου και φωσφόρου

(β) Δίνεται ο χημικός τύπος του υπεροξειδίου του υδρογόνου, H_2O_2 .

Να γράψετε για το H_2O_2 :

i. τον ηλεκτρονιακό τύπο του

ii. τον συντακτικό τύπο του

Ερώτηση 6 (μονάδες 6,5)

Πιο κάτω, γίνεται αναφορά σε δύο (2) πειραματικές ασκήσεις της Α΄ Λυκείου, που πραγματοποιήθηκαν στο σχολικό εργαστήριο.

Να απαντήσετε τα ερωτήματα που ακολουθούν και αφορούν στα πειράματα αυτά.

Πείραμα 1

Οι μαθητές έκοψαν ένα μικρό κομμάτι ταινίας μαγνησίου. Κρατώντας το άκρο της ταινίας μαγνησίου με τη βοήθεια μεταλλικής λαβίδας, στην παρουσία του καθηγητή τους, την πλησίασαν στη φλόγα του λύχνου Bunsen.

(α) Να γράψετε δύο (2) παρατηρήσεις που αναμένεται να γίνουν από τους μαθητές.

(β) Να γράψετε τη χημική εξίσωση της αντίδρασης που πραγματοποιήθηκε.

Πείραμα 2

Στάδιο I. Σε δύο (2) δοκιμαστικούς σωλήνες Α και Β μετέφεραν, ξεχωριστά, με τη βοήθεια σπάτουλας, μικρή ποσότητα στερεού ιωδιούχου καλίου και στερεού νιτρικού μολύβδου, αντίστοιχα.

Στάδιο II. Στους δύο (2) σωλήνες πρόσθεσαν αποσταγμένο νερό και ανακίνησαν το περιεχόμενό τους έντονα.

Στάδιο III. Μετάγγισαν το περιεχόμενο του σωλήνα Α στο περιεχόμενο του σωλήνα Β και άφησαν το μίγμα που σχηματίστηκε σε ηρεμία για λίγα λεπτά.

(α) Τι αναμένεται να παρατηρηθεί, στο Στάδιο II, στον καθένα από τους δύο (2) σωλήνες μετά την ανακίνηση με το αποσταγμένο νερό;

(β) Τι αναμένεται να παρατηρηθεί, στο Στάδιο III, αφού το μίγμα που σχηματίστηκε αφέθηκε σε ηρεμία για λίγα λεπτά;

(γ) Να γράψετε τη χημική εξίσωση της αντίδρασης που πραγματοποιήθηκε στο Στάδιο III.

Ερώτηση 7 (μονάδες 8)

Καθηγητής Χημείας σε σχολικό εργαστήριο, έδωσε σε ομάδα μαθητών στερεό μαγειρικό αλάτι, το οποίο, όπως τους ανέφερε, πιθανόν να περιέχει οργανική ένωση.

Η ομάδα μαζί με τον καθηγητή, προχώρησε στην εκτέλεση, σε κατάλληλη συσκευή, απλού πειράματος ανίχνευσης της παρουσίας οργανικής ένωσης στο αλάτι.

Μαζί με το δείγμα αλατιού, στο δοχείο αντίδρασης, πρόσθεσαν μία μαύρη σκόνη. Κατά την εκτέλεση του πειράματος, στο δοχείο αντίδρασης παρατηρήθηκε αναβρασμός και αναδύονταν λευκοί καπνοί, ενώ στα εσωτερικά τοιχώματα του δοχείου παρατηρήθηκε καφεκόκκινο στερεό.

Τέλος, η ομάδα έλεγξε για την παρουσία των προϊόντων της αντίδρασης που αναμένονταν (αέριο Α και αέριο Β). Τα δύο αέρια ανιχνεύθηκαν με επιτυχία χρησιμοποιώντας τα κατάλληλα αντιδραστήρια.

(α) Να γράψετε τον χημικό τύπο των δύο αερίων που αναμένονταν (αέριο Α και αέριο Β), εάν δίνεται ότι το αέριο Α έχει μικρότερη σχετική μοριακή μάζα από το αέριο Β.

(β) i. Να γράψετε την παρατήρηση που αναμένεται, κατά την ανίχνευση του αερίου Α, με το κατάλληλο αντιδραστήριο.

ii. Να γράψετε τη χημική εξίσωση ανίχνευσης της ένωσης Α.

(γ) Να γράψετε την παρατήρηση που αναμένεται, κατά την ανίχνευση της ένωσης Β, με το κατάλληλο αντιδραστήριο.

(δ) Στο δοχείο αντίδρασης, ο καθηγητής πρόσθεσε μαζί με το μαγειρικό αλάτι και ποσότητα μιας μαύρης στερεής ουσίας.

Να γράψετε:

i. τον χημικό τύπο της ουσίας.

ii. τον ρόλο της ουσίας αυτής.

(ε) Να γράψετε σε τι οφείλονται οι παρατηρήσεις, στο δοχείο αντίδρασης, κατά την εκτέλεση του πειράματος.

(στ) Θα μπορούσε η παραγωγή των δύο αερίων Α και Β, να οφείλεται στο μαγειρικό αλάτι; Να δικαιολογήσετε την απάντησή σας.

Ερώτηση 8 (μονάδες 6)

Η Αλέκα βοήθησε τη γιαγιά της να φτιάξει γλυκό περγαμόντο.

Η γιαγιά ανέφερε στην Αλέκα μικρά σημεία επιτυχίας για να πετύχει το γλυκό τους:

- τα φρούτα να είναι φρέσκα, να μην έχουν κτυπήματα, να μην είναι ούτε ώριμα, ούτε άγουρα.
- το σιρόπι να ετοιμάζεται με μεγάλη ακρίβεια.
- να διατηρείται η θερμοκρασία ψησίματος του γλυκού σταθερή, γύρω στους 100 °C.
- το γλυκό να ψήνεται, τουλάχιστον για τριάντα (30) λεπτά, σε ανοικτή κατσαρόλα.
- να φυλάγεται σε δροσερό μέρος, θερμοκρασίας δωματίου (20 °C).

Ακολούθησαν κατά γράμμα τη συνταγή, καθώς επίσης και τις πιο κάτω οδηγίες και όμως στο γλυκό, μετά από μια βδομάδα, σχηματίστηκαν κρύσταλλοι, κοινώς ζαχάρωσε.

Δοσολογία σιροπιού:

- κάθε 2 kg νερού προστίθενται 1,2 kg ζάχαρη, $C_{12}H_{22}O_{11}$.

Διαλυτότητα λευκής ζάχαρης:

- 60 g ζάχαρης σε 100 g νερού στους 20 °C
- 80 g ζάχαρης σε 100 g νερού στους 100 °C

Αξιοποιώντας όλα τα δεδομένα και καταγράφοντας όλους τους συλλογισμούς σας:

(α) να υπολογίσετε την % κ.μ. περιεκτικότητα σε ζάχαρη του σιροπιού που έφτιαξαν.

(β) να εξηγήσετε τον λόγο για τον οποίο σχηματίστηκαν οι κρύσταλλοι στο γλυκό.

(γ) να εισηγηθείτε τρόπο για να φύγουν οι κρύσταλλοι από το γλυκό.

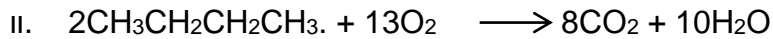
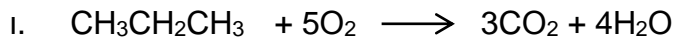
Ερώτηση 9 (μονάδες 10)

Το υγραέριο, διεθνώς γνωστό ως L.P.G., είναι ένα ομοιογενές και εξαιρετικά εύφλεκτο μίγμα των αερίων προπανίου και βουτανίου. Τα δύο αέρια υγροποιούνται υπό πίεση και εμφιαλώνονται σε μεταλλικές φιάλες των 10 kg, 15 kg, 35 kg και 50 kg.

Στο υγραέριο, συνήθως, προστίθεται μικρή ποσότητα κάποιου συστατικού με πολύ ισχυρή οσμή, ώστε να είναι εύκολα ανιχνεύσιμο, σε περίπτωση διαρροής του.

Ως καύσιμο, το υγραέριο θεωρείται πιο «φιλικό» στο περιβάλλον από τους υγρούς υδρογονάνθρακες, διότι έχει μικρές εκπομπές διοξειδίου του άνθρακα, CO₂.

Ποσότητα X g υγραερίου καίγεται στον αέρα, σύμφωνα με τις χημικές εξισώσεις τέλειας καύσης που ακολουθούν:



Το αέριο που ελευθερώνεται διαβιβάζεται σε δοκιμαστικό σωλήνα, ο οποίος περιέχει διαυγές ασβεστόνερο. Καταβυθίζονται 5 g λευκού ιζήματος.

Να υπολογίσετε:

(α) την % κ.μ. σύσταση του υγραερίου, εάν στα X g υγραερίου, το προπάνιο είναι 0,22 g.

(β) τον όγκο του αέριου οξυγόνου που απαιτείται για την πλήρη καύση του υγραερίου, σε Κ.Σ.