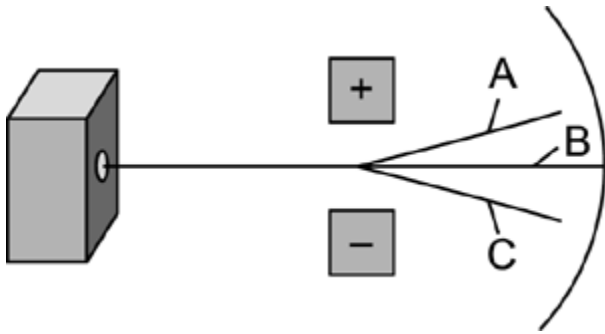


Practice Exam Unit B

1. The constant level of natural radioactivity in our environment is called
A) latent radiation B) ozone radiation C) background radiation D) cosmic rays
2. Which of these is false about ionizing radiation?
A) It is not normally harmful to the human body.
B) It can cause an atom to lose electrons.
C) It usually consists of wavelengths shorter than those for visible light.
D) It is of higher energy than nonionizing radiation.
3. Which of the following is NOT a natural source of background radiation?
A) high tension power lines B) food C) the soil and air D) outer space
4. The only source of background radiation is the result of technology.
A) true B) unknown C) false
5. All living things contain some radioisotopes.
A) unknown B) true C) false
6. The limit for background radiation exposure is lower for workers than it is for the general public.
A) false B) unknown C) true
7. There are factors about where you live that will impact your personal amount of background radiation.
A) unknown B) true C) false
8. The type of radiation that ejects electrons from atoms and molecules is _____.
A) fluorescing B) ionizing C) electronizing D) nonionizing
9. The whole range of electromagnetic waves from radio through visible to gamma and cosmic makes up the electromagnetic _____.
A) spectrum B) periodic table C) rainbow D) decay series
10. The reactions involved in the cooking of food in a microwave oven are initiated by
A) nuclear radiation B) ionizing radiation C) nonionizing radiation
11. A wide spray of water from a sprinkler rather than a concentrated stream of water could model this type of radiation.
A) nuclear radiation B) electromagnetic radiation C) ionizing D) nonionizing

Use the following to answer questions 12-15:



12. Which letter indicates the path of an alpha particle?
A) A B) B C) C D) both A and B
13. Which line represents the path of a beta particle?
A) A B) B C) C D) both B and C
14. Which line represents the path of gamma radiation?
A) A B) B C) C D) both A and C
15. Which of the lines do not represent electromagnetic radiation?
A) A B) B C) C D) both A and C
16. Which part of the atom "decays"?
A) nucleus B) neutrons C) radioisotope D) electron cloud
17. The source of radioactivity is:
A) different physical and chemical properties C) the same elemental composition
B) an unstable atomic nucleus D) all of the above
18. The most penetrating nuclear radiation is _____.
A) beta particles B) gamma rays C) alpha particles
19. Emitters of this type of nuclear radiation can safely be held in your hand because your skin effectively stops the emitted radiation.
A) gamma rays B) alpha particles C) beta particles
20. A neutron is destroyed when this type of nuclear radiation is emitted.
A) beta particles B) gamma rays C) alpha particles
21. The nuclear radiation with a negative charge is
A) alpha particles B) gamma rays C) beta particles
22. When this nuclear radiation is emitted there is no change in atomic number or mass.
A) gamma rays B) beta particles C) alpha particles
23. All of the following statements about radioactive decay are true EXCEPT
A) It is slower at cold temperatures. C) Three types are α , β , and γ .

45. Atomic mass is a relative scale based on which of the following nuclides?
A) carbon-12 B) nitrogen-14 C) hydrogen-1 D) oxygen-16
46. Neon occurs as a mixture of three isotopes: 90.51% is Ne-20, 0.27% is Ne-21, and 9.22% is Ne-22. The atomic mass of neon would be closer to which isotope?
A) Ne-21 B) Ne-20 C) Ne-22 D) none of these
47. The different forms of an atom caused by having varying numbers of neutrons are called
A) isomers B) ions C) isotopes D) radioactivity
48. If an isotope has an atomic number of 100 and a mass number of 257, its number of neutrons is
A) 257 B) 357 C) 157 D) 100
49. If an isotope has an atomic number of 100 and an atomic mass of 257, its number of protons is
A) 157 B) 257 C) 357 D) 100
50. The atomic mass of lithium is 6.941. It exists as two isotopes, lithium-6 and lithium-7. Which is the percent of naturally occurring lithium 7?
A) 94.1 % B) 69.4 % C) 9.5 % D) 5.9 %
51. Which of these statements about the isotopic penny lab is false?
A) Pre-1982 pennies normally have a greater mass than post 1982 pennies.
B) Pennies minted before 1982 contain more copper than those minted after 1982.
C) Post-1982 pennies are less dense than pre-1982 pennies.
D) The total number of pennies in each container ranged from 1 to ten.
52. Which of these nuclei would be most unstable?
A) The number of protons equals the number of neutrons.
B) The number of electrons is greater than the number of neutrons.
C) The number of neutrons is less than the number of protons.
D) The number of protons equals the number of electrons.
53. If the atomic number of an atom is 79 and its atomic mass is 196.97, then the number of electrons in a neutral atom is
A) 196 B) 197 C) 118 D) 79
54. When radium-226 decays into radon-222, it is an example of
A) beta decay B) nuclear bombardment C) gamma decay D) alpha decay
55. Beta decay of bismuth-214 results in the formation of
A) polonium-214 B) lead-214 C) thallium-210 D) astatine-210
56. When technetium-99 decays, its atomic number and mass number are unchanged. This is an example of _____.
A) alpha decay B) gamma decay C) nuclear bombardment D) beta decay

57. Which statement is true for the isotope having symbol ${}^{14}_6\text{C}$
- A) it has 8 neutrons B) it has a mass number of 20 C) it has 14 protons D) all of the above
58. Two different isotopes of the same element can be separated because of their different
- A) atomic masses B) heats of combustion C) pH D) chemical reactions
59. As a result of decay by alpha emission, the mass number of the parent nuclide
- A) increases by 2 B) decreases by 2 C) decreases by 4 D) increases by 4
60. All atoms of uranium contain
- A) 92 electrons B) 146 neutrons C) 92 protons D) 92 neutrons
61. The result of beta decay is that the atomic number of the parent nuclide
- A) decreases by 2 B) increases by 2 C) increases by 1 D) decreases by 1
62. Gamma emission results in the atomic number of the parent nuclide
- A) decreasing by 1 B) remaining the same C) increasing by 1 D) decreasing by 4
63. A sample of silver as it occurs in nature is 52.00% Ag-107 and 48.00% Ag-108. What is the average mass of silver?
- A) 100.0 B) 107.5 C) 107.9 D) 215.0
64. How many protons, electrons, and neutrons are present in an atom of chromium?
- A) 24p, 24e, 28n B) 49p, 46e, 3n C) 21p, 27e, 31n D) 25p, 21e, 28n
65. Among atoms having low atomic numbers, the most stable nuclei have a ratio of neutrons to protons that is
- A) 2:1 B) 4:1 C) 1:1 D) 3:1
66. Isotopes of the same element must have the same
- A) number of electrons B) atomic number C) number of nucleons D) number of neutrons
67. Which of the following is conserved in a nuclear reaction?
- A) types of atoms B) mass and atomic numbers C) number of atoms D) none of the above
68. The U.S. standard for exposure to background radiation by the general public is
- A) 500 mrem B) 135 mrem C) 335 mrem D) 170 mrem
69. Besides having carbon monoxide and smoke detectors in your home, understanding natural radiation hazards might guide you to purchase a
- A) mercury detector B) uranium detector C) lead detector D) radon detector

Use the following to answer questions 70-71:

81. Which type of nuclear radiation is also a type of electromagnetic radiation?
 A) gamma B) none are electromagnetic radiation C) alpha D) beta
82. A sample that emits this type of radiation can safely be held in your hand.
 A) gamma B) none are safe to hold in your hand C) beta D) alpha
83. When a nucleus only emits this type of radiation, the atomic number does not change.
 A) beta B) alpha C) all radiation emission affects atomic number D) gamma
84. Which is not a true statement about nuclear radiation?
 A) Nuclear radiation can both cause and be used to treat cancer.
 B) Intensity of nuclear radiation decreases with increasing distance from the source.
 C) Gamma rays are the most penetrating and alpha rays the least penetrating forms of radiation.
 D) A vacuum will serve as an effective barrier to nuclear radiation.
85. Which will not protect you from hazardous radiation exposure?
 A) limiting the time of your exposure to radiation.
 B) detecting the radiation with a rate meter
 C) placing lead barriers between yourself and the source of radiation
 D) staying far away from the radiation source
86. Nuclear radiation in order from the most penetrating to the least penetrating is
 A) alpha, beta, gamma C) all have equal penetrating strength
 B) gamma, beta, alpha D) beta, alpha, gamma
87. The symbol ${}^4_2\text{He}$ represents which type of radiation?
 A) electromagnetic B) beta C) alpha D) gamma
88. Gamma rays are most similar to
 A) beta particles B) X-rays C) Microwaves D) alpha particles
89. Which of the following materials is most effective in shielding gamma radiation?
 A) cardboard B) all are the same C) aluminum D) lead
90. Which of the following radioactive emissions requires the most shielding?
 A) beta particles B) protons C) alpha particles D) gamma rays
91. Tissue cell mutations are the result of
 A) damaged DNA in cells C) exposure to nonionizing radiation
 B) cancer growth in cells D) both A and B
92. A disease in which cell growth and metabolism are out of control.
 A) birth defect B) plague C) mutations D) cancer
93. Which of the following is (are) ionizing radiation?
 A) gamma rays B) X-rays C) microwaves D) both A and B

- A) a proton B) an alpha particle C) a neutron D) an electron
105. A type of radioactive decay that causes no change in the atomic number or mass number is:
A) spontaneous decay B) gamma decay C) alpha decay D) beta decay
106. If a radioactive atom emits a beta particle, the atomic number increases by one and the mass number
A) increases slightly B) remains the same C) decreases significantly D) increases significantly
107. A radioactive substance will lose the greatest amount of mass when it emits
A) a beta particle B) an alpha particle C) a proton D) a neutron
108. When a radioactive nucleus emits an alpha particle, the mass number
A) increases, and its atomic number decreases
B) decreases, and its atomic number decreases
C) remains the same, and its atomic number decreases
D) decreases, and its atomic number remains the same
109. When an atom emits a beta particle, the total number of nucleons
A) decreases B) remains the same C) increases
110. Which of the following is not a device to detect radiation?
A) scintillation counter B) Geiger-Mueller tube C) solid-state detector D) Schooler gauge
111. Why is it important to have radiation detectors available?
A) because humans cannot detect radiation themselves
B) to act as a barrier to radiation's effects
C) to measure quantities of radiation in your body
D) to provide job opportunities for nuclear physicists
112. The fact that radioactive elements produce charges in air means an instrument can detect them. The name of this instrument is a
A) Einstein counter B) Rutherford counter C) Geiger counter D) none of the above
113. The half-life of radium-226 is 1620 years. What fraction of an original sample will still be radium-226 after 4860 years have passed?
A) one fourth B) one eighth C) one sixth D) one half
114. In the year 2000, a hospital purchased 1 g of cobalt-60 that registered 200 radiation counts per second (cps). Given that the half-life of cobalt-60 is close to five years, how much radiation would be expected to remain by the year 2010?
A) 100 cps B) 25 cps C) 150 cps D) 50 cps
115. The most likely process of dating an Egyptian mummy would be
A) carbon dating B) Geiger counting C) beta emission dating D) brachytherapy
116. Which of these isotopes of carbon are used for carbon dating?

- A) C-14 B) C-15 C) C-12 D) C-13
117. If you start with 500.0 g of a radioisotope with a half-life of 3.0 days, how much of the original isotope will still be in the sample after 18 days?
A) 31.3 g B) 3.9 g C) 7.8 g D) 15.6 g
118. If you start with 259 pounds of Simmsium, a new element, with a half-life of 13 hours, how many half-lives does it undergo before 16.2 pounds of the sample is still the original element?
A) two B) three C) four D) five
119. The half-life of potassium-42 is 12.4 hours. How much of the radiation is left after 62.0 hours?
A) 25% B) 12.4% C) 3.1% D) 6.2%
120. The half-life of thorium-232 is 1.4×10^{10} years. If there are 25.0 grams of Thorium-232 in the sample after 2.8×10^{10} years, how many grams were in the original sample?
A) 100 g B) 25 g C) 150 g D) 50 g
121. If a radioisotope with a half-life of five minutes emits 650 counts per minute (cpm), how much radiation is expected after 30 minutes?
A) 20.3 cpm B) 325 cpm C) 40 cpm D) 10.2 cpm
122. For a radioactive sample to decay until only 6.25% of the original radiation remains takes
A) 6 half-lives B) 5 half-lives C) 3 half-lives D) 4 half-lives
123. The half-life of element X is 10.0 days. How much of the original radiation will remain after 50.0 days?
A) 6.24% B) 1.56% C) 0.78% D) 3.12%
124. The half-life of carbon-14 is 5730 years. "Pre-bomb" carbon-14 emits about 15 beta radiations per minute per gram of material. What fraction of radiations would be expected after 22,920 years?
A) one thirty-second B) one eighth C) one half D) one sixteenth
125. The half-life of Plutonium-239 is 24,300 years. If 8 kilograms of this isotope is stored, how many years would pass before the radiation is $1/8$ of the initial amount?
A) 72,900 years B) 12,150 years C) 48,600 years D) 24,300 years
126. The half-life of a radioactive element can be defined as
A) half the time needed for all of a sample to decay
B) the time required for all of a sample to decay
C) the time needed for half of a sample to decay
D) half the time needed for half of a sample to decay
127. Radioisotopes with short half-lives that are placed in a patient's body for diagnostic purposes.
A) projectiles B) tracers C) particle accelerators D) actinides
128. Radioactive iodine and barium are used mainly
A) to date ancient artifacts C) as tracers in medical scans
B) as fuel for nuclear reactors D) to kill cancer cells

129. Sodium iodide is added to the salt we buy because iodine
- A) helps diagnose thyroid problems C) kills thyroid cancer
 B) is a good tracer D) is needed for normal thyroid function
130. Radioisotopes are effective as tracers because
- A) they behave chemically just as the non-radioactive isotopes
 B) they are easily tracked as they move through the body
 C) they behave biologically just as the non-radioactive isotopes
 D) all of the above
131. Sterilization of medical instruments with radiation would be an example of
- A) irradiation B) tracer studies C) radiation therapy D) carbon dating
132. Which radioisotope is often used in medical treatment to destroy diseased tissue?
- A) strontium-90 B) cobalt-60 C) uranium-235 D) uranium-238
133. Large-scale use of transuranium metallic elements for construction purposes is unlikely because such elements
- A) emit radiation
 B) are unstable; over time they decay to form other elements
 C) emit radiation, are not found in nature, and are unstable
 D) are not found in nature and must therefore be synthesized via nuclear reactions
134. Which equation represents a synthetic nuclear transmutation?
- A) ${}^{14}_6\text{C} \rightarrow {}^{14}_7\text{N} + {}^0_{-1}\text{e}$ C) ${}^1_0\text{n} \rightarrow {}^1_1\text{H} + {}^0_{-1}\text{e} + \text{antineutrino}$
 B) ${}^1_1\text{H} + {}^9_4\text{Be} \rightarrow {}^6_3\text{Li} + {}^4_2\text{He}$ D) ${}^{238}_{92}\text{U} \rightarrow {}^4_2\text{He} + {}^{234}_{90}\text{Th}$
135. A transmutation reaction must involve
- A) a transfer of electrons from a metallic atom to a nonmetallic atom
 B) a sharing of electrons by non-metallic atoms of the same element
 C) a change in the number of protons in a nucleus of an atom
 D) an increase in the number of neutrons in the nucleus of an atom
136. ${}^{27}_{13}\text{Al} + {}^4_2\text{He} \rightarrow {}^1_0\text{n} + \underline{\hspace{2cm}}$
 In the equation the missing element is
 A) phosphorus B) magnesium C) aluminum D) sodium
137. ${}^{27}_{13}\text{Al} + {}^4_2\text{He} \rightarrow {}^1_0\text{n} + \underline{\hspace{2cm}}$
 In the equation, the mass number of the missing isotope is
 A) 27 B) 30 C) 31 D) 15
138. ${}^9_4\text{Be} + {}^1_1\text{H} \rightarrow \underline{\hspace{2cm}} + {}^4_2\text{He}$
 The missing element in this equation is

- A) II B) I C) IV D) III
151. The product of this reaction is helium.
A) IV B) III C) I D) II
152. This reaction can only take place in very high temperatures.
A) II B) IV C) I D) III
153. Uranium-235 is unique in that:
A) it is the only radioisotope that can undergo fission
B) it can be used as a fuel in nuclear power plants but not in nuclear bombs
C) it is the only naturally occurring radioactive isotope
D) it is the only naturally occurring radioisotope that is suitable as a fuel for fission reaction
154. ${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{56}^{140}\text{Ba} + {}_{36}^{93}\text{Kr} + 3 {}_0^1\text{n}$
This bombardment equation is an example of
A) decay B) fusion C) fission D) radioactivity
155. $E = mc^2$ is the equation that describes the amount of energy created when some mass of an atom is lost.
Who is given credit for this equation?
A) Albert Einstein B) Neils Bohr C) Lise Meitner D) Robert Oppenheimer
156. What is the force that holds nucleons together called?
A) nucleon attraction B) proton attraction C) strong force D) nuclear force
157. According to Einstein's equation, $E = mc^2$,
A) the energy and the speed of light are equivalent
B) there is no relationship between mass and energy
C) mass and energy are equivalent
D) mass and the speed of light are equivalent
158. In nuclear fission, some of the particles emitted from the reaction are
A) electrons B) neutrons C) alpha particles D) protons
159. Why is it impossible for a nuclear power plant to explode like a nuclear bomb?
A) Nuclear power plants and nuclear bombs rely on a different type of fuel.
B) Far from being impossible, nuclear power plants do produce explosions like nuclear bombs.
C) A nuclear power plant contains a far lower concentration of fissionable material than found in a nuclear bomb.
D) Nuclear power plants and nuclear bombs rely on entirely different nuclear reactions, even though the fuel is the same.
160. Dominoes placed in a single file line is a simulation of
A) irradiation B) an expanding chain reaction C) nuclear bomb D) limited chain reaction
161. This much fissionable material is necessary to support a chain reaction.
A) 500 g B) two tons C) complementary mass D) critical mass

162. What product of fission reactions is important to supporting a chain reaction?
 A) beta particles B) two smaller nuclei C) heat D) neutrons
163. What property makes nuclear reactors behave differently from nuclear bombs?
 A) shape of container B) concentration of fissionable material C) temperature D) size
164. Which is NOT a correct statement comparing nuclear power plants with coal-fired power plants?
 A) Nuclear power plants are less efficient than coal-fired plants in converting fuel to energy.
 B) Nuclear plants use significantly less fuel than coal-fired plants.
 C) Construction of nuclear plants has met with more public opposition than is the case for coal-fired plants.
 D) Nuclear plants produce little air pollution compared to coal-fired plants.
165. The usual reaction in a nuclear power plant is an example of
 A) expanding fusion B) limited fission C) limited fusion D) expanding fission
166. In a nuclear reactor, the normal fuel is
 A) cadmium B) graphite C) uranium oxide D) boron carbide
167. In a nuclear reactor the main function of the moderator is to
 A) speed up neutrons B) slow down neutrons C) absorb nuclei D) absorb neutrons
168. In a nuclear reactor the main function of the control rods is to
 A) slow down neutrons B) absorb neutrons C) absorb nuclei D) speed neutrons
169. The "white smoke" seen pouring out of the top of a nuclear power plant is
 A) carbon pollution B) radioactive fumes C) steam D) uranium dust
170. What percentage of total radioactive waste volume does nuclear plant waste occupy?
 A) about 25% B) far more than 50% C) far less than 1% D) somewhere between 1% and 25%

Use the following to answer questions 171-173:

Two statements regarding a proposed nuclear power plant.

Statement from a Power Company official:

"Our company is very eager to build a new nuclear power plant. Our studies have shown that the need for electrical power in the county will increase by 28% in the next 10 years. Our present plant will be able to supply no more than 7% of that need. The people of this area will continue to use more and more electrical power over the next 30 years, and nuclear power is the best source available to them."

Statement from a Famous Nuclear Physicist:

"Nuclear power is a very dangerous resource. The world has already experienced the terrible destruction that can come from nuclear bombs. The electrical power that people in this county need can be provided by means that are both safer and less expensive than nuclear power."

171. What do you conclude about the statement made by the power company's representative?
- A) Only factual information was presented by the power company official.
 - B) The statement is only company propaganda about nuclear power.
 - C) Both factual information and statements of opinion are presented.
 - D) The statement contains only expressions of opinion.
172. What do you conclude about the famous nuclear physicist's statement?
- A) The statement contains factual information only.
 - B) The scientist's opinions are based solely on scientific information in this case.
 - C) We should agree with the opinions given because the nuclear physicist is famous.
 - D) It is possible that the scientist can have some of the same kinds of biases that a non-scientist might have.
173. In comparing the two statements, what can you conclude?
- A) The statement from the power company representative, being an agent of business, probably contains false information.
 - B) Because the views expressed in both statements are different, we should seek and evaluate additional opinions on the question.
 - C) The statement from the scientist, being an intellectual, should probably be the one to base action upon.
 - D) The statement from the power company representative, being an agent of business, probably contains the best economic advice for the county.
174. In a nuclear power plant, the _____ slow(s) down neutrons to enhance the probability of continued fission.
- A) fuel rods
 - B) cooling tower
 - C) moderator
 - D) control rods
 - E) containment dome
175. Which statement about the Chernobyl and Three Mile Island incidents is NOT true?
- A) They both increased fears about nuclear power.
 - B) They both caused numerous deaths.
 - C) They both disabled the reactor.
 - D) They both involved operator error.
176. Which of the following best describes fusion?
- A) a large atom is split into two almost equal atoms
 - B) a large atom loses an alpha particle to become an atom of a different element
 - C) two small atoms join to form one larger atom
 - D) a small atom loses a beta particle to become an atom of a different element
177. Which of the following prevent the use of fusion as a fuel source?
- A) availability of fuel
 - B) amount of waste created
 - C) difficulty creating and maintaining high temperatures
 - D) both B and C
178. A good example of fusion is
- A) nuclear submarines
 - B) uranium decay
 - C) the Sun
 - D) infusion

Answer Key -- Unit B Practice

- | | | | | |
|-------|-------|--------|--------|--------|
| 1. C | 38. B | 75. A | 112. C | 149. D |
| 2. A | 39. A | 76. A | 113. B | 150. A |
| 3. A | 40. D | 77. D | 114. D | 151. D |
| 4. C | 41. A | 78. C | 115. A | 152. A |
| 5. B | 42. A | 79. B | 116. A | 153. D |
| 6. A | 43. B | 80. A | 117. C | 154. C |
| 7. B | 44. A | 81. A | 118. C | 155. A |
| 8. B | 45. A | 82. D | 119. C | 156. C |
| 9. A | 46. B | 83. D | 120. A | 157. C |
| 10. C | 47. C | 84. D | 121. D | 158. B |
| 11. D | 48. C | 85. B | 122. D | 159. C |
| 12. C | 49. D | 86. B | 123. D | 160. D |
| 13. A | 50. A | 87. C | 124. D | 161. D |
| 14. B | 51. D | 88. B | 125. A | 162. D |
| 15. D | 52. C | 89. D | 126. C | 163. B |
| 16. A | 53. D | 90. D | 127. B | 164. A |
| 17. B | 54. D | 91. A | 128. C | 165. B |
| 18. B | 55. A | 92. D | 129. D | 166. C |
| 19. B | 56. B | 93. D | 130. D | 167. B |
| 20. A | 57. A | 94. D | 131. A | 168. B |
| 21. C | 58. A | 95. A | 132. B | 169. C |
| 22. A | 59. C | 96. C | 133. C | 170. C |
| 23. A | 60. C | 97. B | 134. B | 171. C |
| 24. C | 61. C | 98. B | 135. C | 172. D |
| 25. C | 62. B | 99. A | 136. A | 173. B |
| 26. B | 63. B | 100. A | 137. B | 174. C |
| 27. D | 64. A | 101. B | 138. B | 175. B |
| 28. B | 65. C | 102. C | 139. C | 176. C |
| 29. D | 66. B | 103. A | 140. C | 177. D |
| 30. A | 67. B | 104. B | 141. B | 178. C |
| 31. C | 68. A | 105. B | 142. D | 179. C |
| 32. D | 69. D | 106. B | 143. D | 180. C |
| 33. D | 70. A | 107. B | 144. A | 181. C |
| 34. A | 71. D | 108. B | 145. A | 182. A |
| 35. A | 72. B | 109. B | 146. C | |
| 36. B | 73. D | 110. D | 147. A | |
| 37. C | 74. D | 111. A | 148. C | |