1012_4th Exam_1020619

1) To produce an ether from methanol, one can use:
   A) alcohol and concentrated H_2SO_4
   B) reacting alkene with water in a presence of a strong mineral acid
   C) Cu, heat
   D) KOH in alcohol
   E) reacting alcohol with sodium

   Answer: A

2) What is the decay constant for ^{131}I if the half-life is 8.04 d?
   A) $3.48 \times 10^{-6}\ s^{-1}$ B) $9.98 \times 10^{-7}\ s^{-1}$ C) $4.81 \times 10^{-4}\ s^{-1}$ D) $9.31 \times 10^{-5}\ s^{-1}$

   Answer: B

3) The binding energy per nucleon is largest for _____.
   A) ^{1}H B) ^{59}Co C) ^{3}He D) ^{235}U E) ^{98}Tc

   Answer: B

4) Which of the following would have the greatest penetrating power through matter?
   A) beta particles
   B) protons
   C) alpha particles
   D) positron particles
   E) gamma rays

   Answer: E

5) Which statements regarding chiral compounds are correct?
   I) "Chiral carbon" is synonymous with "asymmetric carbon".
   II) The presence of one chiral carbon in a structure results in two possible enantiomers.
   III) Two enantiomers can be interconverted without breaking any bonds.
   IV) Two chiral molecules are mirror images of each other.
   V) Two chiral molecules have significantly different chemical properties.
   A) II), IV) and V)
   B) I), III), and IV)
   C) II), III), and V)
   D) III), and V)
   E) I), II), and IV)

   Answer: E

6) Which of the following statements correctly describe S_N2 and S_N1 reactions?

I) S_N2 reactions proceed with retention of configuration.

II) S_N1 reactions prefer polar protic solvents

III) S_N1 reactions produce racemic products

IV) S_N2 reactions are promoted in the presence of a substrate that produces a very stable carbocation

V) S_N1 reactions have a unimolecular rate-determining step.

A) II), III), and IV)
B) I), II) and V)
C) III), IV) and V)
D) I), III), and IV)
E) II), III) and V)

Answer: E

7) Choose the possible products for the nuclear reaction $^{40}Ca + {}^{4}He$(alpha).

A) $^{43}Ar + n$ B) $^{43}Sc + p$ C) $^{43}Ca + n$ D) $^{42}Ca + {}^{2}H$ E) $^{42}Ti + n$

Answer: B

8) Which class of compounds is the least reactive?

A) aldehydes
B) ketones
C) ethers
D) alcohols
E) alkyl halides

Answer: C

9) Half-life is:

I) the time for a sample to decay completely.

II) constant for a given radioisotope.

III) the time required for half of a sample to decay.

IV) inversely proportional to the decay constant.

A) I and II
B) I, II, and III
C) I and III
D) I, III, and IV
E) II, III, and IV

Answer: E

10) Consider the following nuclear reactions.

$$^{27}_{13}Al + {}^{4}_{2}He \rightarrow \underline{1} + {}^{1}_{0}n$$

$$\underline{1} \rightarrow {}^{30}_{14}Si + \underline{2}$$

What are the nuclides 1 and 2, respectively?

A) $^{30}_{16}S$ and $^{0}_{-1}\beta$ B) $^{30}_{12}Mg$ and $2\ {}^{0}_{+1}\beta$ C) $^{30}_{15}P$ and $^{0}_{+1}\beta$ D) $^{30}_{14}Si$ and $^{0}_{-1}\beta$

Answer: C

11) Which of the following is unimportant for tertiary structure of the proteins?

A) peptide bonds B) salt linkages C) hydrogen bonding D) disulfide linkages

Answer: A

12) Amino acids are joined into proteins by:

A) peptide bonds
B) a beta 1-4 linkage
C) an ester
D) DNA
E) a 3'-5' linkage

Answer: A

13) Find the INCORRECT nuclear reaction.

A) $^{239}_{94}Pu + {}^{1}_{0}n \rightarrow {}^{140}_{55}Cs + {}^{100}_{39}Y$

B) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{139}_{56}Ba + {}^{94}_{36}Kr + 3\,{}^{1}_{0}N$

C) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{232}_{90}Th + {}^{4}_{2}He$

D) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{139}_{56}Ba + {}^{94}_{36}Kr + {}^{1}_{0}n$

E) $^{238}_{92}U + {}^{1}_{0}n \rightarrow {}^{239}_{92}U$

Answer: D

14) Which of the following is correct with respect to the purine and pyrimidine bases in nucleic acids?

A) T = C B) G + A = C + T C) G = T D) A = C

Answer: B

15) You found an organic compound containing chiral carbon atom with the following four substituents: HC≡C-, Cl-, O=C- and H_2C=CH-. What would be the correct order of their priorities?

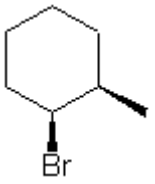
A) HC≡C- > O=C- > Cl- > H_2C=CH-
B) O=C- > Cl- > HC≡C- > H_2C=CH-
C) Cl- > HC≡C- > O=C- > H_2C=CH-
D) Cl- > O=C-> H_2C=CH- > HC≡C-
E) Cl- > O=C- > HC≡C- > H_2C=CH-

Answer: E

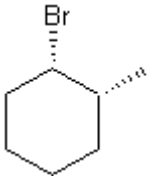
16) Which of the following structures represent the structure of trans-1-bromo-2-methylcyclohexane?

A)

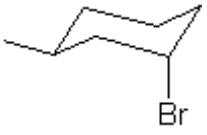
B)



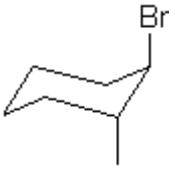
C)



D)

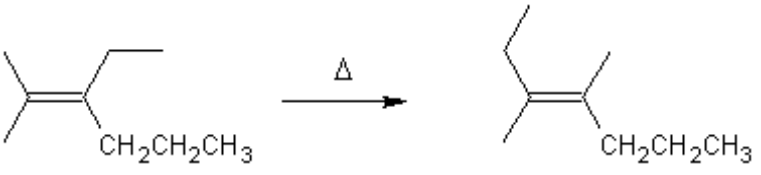


E)



Answer: E

17) For which type of reaction is the following an example?



A) polymerization
B) addition
C) elimination
D) rearrangement
E) substitution

Answer: D

18) There have been two ways of making transuranium elements: neutron bombardment and:

A) positron bombardment
B) gamma bombardment
C) heavy-atom bombardment
D) photon bombardment
E) beta bombardment

Answer: C

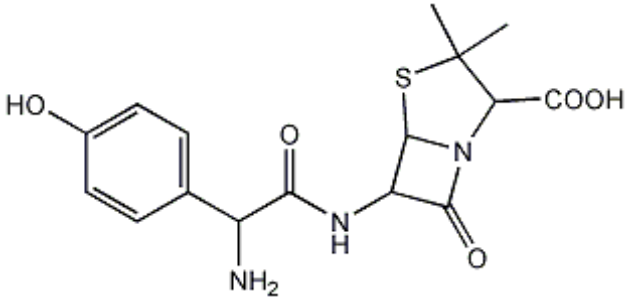
19) Which of the following synthetic procedures are plausible?

I) synthesis of esters from alcohols and acids
II) synthesis of ethers from acids and alcohols
III) synthesis of amides from acids and amines
IV) synthesis of alcohols from alkanes and water
V) synthesis of aldehydes from alcohols and oxidizing agents

A) II), III), and V)
B) I), III), and V)
C) III), IV), and V)
D) II), III), and IV)
E) I), III), and IV)

Answer: B

20) How many chiral carbon atoms can you find in the molecule below?



A) 1 B) 2 C) 3 D) 4 E) 5

Answer: D

21) Why does benzene have a much higher boiling point (80°C) than hexane (69°C), even though they have the same number of carbons?

A) Benzene can covalently bond to another benzene molecule which increases its boiling point.
B) Hexane has more Kekulé structures than benzene.
C) Benzene is planar and has delocalized electron density which increases the attractive forces between molecules and raises the boiling point.
D) Benzene is much more polar than hexane which enhances the attractive forces between molecules and raises the boiling point.
E) Benzene has fewer hydrogens than hexane.

Answer: C

22) The diol, ethylene glycol, is used extensively as an antifreeze additive in automobile radiators. What properties of ethylene glycol make it a good antifreeze?

A) Ethylene glycol has a higher boiling point than water and is soluble in water.
B) Ethylene glycol has a lower boiling point than water and is soluble in water.
C) Ethylene glycol coats the radiator to prevent crystallization of ice at low temperatures.
D) Ethylene glycol forms a film on the surface of the water to prevent ice formation in the radiator.
E) Ethylene glycol will remain in the radiator after the water evaporates. This prevents freezing in cold climates.

Answer: A

23) Choose the INCORRECT statement.
A) Hydrocarbons are compounds of carbon and hydrogen.
B) Saturated hydrocarbons have only single bonds connecting each atom.
C) Isomers have the same chemical formula but differ with respect to the arrangement of atoms.
D) Organic compounds can be obtained only from living tissue.
E) Skeletal isomerism is also called chain isomerism.

Answer: D

24) The most highly charged particle is:
A) beta B) alpha C) positron D) gamma E) neutron

Answer: B

25) Which of the following readily dissolve in nonpolar solvents?
A) lipids
B) enzymes
C) glycine
D) nucleic acids
E) proteins

Answer: A

26) Which class of compounds is most oxidized?
A) alcohols B) alkanes C) aldehydes D) acids E) ketones

Answer: D

27) Define "conformation".
A) Conformations are different structural representations of the same molecule.
B) Conformations are different arrangements of bonds in space
C) Conformations are two enantiomers.
D) Conformations are all possible structural isomers for a given molecular formula
E) Conformations are different spatial arrangements one structure can have

Answer: E

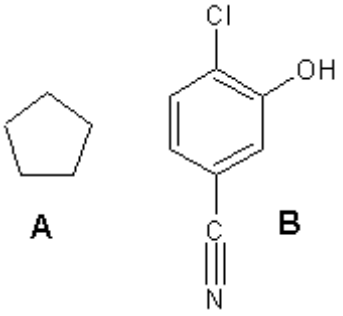
28) The observation that a 30 g sample of C-14 has a decay rate faster than that of a 20 g sample of C-14 would be consistent with the:
A) Mass-Rate Principle
B) Half-Life Principle
C) Disintegration Rule
D) Radioactive decay law
E) Mass-decay ratio

Answer: D

29) Can 1,3,5-hexatriene be considered an aromatic compound? Why do you think so?
A) Yes, because the molecule has a delocalized π electron cloud.
B) No, because the structure is not based on benzene ring.
C) No, because the molecule is not a flat ring.
D) Yes, because it contains alternating double and single bonds.
E) Yes, because its double bonds contain $4n+2$ electrons ($n = 1$).

Answer: C

30) What is the degree of unsaturation for the following compounds?



A B

$C_{20}H_{32}ClN$

C

A) For A the degree of unsaturation is 1, for B is 5 and for C is 6.
B) For A the degree of unsaturation is 1, for B is 6 and for C is 5.
C) For A the degree of unsaturation is 0, for B is 6 and for C is 5.
D) For A the degree of unsaturation is 1, for B is 6 and for C is 4.
E) For A the degree of unsaturation is 1, for B is 4 and for C is 5.

Answer: B

31) Which of the following nuclides is most likely to be stable?

A) ^{208}Pb B) ^{209}Bi C) ^{24}Na D) ^{205}Tl

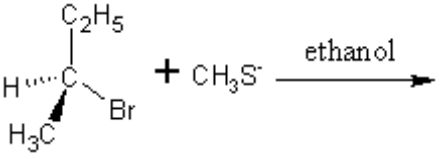
Answer: A

32) Choose the INCORRECT statement.

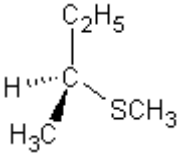
A) Branched-chain hydrocarbons have higher octane numbers.
B) Alkylation is the joining of small hydrocarbon fragments to larger molecules.
C) In thermal cracking large hydrocarbon molecules are broken down into smaller molecules, ideally, molecules in the gasoline range.
D) Reforming converts straight-chain hydrocarbons into branched-chain hydrocarbons.
E) Engine knocking is caused by the smooth firing of gasoline.

Answer: E

33) Predict the product and mechanism type for the following reaction:

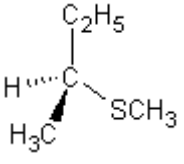


A)



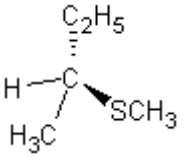
S_N2 mechanism

B)



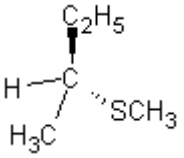
S_N1 mechanism

C)



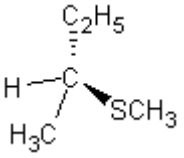
S_N2 mechanism

D)



S_N1 mechanism

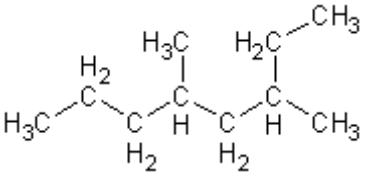
E)



S_N1 mechanism

Answer: C

34) What is the correct IUPAC name for the following structure?



A) 4, 6 - dimethyloctane
B) 3, 5 - dimethyloctane
C) 2-ethyl-3- methylheptane
D) 4-methyl-6-ethylheptane
E) 3, 5 - dimethyloctyl

Answer: B

35) What are heterocyclic compounds?
A) They are cyclic compounds in which carbon ring is connected to another ring not containing carbon atoms
B) They are cyclic compounds in which two or more carbon rings are connected with C-C bons (for example biphenyl)
C) They are cyclic compounds in which one or more atoms are not carbon atoms
D) They are cyclic compounds that can have more than one stable conformation
E) They are cyclic compounds in which carbon has one or more substituents that are neither hydrogen or another carbon atom

Answer: C

36) An alcohol of formula C_3H_8O in which there are only three different kinds of hydrogens is:

A) $CH_3CH_2CH_2OH$
B) cyclopropanol
C) ethanol
D) 1-propanol
E) 2-propanol

Answer: E

37) Which of the following examples of protein structure would be classified as the tertiary structure of a protein?

A) gly-leu-trp-lys-lys-arg-met
B) β-pleated sheet
C) amorphous, globular peptide
D) three identical subunits
E) an elongated α-helix between two β-pleated sheets

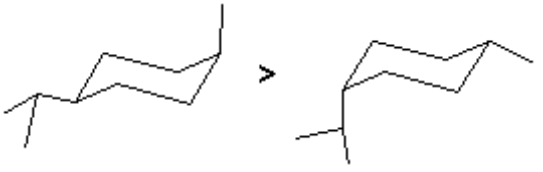
Answer: E

38) Find the answer that has correct both the two structures of cis-1-isopropyl-4-methylcyclohexane and their relative stability (stability is indicated with ">" meaning "more stable than").

A) 

B) 

C) 

D) 

Answer: D

39) Choose the correct statement.

A) Fructose is a pentose.
B) All sugars have oxygen and are good oxidizing agents
C) Sucrose is a disaccharide.
D) Ribose and deoxyribose are hexoses.
E) Reducing sugars don't open into the straight chain form.

Answer: C

40) Identify a reaction that follows a different decay process than the rest.

A) $^{238}_{92}U \rightarrow {}^{237}_{89}Ac$

B) $^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn$

C) $^{248}_{96}Cm \rightarrow {}^{244}_{94}Pu$

D) $^{222}_{86}Rn \rightarrow {}^{218}_{84}Po$

E) $^{218}_{84}Po \rightarrow {}^{214}_{82}Pb$

Answer: A

41) Triglycerides are composed of which two compounds linked through an ester functionality?

A) glycine and carboxylic acids
B) lauric acid and glucose
C) glycerol and long-chain monocarboxylic acids
D) glycerol and long chain monoalcohols
E) ethylene glycol and dicarboxylic acids

Answer: C

42) A wooden artifact is subjected to radiocarbon dating. The activity associated with its ^{14}C content is 12 dis min^{-1} g^{-1}. A sample of wood from a modern source gave 15 dis min^{-1} g^{-1}. If the half-life of ^{14}C is 5730 y, what is the age of the artifact?

A) 1.8×10^3 y B) 7.2×10^3 y C) 1.3×10^3 y D) 800 y

Answer: A

43) Choose the INCORRECT statement.

A) Polysaccharides contain more than 10 monosaccharide units.
B) Starch and cellulose are polysaccharides.
C) The general term for all carbohydrates is glycoses.
D) Mono- and oligosaccharides are called sugars.
E) The simplest carbohydrates are the oligosaccharides.

Answer: E

44) Which of the following types of nuclear decay result in a decrease in nuclear charge?

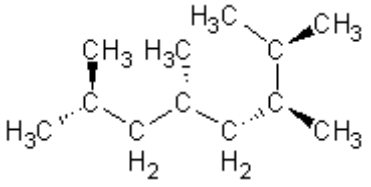
I) alpha emission
II) beta emission
III) positron emission
IV) electron-capture

A) IV only B) I and II C) II and IV D) I and III E) III and IV

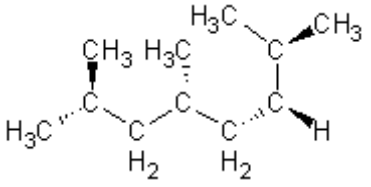
Answer: E

45) Find the structure for 2,3,5,7-tetramethyloctane

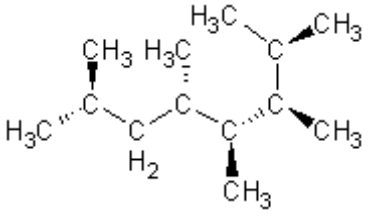
A)



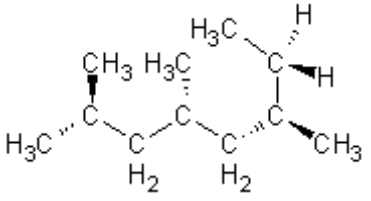
B)



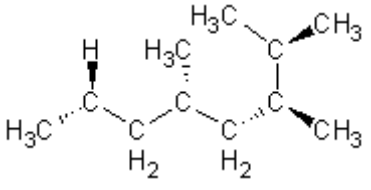
C)



D)



E)



Answer: A

46) Order the following substrates according to the *increase* in S_N2 reaction rate:

$(CH_3)_2CHBr$, $(CH_3)_3CBr$, CH_3CH_2Br, CH_3Br

A) $(CH_3)_2CHBr < (CH_3)_3CBr < CH_3CH_2Br < CH_3Br$

B) $(CH_3)_3CBr < (CH_3)_2CHBr < CH_3CH_2Br < CH_3Br$

C) $(CH_3)_3CBr < (CH_3)_2CHBr < CH_3Br < CH_3CH_2Br$

D) $(CH_3)_3CBr < CH_3CH_2Br < (CH_3)_2CHBr < CH_3Br$

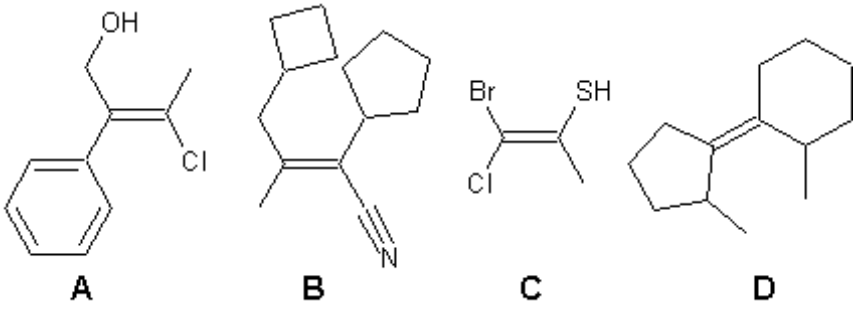
E) $CH_3CH_2Br < (CH_3)_3CBr < (CH_3)_2CHBr < CH_3Br$

Answer: B

47) A glycerol ester of unsaturated fatty acids best describes a(n):
A) vegetable starch
B) animal fat
C) wax
D) vegetable oil
E) lipid

Answer: D

48) Find the correct stereochemistries for the following four alkenes:



A) A is *Z*, B is *Z*, C is *E*, D is *E*
B) A is *E*, B is *E*, C is *Z*, D is *Z*
C) A is *Z*, B is *Z*, C is *E*, D is *Z*
D) A is *Z*, B is *E*, C is *Z*, D is *E*
E) A is *E*, B is *E*, C is *Z*, D is *E*

Answer: B

49) Which of the following is a basic amino acid?
A) cysteine
B) glycine
C) lysine
D) alanine
E) aspartic acid

Answer: C

50) Which molecule is optically active?
A) trans-propene B) 1-chlorobutane C) 2-chlorobutane D) cis-propene

Answer: C