

**CHE1502**

( 478214)

May/June 2013

**GENERAL CHEMISTRY IB**

Duration · 2 Hours

100 Marks

EXAMINERS .

FIRST :

SECOND .

PROF CA SUMMERS

MR LG LESENYEHO

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Use of a non-programmable pocket calculator is permissible.

Closed book examination.

This examination question paper remains the property of the University of South Africa and may not be removed from the examination venue.

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**EXAMINATION PAPER UNIQUE NUMBER: 478214**

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The examination paper consists of 21 pages (a periodic table is on page 21) plus 5 pages for rough work plus instructions for completion of the mark reading sheet

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The examination paper consists of two parts:

**SECTION A:** consists of 40 multiple choice questions –answer on marking reading sheet.

**SECTION B:** Written questions – answer in green book.

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**SECTION A:** Each question is allocated TWO marks- 80 marks

**SECTION B:** 20 marks

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The multiple choice questions have four possible answers. In each case, provide only ONE answer to each question

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The use of molecular models is permissible

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**ANSWER ALL QUESTIONS IN SECTION A AND SECTION B**

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**SECTION A**

This section consists of **40 MULTIPLE CHOICE QUESTIONS**.

Answer **ALL** the questions in this section on the **MARK READING SHEET**.

Unique Number. **478214**

1. What type of bonding is found in the compound ammonium carbonate ( $\text{NH}_4\text{CO}_3$ )?

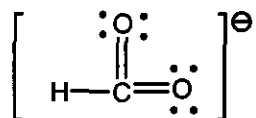
- (1) nonpolar covalent
- (2) ionic
- (3) a mixture of covalent and ionic
- (4) polar covalent

2. What type of hybrid orbitals of the Cl atom are involved in bonding of  $\text{ClO}_4^-$ ?

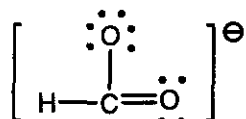
- (1) sp
- (2)  $\text{sp}^2$
- (3)  $\text{dsp}^3$
- (4)  $\text{sp}^3$

3. Which of the following is NOT a valid Lewis structure of the formate ion,  $\text{HCO}_2^-$ ?

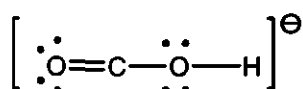
(1)



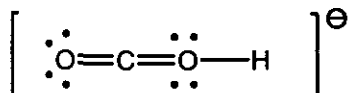
(2)



(3)



(4)



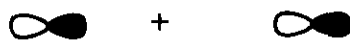
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(2)



(3)



(4)

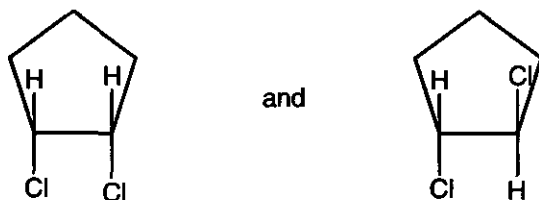


7 Use the VSEPR method and predict the shape of the  $\text{SnCl}_3^-$  ion.

- (1) tetrahedral
- (2) Square planar
- (3) bent
- (4) trigonal pyramidal

8 Which of the following pairs of compounds are constitutional isomers?

(1)



(2)



(3)

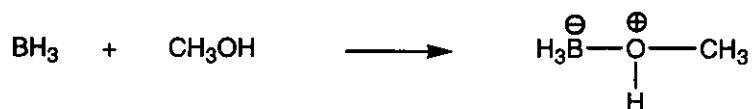


(4)



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9. Consider the reaction below

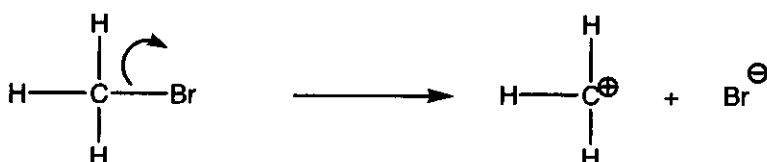


Which of the following is INCORRECT?

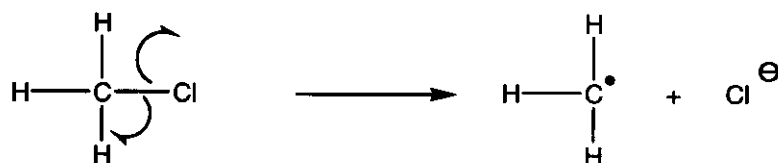
- (1)  $\text{CH}_3\text{OH}$  is a nucleophile
- (2)  $\text{BH}_3$  is an electrophile
- (3) This is an example of an elimination reaction
- (4) This is an acid-base reaction

10. Identify the CORRECT process of heterolytic bond breaking below:

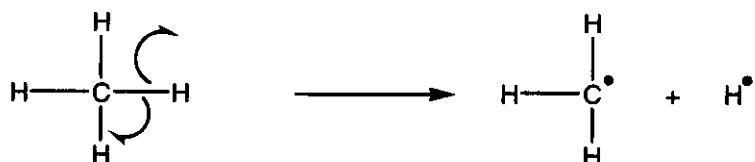
(1)



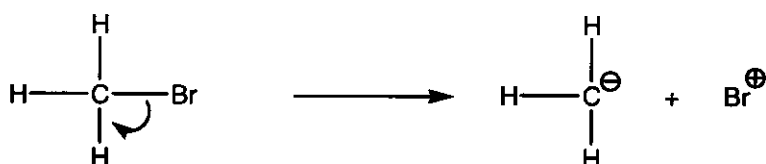
(2)



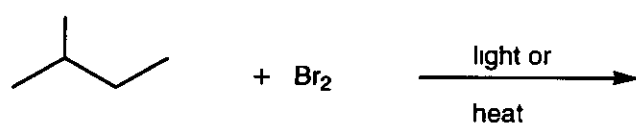
(3)



(4)

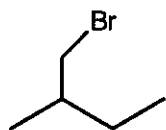


11. What is the MAJOR monobrominated product formed in the following reaction?

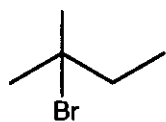


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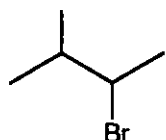
(1)



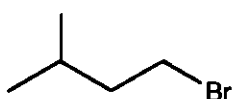
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(3)

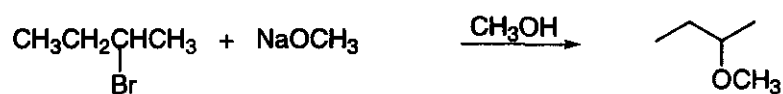


(4)



12. Which of the following reactions is an example of an addition reaction?

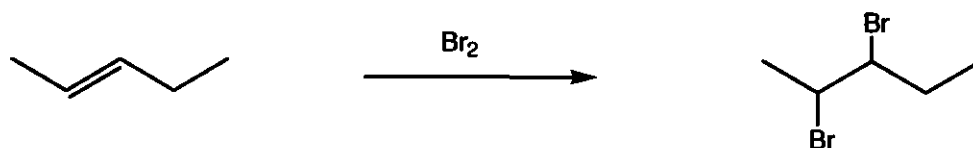
(1)



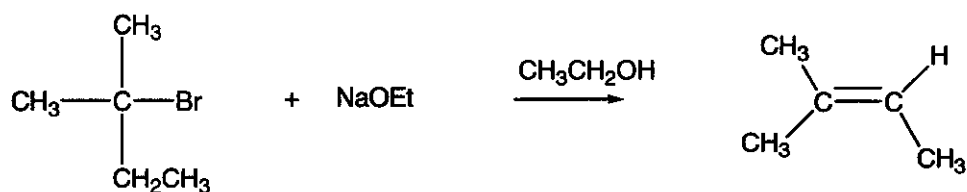
(2)



(3)



(4)



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13. Which of the following reactions will NOT TAKE PLACE?

(1)



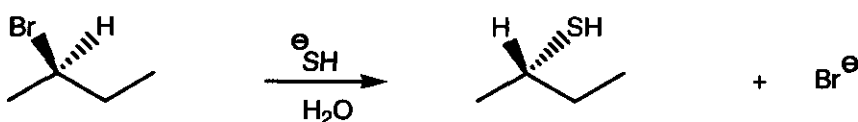
(2)



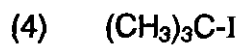
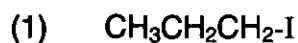
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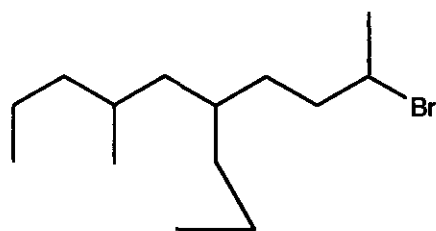
(4)



14. Which of the following species will react the FASTEST in a  $\text{S}_\text{N}1$  nucleophilic substitution reaction?



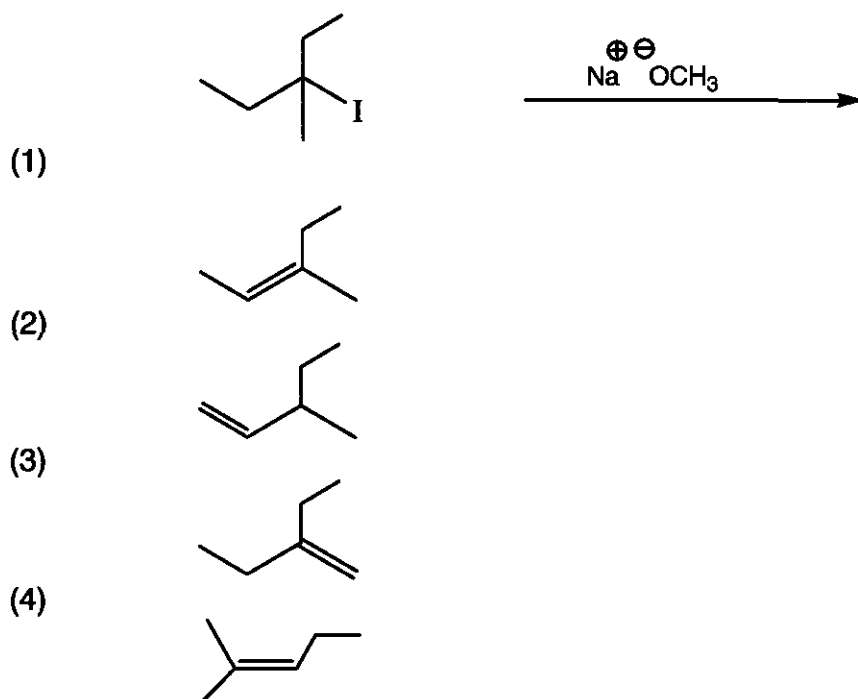
15. What is the IUPAC name of the molecule shown below?



[TURN OVER]

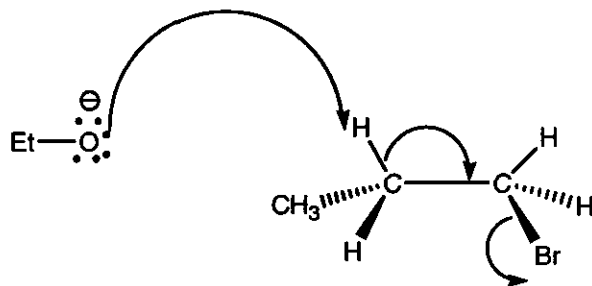
- (1) 1-bromo-1,6-dimethyl-4-propylnonane
- (2) 2-bromo-7,9-dimethyl-5-propylnonane
- (3) 1-bromo-1,6,8-trimethyl-4-propyloctane
- (4) 2-bromo-7-methyl-5-propyldecane

16 What is the MAJOR product formed in the following reaction?



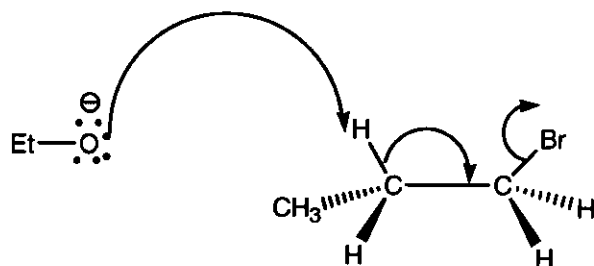
17. The mechanism for the E2 reaction of 1-bromopropane with ethoxide anion in the presence of heat is.

(1)

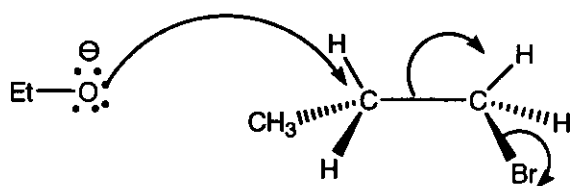


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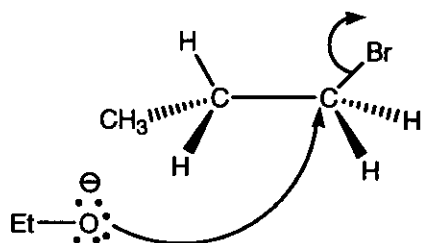
(2)



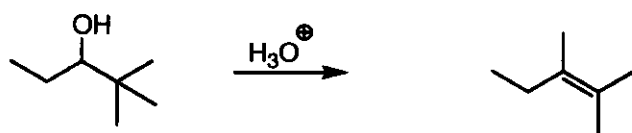
(3)



(4)

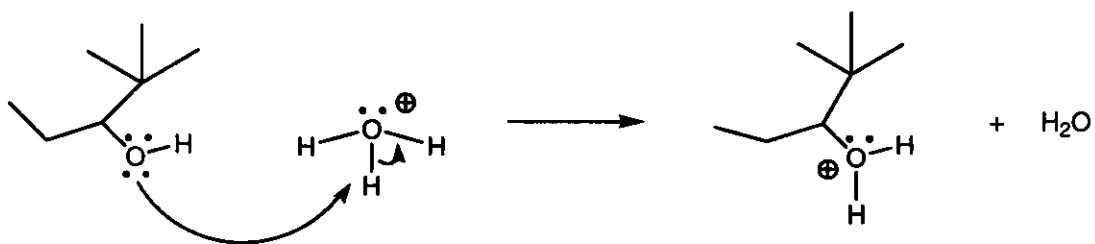


18. Consider the following reaction:



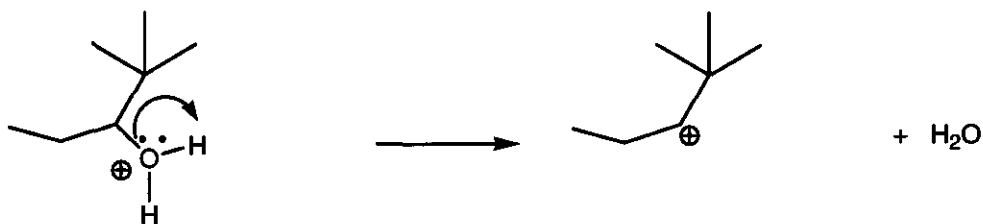
Which step is LEAST LIKELY to occur in the reaction mechanism?

(1)

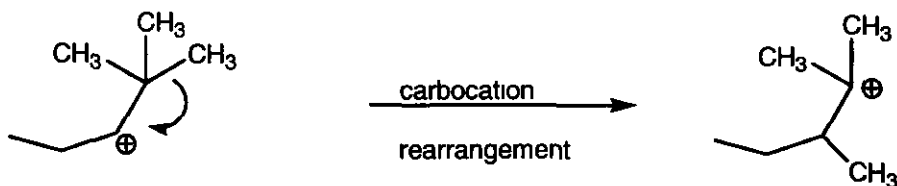


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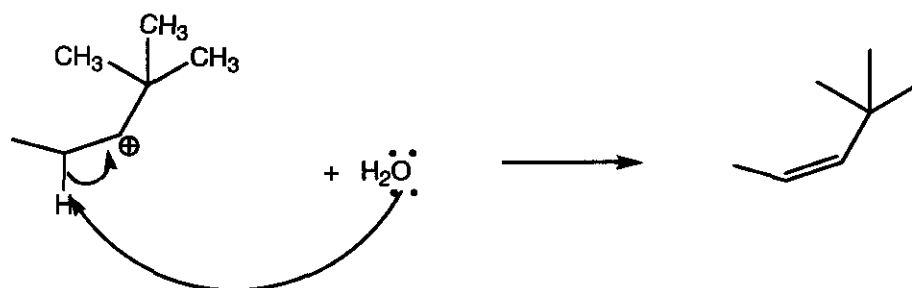
(2)



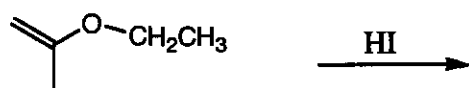
(3)



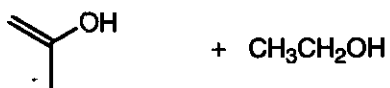
(4)



19. What are the major products formed in the following reaction?



(1)



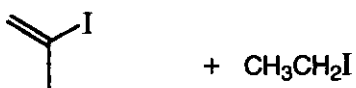
(2)



(3)



(4)

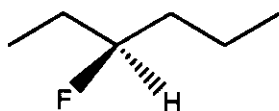


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20. Which of the following molecules has a chiral (asymmetric) carbon atom?

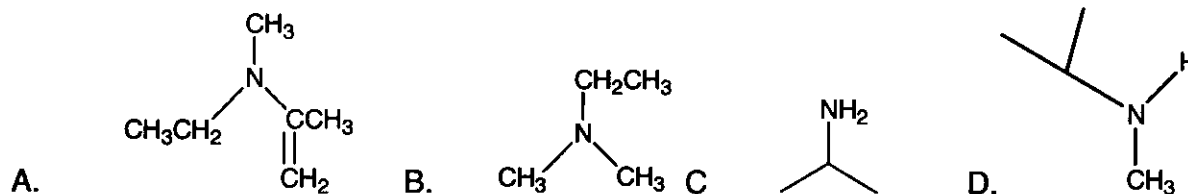
- (1) 2-methylpropane
- (2) 2-butanol
- (3) 2-methylbutane
- (4) ethene

21. The absolute configuration of a chiral carbon is defined as R- or S- according to the Cahn-Ingold-Prelog rules. What is the name for the following compound?



- (1) R-3-fluorohexane
- (2) S-1-ethylfluorobutane
- (3) S-3-fluorohexane
- (4) R-1-ethylfluorobutane

22. Identify the tertiary amine(s) below?



- (1) C only
- (2) A and B
- (3) D only
- (4) A and D

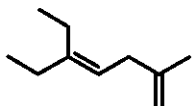
23. Amines tend to be soluble in polar solvents because

- (1) polar solvents dissolve only non polar covalent compounds
- (2) amines are capable of forming hydrogen bonds with the solvent
- (3) amines are unsaturated hydrocarbons.
- (4) the nitrogen atoms in amines are positively charged

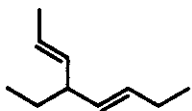
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24. Which of the following structures contains ONLY *trans* double bonds?

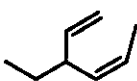
(1)



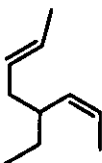
(2)



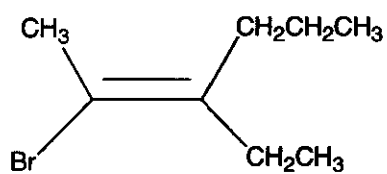
(3)



(4)



25. Name the following compound according to the IUPAC rules.



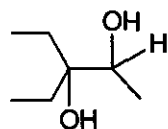
- (1) (Z)-2-bromo-3-ethylhex-2-ene
- (2) (E)-1-bromo-2-ethyl-1-methylpent-1-ene
- (3) (Z)-2-bromoethenylhex-3-ene
- (4) (E)-2-bromo-3-ethylhex-2-ene

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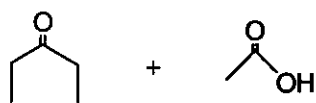
26. What is the MAJOR product(s) formed in the following reaction?



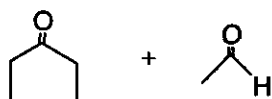
(1)



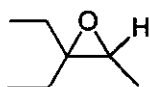
(2)



(3)



(4)

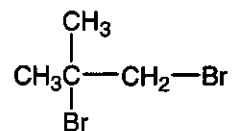


27. Consider the following reaction:

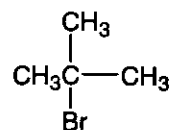


The product formed in the reaction is.

(1)

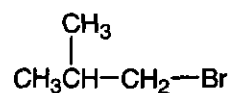


(2)

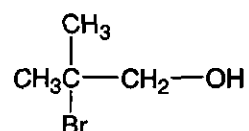


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(3)

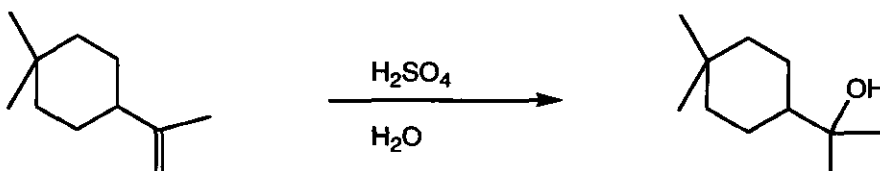


(4)

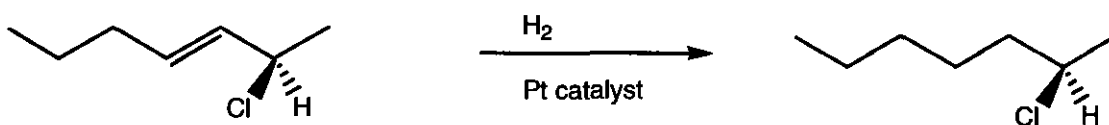


28. Which of the following reactions does NOT produce the product as shown?

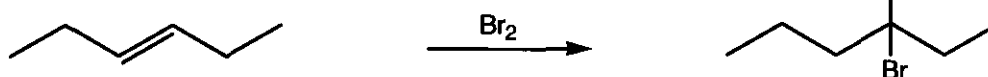
(1)



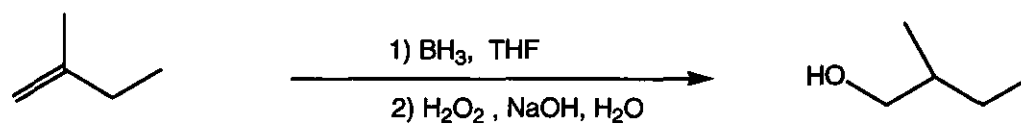
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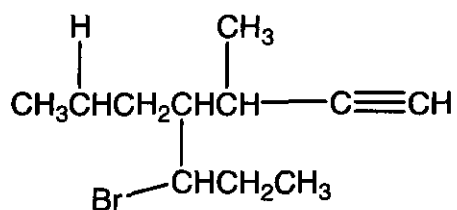
(3)



(4)



29. Name the following compound according to the IUPAC rules.

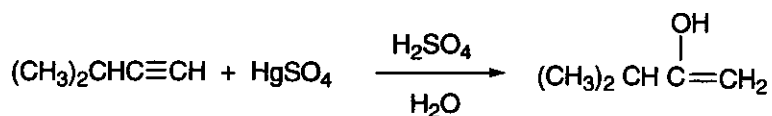


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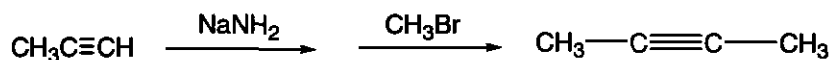
- (1) 5-bromo-3-methyl-4-propylhept-1-yne  
 (2) 3-bromo-5-methyl-4-propylhept-6-yne  
 (3) 4-(1-bromopropyl)-5-methylhept-1-yne  
 (4) 3-methyl-4-(1-bromopropyl)hept-1-yne

30. Which of the following reactions yield the final product as shown?

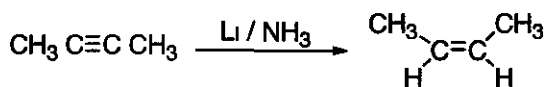
(1)



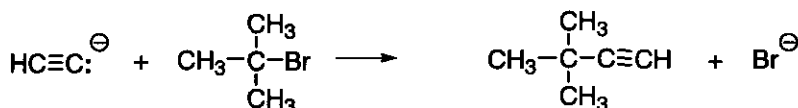
(2)



(3)



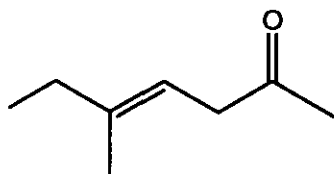
(4)



31. Using Zaitsev's rule, choose the most stable alkene among the following.

- (1) pent-2-ene  
 (2) 2-methylbut-2-ene  
 (3) pent-1-ene  
 (4) They are all of equal stability according to Zaitsev's rule.

32. What is the IUPAC name for the following compound?



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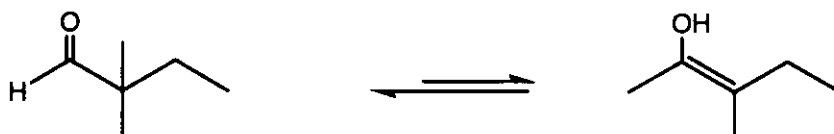
- (1) 5-methylhept-4-enone
- (2) 5-methylhept-4-en-2-one
- (3) 1,4-dimethylhex-3-enal
- (4) 5-methyl-2-oxohept-4-ene

33. Which of the following represents keto-enol tautomerism?

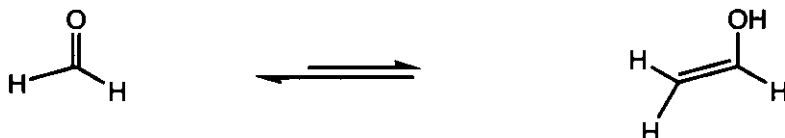
(1)



(2)



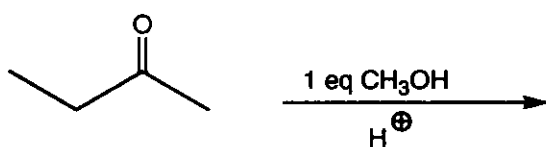
(3)



(4)

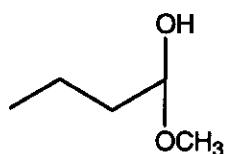


34. What is the final product of the following reaction?

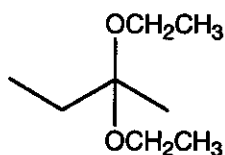


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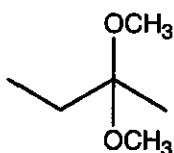
(1)



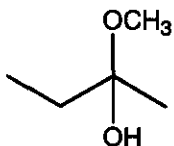
(2)



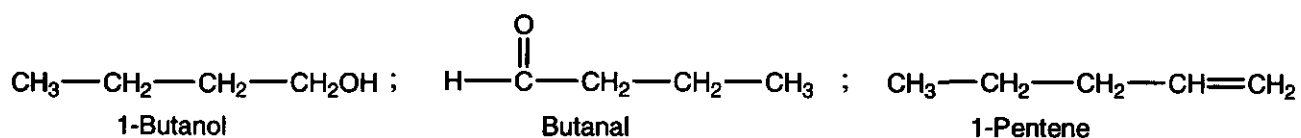
(3)



(4)



35. Consider the compounds below:



Which of the following represents the correct ranking of these compounds in terms of increasing solubility in water (from lowest to highest)?

- (1) 1-pentene < 1-butanol < butanal
- (2) 1-pentene < butanal < 1-butanol
- (3) 1-butanol < 1-pentene < butanal
- (4) 1-pentene < 1-butanol = butanal

36. What reagent can be used to convert 2-methylbutan-1-ol into 2-methylbutanal?

- (1)  $\text{LiAlH}_4$
- (2) PCC

[TURN OVER]

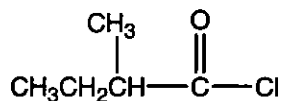
- (3)  $O_3$   
(4)  $Na_2Cr_2O_7$

37. Which of the following compounds is the strongest acid?

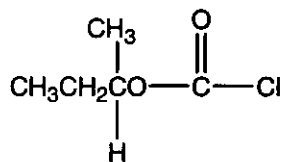
- (1)  $Cl_3CCOOH$   
(2)  $CH_3COOH$   
(3)  $ClCH_2COOH$   
(4)  $(Cl)_2CHCOOH$

38. What is the correct structure of 2-methylbutanoyl chloride?

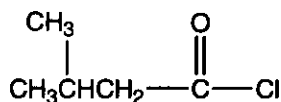
(1)



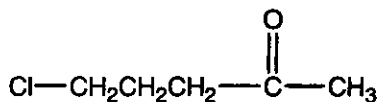
(2)



(3)

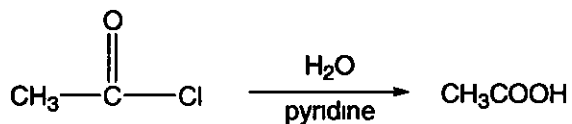


(4)

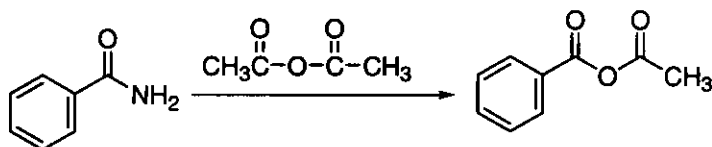


39. The characteristic reaction of carboxylic acids and its derivatives is nucleophilic acyl substitution. Which of the following reactions is the **LEAST LIKELY** to take place?

(1)

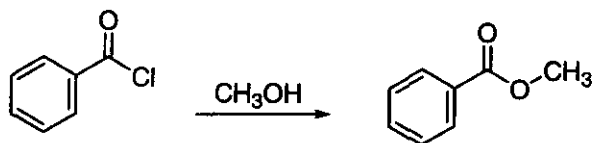


(2)

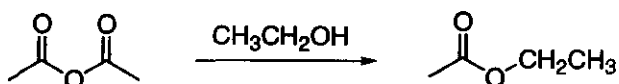


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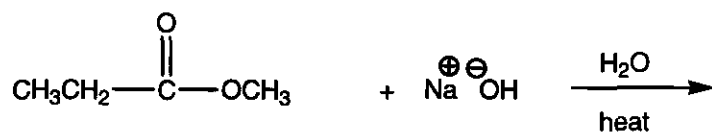
(3)



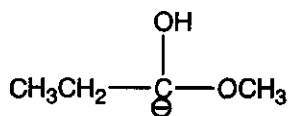
(4)



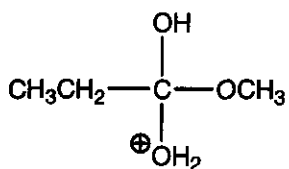
40. Which of the following is an intermediate in the following reaction of methyl propanoate?



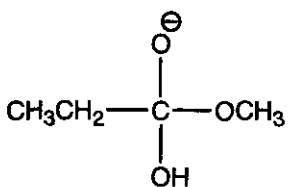
(1)



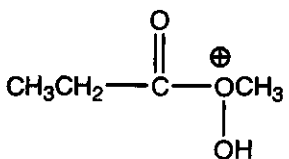
(2)



(3)



(4)



[80]

[TURN OVER]

**SECTION B**

Answer ALL the questions in this section.

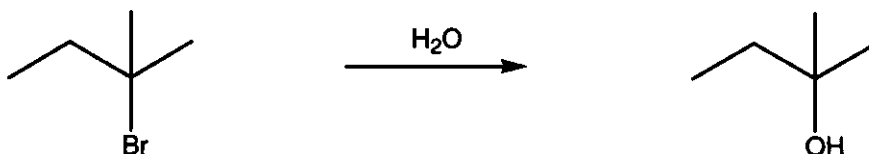
Answer this section in the GREEN EXAMINATION BOOK.

**Question 1**

- (a) Draw the Newman projections of the different conformations of 1-bromopropane viewing along the C1-C2- bond. Label the most stable and least stable conformation.

(6)

- (b) Write the detailed mechanism of the following reaction.

(4)  
[10]**Question 2**

- (a) Draw the structure of any secondary alcohol.
- (b) Draw the geometric isomers of 3-methyl-2-pentene. Give the IUPAC name of each isomer.
- (c) Give the mechanism of the reaction of HCl with CH<sub>3</sub>CH=CH<sub>2</sub>.

(2)

(4)

(4)  
[10]**TOTAL MARKS [100]**

[TURN OVER]

Periodic Table of Elements

1 1A		2 IIA		3 IIIB		4 IVB		5 VB		6 VIB		7 VIIB		8 VIII		9 VIII		10 VIII		11 IB		12 IIB		13 IIIA		14 IVA		15 VA		16 VIA		17 VIIA		18 VIIIA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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1 1.008	H	2 4.003	He	3 6.941	Li	4 9.012	Be	5 22.99	Na	6 24.31	Mg	7 39.10	K	8 40.08	Ca	9 39.10	Sc	10 44.96	Ti	11 47.88	V	12 50.94	Cr	13 52.00	Mn	14 54.94	Fe	15 55.85	Co	16 58.93	Ni	17 58.69	Cu	18 63.55	Zn	19 65.39	Ga	20 69.72	Ge	21 72.59	As	22 74.92	Se	23 78.96	Br	24 79.90	Kr	25 83.80	Rb	26 85.47	Sr	27 87.62	Y	28 88.91	Zr	29 91.22	Nb	30 92.91	Mo	31 95.94	Tc	32 98.91	Ru	33 101.1	Rh	34 102.9	Pd	35 106.4	Ag	36 107.9	Cd	37 112.4	In	38 114.8	Sn	39 118.7	Sb	40 121.8	Te	41 127.6	I	42 126.9	Xe	43 131.3	Cs	44 132.9	Ba	45 137.3	La*	46 138.9	Hf	47 178.5	Ta	48 180.9	W	49 183.8	Re	50 186.2	Os	51 190.2	Ir	52 192.2	Pt	53 195.1	Au	54 197.0	Hg	55 200.6	Tl	56 204.4	Pb	57 207.2	Bi	58 209.0	Po	59 209.0	At	60 209.0	Rn	61 222	Fr	62 223	Ra	63 226	Ac**	64 227	Unq	65 257	Unp	66 260	Unh	67 263	Uns	68 262	Uno	69 265	Une	70 266	Uuo	71 266	Uus	72 262	Uuh	73 263	Uuq	74 267	Uur	75 268	Uus	76 269	Uut	77 271	Uuq	78 272	Uur	79 273	Uus	80 274	Uut	81 275	Uuq	82 276	Uur	83 277	Uus	84 278	Uut	85 279	Uuq	86 280	Uur	87 281	Uus	88 282	Uut	89 283	Uuq	90 284	Uur	91 285	Uus	92 286	Uut	93 287	Uuq	94 288	Uur	95 289	Uus	96 290	Uut	97 291	Uuq	98 292	Uur	99 293	Uus	100 294	Uut	101 295	Uuq	102 296	Uur	103 297	Uus	104 298	Uut	105 299	Uuq	106 300	Uur	107 301	Uus	108 302	Uut	109 303	Uuq	110 304	Uur	111 305	Uus	112 306	Uut	113 307	Uuq	114 308	Uur	115 309	Uus	116 310	Uut	117 311	Uuq	118 312	Uur	119 313	Uus	120 314	Uut	121 315	Uuq	122 316	Uur	123 317	Uus	124 318	Uut	125 319	Uuq	126 320	Uur	127 321	Uus	128 322	Uut	129 323	Uuq	130 324	Uur	131 325	Uus	132 326	Uut	133 327	Uuq	134 328	Uur	135 329	Uus	136 330	Uut	137 331	Uuq	138 332	Uur	139 333	Uus	140 334	Uut	141 335	Uuq	142 336	Uur	143 337	Uus	144 338	Uut	145 339	Uuq	146 340	Uur	147 341	Uus	148 342	Uut	149 343	Uuq	150 344	Uur	151 345	Uus	152 346	Uut	153 347	Uuq	154 348	Uur	155 349	Uus	156 350	Uut	157 351	Uuq	158 352	Uur	159 353	Uus	160 354	Uut	161 355	Uuq	162 356	Uur	163 357	Uus	164 358	Uut	165 359	Uuq	166 360	Uur	167 361	Uus	168 362	Uut	169 363	Uuq	170 364	Uur	171 365	Uus	172 366	Uut	173 367	Uuq	174 368	Uur	175 369	Uus	176 370	Uut	177 371	Uuq	178 372	Uur	179 373	Uus	180 374	Uut	181 375	Uuq	182 376	Uur	183 377	Uus	184 378	Uut	185 379	Uuq	186 380	Uur	187 381	Uus	188 382	Uut	189 383	Uuq	190 384	Uur	191 385	Uus	192 386	Uut	193 387	Uuq	194 388	Uur	195 389	Uus	196 390	Uut	197 391	Uuq	198 392	Uur	199 393	Uus	200 394	Uut	201 395	Uuq	202 396	Uur	203 397	Uus	204 398	Uut	205 399	Uuq	206 400	Uur	207 401	Uus	208 402	Uut	209 403	Uuq	210 404	Uur	211 405	Uus	212 406	Uut	213 407	Uuq	214 408	Uur	215 409	Uus	216 410	Uut	217 411	Uuq	218 412	Uur	219 413	Uus	220 414	Uut	221 415	Uuq	222 416	Uur	223 417	Uus	224 418	Uut	225 419	Uuq	226 420	Uur	227 421	Uus	228 422	Uut	229 423	Uuq	230 424	Uur	231 425	Uus	232 426	Uut	233 427	Uuq	234 428	Uur	235 429	Uus	236 430	Uut	237 431	Uuq	238 432	Uur	239 433	Uus	240 434	Uut	241 435	Uuq	242 436	Uur	243 437	Uus	244 438	Uut	245 439	Uuq	246 440	Uur	247 441	Uus	248 442	Uut	249 443	Uuq	250 444	Uur	251 445	Uus	252 446	Uut	253 447	Uuq	254 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