# Question **1**

Select the correct products of the following reaction:

$CaF_2 + H_2SO_4 \rightarrow$

*Select one:*

- ◯ $\rightarrow Ca(OH)_2 + SO_2F_2$
- ◯ $\rightarrow CaO + F_2 + H_2SO_3$
- ◯ $\rightarrow 2\ HF + CaSO_4$
- ◯ $\rightarrow CaF_2 + H_2SO_4$ (no reaction)

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# Question **2**

Select a strong acid.

*Select one:*

- ◯ HCl
- ◯ $H_2S$
- ◯ $H_3PO_4$
- ◯ $H_2CO_3$

## Question **3**

Select the conjugate acid of $H_2O$.

*Select one:*

- $H_2O_2$
- $H_3O^+$
- HCOOH
- $OH^-$

## Question **4**

Select the correct electron configuration for nitrogen (N).

*Select one:*

- $1s^2\ 2s^2\ 2p^5$
- $1s^2\ 2p^5$
- $1s^2\ 2s^2\ 2p^3$
- $1s^2\ 1p^5$

## Question **5**

Select the true statement for the following reaction at the equilibrium state:

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO(g) + 6\ H_2O(g)$

*Select one:*

- The reaction will be stimulated by decrease in the concentration of $O_2$.
- The reaction will be stimulated by increase in the concentration of NO.
- The reaction will be stimulated by decrease in the pressure.
- Changes in the pressure will not affect the reaction.
- The reaction will be stimulated by increase in the pressure.

## Question **6**

Select the atom, which possesses the same electron configuration as oxide anion ($O^{2-}$).

*Select one:*

- F
- C
- S
- Ne

# Question **7**

Select the true statement for the following exothermic reaction at the equilibrium state:

$SO_2(g) + O_2(g) \rightarrow 2\ SO_3(g)$

*Select one:*

- The reaction will be stimulated by decrease in the concentration of $O_2$.
- The decrease in temperature will stimulate production of $SO_3$.
- The reaction will be stimulated by increase in the concentration of $SO_3$.
- The increase in temperature will stimulate production of $SO_3$.
- Changes in temperature will not affect the reaction.

# Question **8**

Which of the following reactions is an oxidation-reduction reaction?

*Select one:*

- $NaNO_3 + NaHSO_4 \rightarrow Na_2SO_4 + HNO_3$
- $2\ HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2\ H_2O$
- $NaNO_3 + H_2SO_4 \rightarrow NaHSO_4 + HNO_3$
- $8\ HNO_3 + 3\ Cu \rightarrow 3\ Cu(NO_3)_2 + 4\ H_2O + 2\ NO$

# Question **9**

2-Methylpropan-2-ol is classified as

*Select one:*

- a tertiary alcohol
- a ketone
- a secondary alcohol
- an aldehyde
- a primary alcohol

# Question **10**

Products of reaction between ethanol and hydrogen chloride are

*Select one:*

- Chloroethane and water
- Hydrogen chloride and water
- Carbon dioxide and water
- Carbon and water
- Chlorine and water

# Question **11**

Reduction of ketone produces

*Select one:*

a. Secondary alcohol

b. Tertiary alcohol

c. Carboxylic acid

d. Aldehyde

e. Primary alcohol

## Question **12**

The first step of substitution reaction of alkanes is.....

*Select one:*

a. termination, formation of the radical

b. propagation, radical attacks the alkane

c. initiation, formation of radical

d. propagation, formation of the radical

e. initiation, takes place in the darkness

## Question **13**

The addition polymerisation is characterised by .....

*Select one:*

a. the polymer being completely dissolved at the end of the reaction.

b. the polymer being the only product of the reaction.

c. the product of the reaction is polymer and water.

d. the product is always colourless.

e. an unpleasant gas is produced during this reaction.

## Question **14**

During the reaction of bromoethane with cyanide ions in ethanol, which one of the following is formed?

*Select one:*

a. ethanecyanide

b. propanenitrile

c. propanecyanide

d. ethanenitrile

e. ethane and hydrogenbromide

## Question **15**

Alkylation of benzene is

*Select one:*

a. Nucleophilic substitution

b. Electrophilic substitution

c. Electrophilic addition

d. Elimination

e. Nucleophilic addition

# Question **16**

When esters are refluxed with an alkali, the product(s) of this reaction is/are

*Select one:*

a. Ester and water

b. Alcohol and water

c. Alcohol and salts of carboxylic acid

d. Ester and carboxylic acid

e. Ester and alcohol

## Question **17**

The presence of $H^+$ (aq) ions in solution of carboxylic acid means that they undergo all the usual reactions of acid. When an acid reacts with carbonates, ……. are formed.

*Select one:*

a. Salts and water

b. Salts, water and carbon dioxide

c. Salts and carbon dioxide and hydrogen

d. Salts and hydrogen

e. Salts and carbon dioxide

## Question **18**

Amines contains nitrogen atom with a lone pair of electrons that is available to attack the carbonyl carbon atom in acyl chloride. The reaction is vigorous and organic product of this reaction is

*Select one:*

a. amine

b. amide

c. carboxylic acid and amine

d. alcohol and nitrogen

e. carboxylic acid and ammonia

# Question **19**

Functional group isomers

*Select one:*

a. are compounds with the same structural formula but different molecular formula.

b. are compounds with a different position of the functional group.

c. contain a chiral centre.

d. differ in the structure of their carbon skeleton.

e. have different functional group present.

# Question **20**

Optical isomers

*Select one:*

a. contain a chiral centre.

b. have no free rotation.

c. have different functional group present.

d. differ in the structure of their carbon skeleton.

e. are compounds with a different position of the functional group.

# Question **21**

Select the FALSE statement about amines.

*Select one:*

a. By realising electrons to the N atom of the ethyl group of ethylamine makes the lone electron pair more readily available to bond with H+ ion than it is in ammonia.

b. Ethylamine is a stronger base than ammonia.

c. Ammonia and the amines have different strengths as bases.

d. The strongest base of the following (ammonia, ethylamine and phenylamine) is ammonia.

e. Phenylamine is a weaker base than ammonia.

# Question **22**

The functional group in the following compound $CH_3NH_2$ is

*Select one:*

a. nitrile

b. amine

c. ester

d. amide

e. alcohol

## Question **23**

The functional group of the following compound $CH_3COOC_2H_5$ is

*Select one:*

- a. ester
- b. alcohol
- c. aldehyde
- d. anhydride
- e. ketone

## Question **24**

Classify this reaction, choosing from the types of reactions below

$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$

*Select one:*

- a. Oxidation
- b. Elimination
- c. Addition
- d. Hydrolysis
- e. Substitution

## Question **25**

Characterize alanine in the environment that has pH lower than the isoelectric point of alanine

*Select one:*

- a. behaves as an acid
- b. has an overall zero charge
- c. it moves towards the anode in the electric field
- d. it moves towards the cathode in electric field
- e. loses its hydroxyl group

## Question **26**

Which one of the following contains indole moiety?

*Select one:*

- a. tryptophane
- b. ethanolamine
- c. acetaldehyde
- d. histidine
- e. vinylalcohol

## Question **27**

From the following select the INCORRECT statement on linoleic acid

*Select one:*

- a. is a hydrophobic molecule
- b. it is an essential acid
- c. complete hydrogenation of linoleic acid results in palmitic acid formation
- d. contains two double bonds in *cis* formation
- e. is part of plant oils

## Question **28**

Gangliosides are:

*Select one:*

- a. steroids
- b. triacylglycerols
- c. polysaccharides
- d. lipoproteins
- e. glycolipids

## Question **29**

Proteins are effective buffers because they contain:

*Select one:*

- a. a large number of hydrogen bonds in α-helices
- b. N-terminal and C-terminal residues that can donate and accept protons
- c. peptide bonds that readily hydrolyze, consuming hydrogen and hydroxyl ions
- d. amino acid residues with different pKs
- e. a large number of amino acids

## Question **30**

From the following select the INCORRECT statement on ATP

*Select one:*

- a. xanthine and phosphoric acid are formed during its hydrolysis
- b. contains N-glycosidic, ester and anhydride bond
- c. is energy source within a cell
- d. contains macroergic bond
- e. is formed in respiratory chain

## Question **31**

Transamminases catalyze the transfer of

*Select one:*

- a. ammonia
- b. nitrogen
- c. OH group
- d. $NO_2$ group
- e. $NH_2$ group

## Question **32**

From the following select the molecule which causes lowering of blood glucose concentration:

*Select one:*

- a. glucagon
- b. aldosterone
- c. insulin
- d. parathyrine
- e. adrenaline

## Question **33**

Starch contains:

*Select one:*

- a. amylopectin
- b. galactose
- c. fructose
- d. dextran
- e. amylase

## Question **34**

From the following select a molecule that DOES NOT belong among polysaccharides:

*Select one:*

- a. agar
- b. cellulose
- c. amylase
- d. amylopectin
- e. glycogen

# Question **35**

What is the concentration of $Ca(OH)_2$ with pH = 10.

*Select one:*

- a. 0.00005
- b. 0.1
- c. 0.0005
- d. 0.0004
- e. 0.0001

# Question **36**

From the following select the reaction with correct stoichiometric coefficients. The reaction is:

$Cr^{3+} + H_2O_2 + OH^- \rightarrow CrO_4^{2-} + H_2O$

*Select one:*

- a. $2Cr^{3+} + 2H_2O_2 + 12OH^- \rightarrow 2CrO_4^{2-} + 8H_2O$
- b. $2Cr^{3+} + 4H_2O_2 + 8OH^- \rightarrow 2CrO_4^{2-} + 8H_2O$
- c. $2Cr^{3+} + 3H_2O_2 + 10OH^- \rightarrow 2CrO_4^{2-} + 8H_2O$
- d. $2Cr^{3+} + 5H_2O_2 + 4OH^- \rightarrow 2CrO_4^{2-} + 7H_2O$
- e. $2Cr^{3+} + H_2O_2 + 6OH^- \rightarrow 2CrO_4^{2-} + 6H_2O$

## Question **37**

Calculate the content of carbon, in mass percentage, in lactic acid $CH_3CH(OH)COOH$.

M(C) = 12.0 g/mol, M(O) = 16.0 g/mol, M(H) = 1.0 g/mol.

*Select one:*

- 13.33%
- 40.00%
- 53.33%
- 26.67%

## Question **38**

Sample weighing 800 mg contains glucose and 20% water, it is dissolved in 145 $cm^3$ of solution. Calculate the molar concentration of glucose in mmol/$dm^3$. Mr (glucose) = 180, density of glucose solution is 1 g/$cm^3$.

*Select one:*

- a. 30.6 mmol/$dm^3$
- b. 306 mmol/$dm^3$
- c. 2.45 mmol/$dm^3$
- d. 3.06 mmol/$dm^3$
- e. 24.5 mmol/$dm^3$
- f. 245 mmol/$dm^3$

## Question **39**

Calculate the pH of 0.2M $H_2SO_4$.

*Select one:*

- a. 0.2
- b. 0.1
- c. 0.3
- d. 0.5
- e. 0.4

## Question **40**

Calculate pOH of 0.1 M $Ca(OH)_2$.

*Select one:*

- a. 0.7
- b. 13
- c. 1
- d. 12
- e. 13.3

## Question **41**

Balance the following molecular equation by the oxidation-number-change method.

$C_3H_7OH + Na_2Cr_2O_7 + H_2SO_4 \rightarrow Cr_2(SO_4)_3 + Na_2SO_4 + H_2O + HC_3H_5O_2$

*Select one:*

- a. $3C_3H_7OH + 3Na_2Cr_2O_7 + 12H_2SO_4 \rightarrow 3Cr_2(SO_4)_3 + 2Na_2SO_4 + 11H_2O + 3HC_3H_5O_2$
- b. $3C_3H_7OH + 2Na_2Cr_2O_7 + 6H_2SO_4 \rightarrow 2Cr_2(SO_4)_3 + 2Na_2SO_4 + 9H_2O + 3HC_3H_5O_2$
- c. $3C_3H_7OH + 2Na_2Cr_2O_7 + 10H_2SO_4 \rightarrow 3Cr_2(SO_4)_3 + 2Na_2SO_4 + 11H_2O + 4HC_3H_5O_2$
- d. $2C_3H_7OH + Na_2Cr_2O_7 + 4H_2SO_4 \rightarrow Cr_2(SO_4)_3 + Na_2SO_4 + 7H_2O + 3HC_3H_5O_2$
- e. $3C_3H_7OH + 2Na_2Cr_2O_7 + 8H_2SO_4 \rightarrow 2Cr_2(SO_4)_3 + 2Na_2SO_4 + 11H_2O + 3HC_3H_5O_2$

## Question **42**

How many grams of glucose are needed to prepare 800 mL of 500 mmol/L glucose solution?

M(glucose) = 180.16 g/mol.

*Select one:*

- 144.1 g
- 36.0 g
- 90.1 g
- 72.1 g

Correct answers:

| | | | | |
|---|---|---|---|---|
| 1 C | 11 A | 21 D | 31 E | 41 E |
| 2 A | 12 C | 22 B | 32 C | 42 D |
| 3 B | 13 B | 23 A | 33 A | |
| 4 C | 14 B | 24 E | 34 C | |
| 5 C | 15 B | 25 D | 35 A | |
| 6 D | 16 C | 26 A | 36 C | |
| 7 B | 17 B | 27 C | 37 B | |
| 8 D | 18 B | 28 E | 38 E | |
| 9 A | 19 E | 29 D | 39 E | |
| 10 A | 20 A | 30 A | 40 A | |