3051/1

BGCSE

School Number	Candidate Number
Surname and Initials	

CHEMISTRY

PAPER 1 3051/1

Wednesday 23 MAY 2007 12.30 – 1.45 P.M.

No additional materials required

MINISTRY OF EDUCATION
NATIONAL EXAMINATIONS

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

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Relative atomic masses are given in the Periodic Table of elements printed on page 2.

The volume of one mole of gas at room temperature and pressure (r.t.p.) is 24 000 cm^3 and at standard temperature and pressure (s.t.p.) is 22 400 cm^3.

This question paper consists of 13 printed pages and 3 blank pages.

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

1. Air is a mixture of gases.
What information best describes its composition?

	% oxygen	% nitrogen	% carbon dioxide	% rare gases
A	78.10	20.90	0.03	0.97
B	20.90	78.10	0.97	0.03
C	20.90	78.10	0.03	0.97
D	0.97	0.03	78.10	20.90

2. Water sources in The Bahamas are described as being hard water.
Which chemical compound can be added to this hard water to soften it?

A a synthetic detergent
B magnesium sulphate
C potassium chloride
D sodium carbonate

3. What is the most efficient but least economic method of removing hardness from water?

A centrifuging
B decantation
C distillation
D filtration

4. Heating a liquid causes it to become a vapour.
What happens to the molecules of the liquid during this process?

A They become bigger.
B They become smaller.
C They move closer together.
D They move further apart.

5. Which pair of physical changes are both endothermic?

A condensation and sublimation
B condensation and freezing
C melting and evaporation
D melting and freezing

Use the information below to answer **questions 6 and 7.**

When copper carbonate is heated, a black substance is produced and a heavy gas that turns lime water cloudy is given off.

6. Heat causes solid copper carbonate to

A melt,
B decompose,
C sublime,
D expand.

7. Which gas is produced?

A carbon monoxide
B carbon dioxide
C hydrogen
D oxygen

8. A student places one drop of food colouring into a beaker of cold water. After 2-3 minutes it is observed that the food colour spreads throughout the water. Which process has occurred?

A crystallization
B convection
C diffusion
D evaporation

9. Which facts about hydrogen chloride gas ($HC\ell$) are correct?

1 It has no smell.
2 It is soluble in water.
3 It reacts with ammonia.

A 1 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

Questions 10 – 13 refer to the information given in the table.

element	melting point /°C	boiling point /°C	electrical conductivity
A	114	183	poor
B	–101	–35	poor
C	–38	357	good
D	1 083	2 600	good

The choices A, B, C and D may be used once, more than once or not at all.

Which element

10. could be used for electrical wiring? A B C D

11. is a gas at room temperature? A B C D

12. is a liquid over the smallest temperature range? A B C D

13. is a solid non-metal at room temperature? A B C D

14. Which particles have approximately the same mass?

A electrons, protons and neutrons
B neutrons and electrons
C protons and electrons
D protons and neutrons

15. What is the correct formula for a copper atom that has lost two electrons?

A Co^{+}
B Co^{2+}
C Cu^{2-}
D Cu^{2+}

16. An atom of beryllium has five neutrons in its nucleus and two electrons in each of the **K** and **L** shells.
What is the atomic mass and the atomic number for beryllium?

A an atomic mass of 4 and an atomic number of 9
B an atomic mass of 5 and an atomic number of 4
C an atomic mass of 9 and an atomic number of 5
D an atomic mass of 9 and an atomic number of 4

17. What is the correct name for the formula CH_3COONH_4?

A ammonium carbonate
B ammonium ethanoate
C ammonium hydroxide
D ammonium methyl dioxide

18. Facts about a chemical substance may include the following:

1 the number of atoms in a molecule
2 the arrangement of the atoms in the molecule
3 the relative molecular mass

Which of these facts may be deduced from the structural formula of the substance?

A 1 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

19. Which group of elements from the Periodic Table, when placed in water, will each turn litmus blue?

A alkali metals
B halogens
C noble gases
D transition elements

20. Given the equation

$$3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$$

How many litres of hydrogen are required to produce 24 litres of ammonia?

A 2
B 3
C 24
D 36

21. Which statement about oxygen is **false**?

A Air is made up of about one-fifth oxygen.
B Oxygen burns by itself.
C Oxygen is an odourless and colourless gas.
D Oxygen supports combustion.

22. Which element has chemical properties most similar to the chemical properties of chlorine?

A. iodine
B oxygen
C sulphur
D sodium

23. Which metal reacts with a solution containing zinc ions?

A copper
B magnesium
C nickel
D silver

24. Which pair of substances cannot be separated by sublimation?

A ammonium chloride and potassium chloride
B ammonium chloride and sodium chloride
C sand and iodine
D sodium chloride and zinc oxide

25. The combination of an element **A** with an element **B** to form a new compound **AB** is called a synthetic reaction.
What name is given to the reverse reaction?

A decomposition
B double displacement
C single displacement
D synthesis

26. A compound has the formula ABC_3. A, B and C are not the usual symbols for the elements it contains.

The equation shows the action of heat on ABC_3

$$xABC_3 \rightarrow yAB + zC_2$$

What are the values for x, y and z in the balanced equation?

	x	y	z
A	1	1	1
B	2	1	3
C	2	2	3
D	2	3	1

27. What is the chemical classification for washing soda?

A a carbonate
B a chloride
C an hydroxide
D an oxide

28. In a molecule of an alkane, how many covalent bonds does one carbon atom form?

A 4
B 3
C 2
D 1

29. A physician has determined that a patient requires sodium therapy. He prescribes 585.0 mg of sodium chloride.

How much sodium is present in this dosage?

A 23.0 mg
B 35.5 mg
C 230.0 mg
D 585.0 mg

30. Which compound forms a coloured aqueous solution?

A $CaC\ell_2$, calcium chloride
B $CrC\ell_3$, chromium(III) chloride
C KBr, potassium bromide
D NaOH, sodium hydroxide

31. Which is a statement of Avogadro's Law?

A all gases contain different numbers of molecules, irrespective of pressure and temperature conditions
B only under equal volumes will all gases contain the same number of molecules
C under identical temperatures and pressures, only certain gases contain the same number of molecules
D under identical conditions of temperature and pressure, equal volumes of all gases contain the same number of molecules

32. What is the M_r of $Ca(OH)_2$?

A 2
B 5
C 57
D 74

33. Calculate the percentage of iron in haematite (Fe_2O_3) if the r.a.m.s are 56 and 16 respectively.

A 70%
B 48%
C 35%
D 10%

34. Which of these compounds has the highest percentage of oxygen by mass?

A CH_4O
B CO_2
C H_2O
D Na_2CO_3

35. Plastics can become serious pollutants. Why is this?

A they cannot be recycled
B they are non-biodegradable
C they are made from monomers
D they are polymers

36. Which gases are pollutants and contribute to acid rain?

A carbon monoxide and carbon dioxide
B carbon monoxide and ozone
C sulphur dioxide and oxides of nitrogen
D ozone and methane

37. What is the name of the hydrocarbon having the molecular formula C_8H_{18}?

A butene
B butane
C octene
D octane

38. Which formula can have the greatest number of isomers?

A C_2H_6
B C_3H_8
C C_6H_6
D $C_{20}H_{42}$

39. What is the mole ratio of CO_2 to $C_6H_{12}O_6$ in this reaction?

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

A 1:2
B 1:1
C 1:4
D 6:1

40. The molecular formula for ethyne is C_2H_2. The molecular formula of benzene is C_6H_6.

What is the empirical formula for both ethyne and benzene?

A CH
B C_2H_2
C C_6H_6
D $(CH)_2$

41. During electrolysis of molten $CaBr_2$, which of the following would be made at the anode?

A bromine
B calcium
C hydrogen
D oxygen

42. At which electrode does reduction occur?

A the anode only
B the cathode only
C the anode or the cathode
D the half-cell

43. The higher the pH of a solution, the

A greater number of molecules of acid per dm^3 of solution.
B higher the hydrogen ion concentration.
C lower the acidity.
D stronger the acid.

44. Which of these materials is an example of an acid?

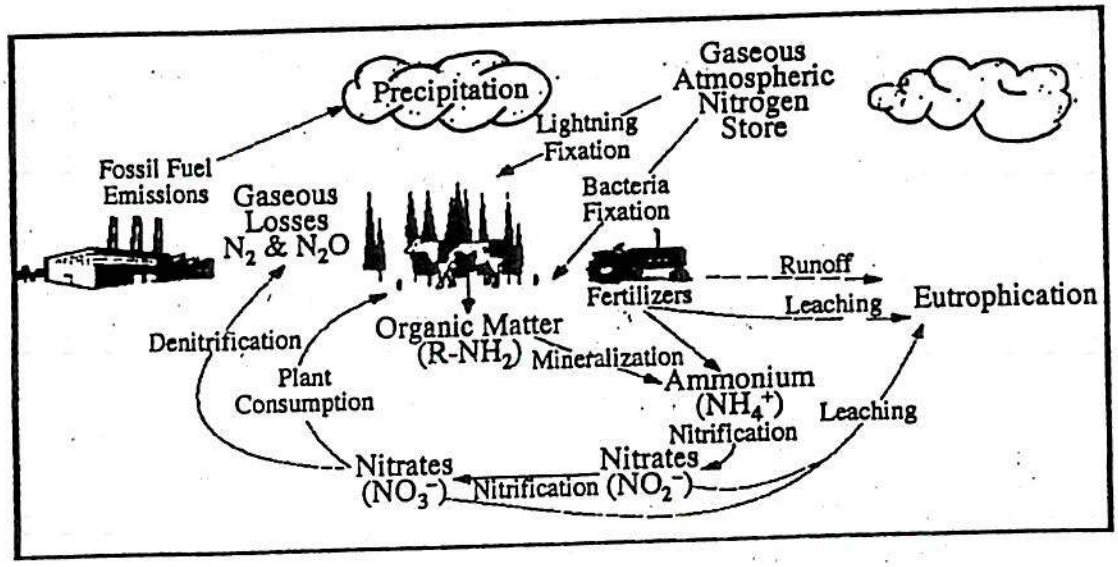
A lime juice
B lime water
C oven cleaner
D toothpaste

45. Magnesium dissolves in hydrochloric acid to produce magnesium chloride and hydrogen gas.

In this reaction the reactants are

A hydrochloric acid and hydrogen gas.
B magnesium and magnesium chloride.
C magnesium and hydrochloric acid.
D magnesium chloride and hydrogen gas.

Use the diagram to answer questions 46 and 47.
The diagram illustrates the Nitrogen cycle.



46. What is the conversion of nitrogen gas directly to an organic compound called?

A bacterial fixation
B denitrification
C leaching
D lightning fixation

47. In which form do plants take in nitrogen through their root hairs?

A atoms
B bacteria
C ions
D molecules

48. Phosphoric acid has the formula H_3PO_4.

What is the correct formula for ammonium phosphate?

A $(NH_4)_3PO_4$
B $(NH_4)_2PO_4$
C NH_4PO_4
D $NH_4(PO_4)_2$

49. Which commercial process produces ammonia on a large scale?

A Contact process
B Haber process
C Polymerisation process
D Solvay process

50. Which of the following could represent à pair of isotopes?

A $^{20}_{8}X$ and $^{20}_{9}X$

B $^{44}_{23}X$ and $^{44}_{23}X$

C $^{32}_{15}X$ and $^{34}_{16}X$

D $^{40}_{19}X$ and $^{42}_{19}X$

End]

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*58-71 Lanthanoid series
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Key: a / X / b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

1. In which state of matter, under the same conditions of temperature and pressure, will particles have the most energy?

A molecules in a solid
B molecules in a liquid
C dissolved ions in a liquid
D molecules in a gas

2. Which are pure substances?

A elements and mixtures
B compounds and mixtures
C elements and compounds
D elements, compounds and mixtures

3. Which element is the most powerful oxidizing agent?

A bromine
B chlorine
C iodine
D sodium

4. Which of these oxides is acidic?

A Al_2O_3
B K_2O
C MgO
D SO_2

5. What is formed when sulfur dioxide dissolves in water?

A sulfurous acid
B sulfur trioxide
C hydrogen sulfide
D sulfuric acid

6. The table shows the pH of the solutions of four salts dissolved in water.
Which of the solutions is acidic?

		pH of its solution in water
A	ammonium chloride	5
B	potassium chloride	7
C	potassium nitrate	7
D	sodium carbonate	9

7. Which statement about both graphite and diamond is true?

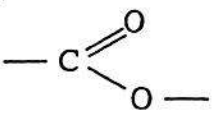
A They have the same crystal lattice structure.
B They have the same degree of hardness.
C They have the same electrical conductivity.
D They can undergo the same chemical reactions.

8. What is the formula for magnesium hydroxide?

A $MgOH$
B $Mg(OH)_2$
C Mg_2OH
D $Mg_2(OH)_3$

9. Which atom has the greatest number of electrons that can form bonds with other atoms?

A Al
B P
C S
D Si

10. Which compound has the functional group  in its molecule?

A carboxylic acid
B aldehyde
C ester
D ether

11. Which compounds are isomers?

A 1-propanol and 2-propanol
B ethane and ethanol
C methanoic acid and ethanoic acid
D methanol and ethanol

12. Which substance, in combination with an organic acid, forms an ester?

A an alcohol
B an alkane
C an ether
D a ketone

13. Which formula represents an organic ester?

A CH_3CH_2OH
B CH_3OCH_3
C $HCOOH$
D CH_3COOCH_3

Shown are **four** methods of separation, labelled **A**, **B**, **C** and **D**.

A chromatography
B distillation
C evaporation
D filtration

Which method of separation can be used to

14. obtain crystals of fertilizer from a mixture of nitric acid and ammonia; A B C D

15. obtain pure water from seawater; A B C D

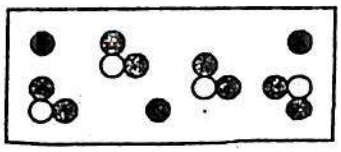
16. analyse ink from a forged cheque? A B C D

17. When copper is heated in a Bunsen flame it forms a black solid.

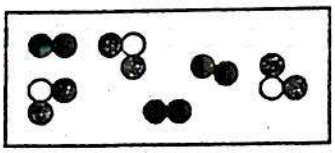
What is the name of this solid?

A copper oxide
B copper carbide
C copper hydroxide
D copper nitride

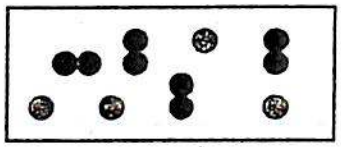
18. Which diagram represents a mixture of the molecules of an element and the molecules of a compound?



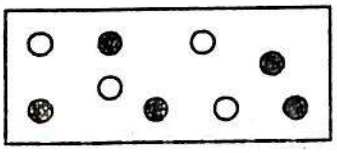
A



B



C



D

19. A student tests several solutions with Universal Indicator to see whether they were acidic, alkaline or neutral. The results are shown in the table.

solution	colour
solution **W**	greenish-blue
solution **X**	blue-purple
solution **Y**	pinkish-red
solution **Z**	yellow-orange

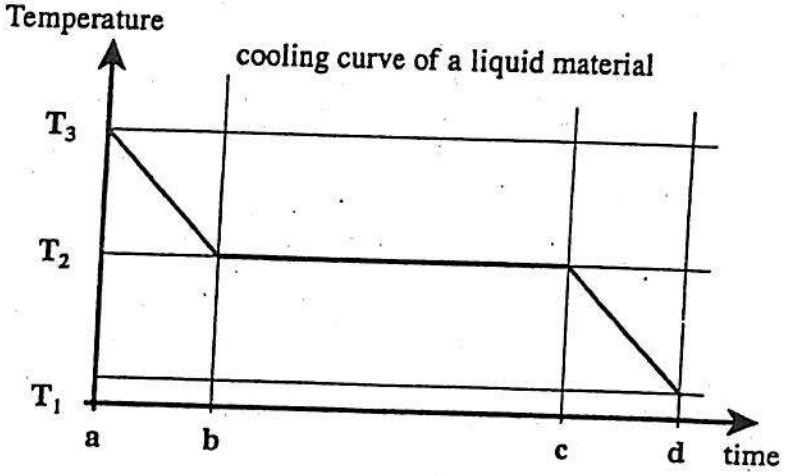
Which solution is nearest to neutral?

A Y
B W
C X
D Z

20. Which one of these descriptions is a **physical change** and not a **chemical change**?

A cast iron solidifying from a blast furnace
B burning petrol to form liquid water and carbon dioxide gas
C shiny steel changing to a brown rust powder
D zinc dissolving in hydrochloric acid

21. The graph shows the results of observing hot, liquid, pure wax, as it slowly cools to room temperature.



What can be deduced from these results?

A **a** to **b**, the wax is starting to freeze
B **b** to **c**, the wax is changing state from liquid to solid
C **c** to **d**, some wax is still liquid
D the freezing point of the wax is T_1

22. Which statement best describes what happens to water particles when the water freezes?

A they lose energy and escape into the atmosphere
B they lose energy and lose freedom to move about
C they gain energy and break up into atoms of hydrogen and oxygen
D they gain energy and gain freedom to move about

23. Which of these is an alkali in solution?

A salt solution
B battery acid
C oven cleaner
D lime juice

24. Which statement best explains why the gas pressure in a metal cylinder containing oxygen gas increases when it is heated?

A the higher temperature makes some of the molecules split up
B the molecules expand when they are heated and so take up more space
C the higher temperature makes the molecules collide more violently with the walls
D the higher temperature makes the molecules attract each other

25. When solid *P* reacts with an acid, a colourless gas, *Q*, is given off. When gas *Q* is bubbled into limewater, a white precipitate is formed.

What is solid *P* most likely to be?

A a metal carbonate
B a metal sulphate
C a metal chloride
D carbon

26. The equation is not balanced.

$$x\ Li_{(s)} + y\ O_{2(g)} \longrightarrow z\ Li_2O_{(s)}$$

Which numbers for x, y and z balance the equation?

	x	y	z
A	4	2	1
B	2	2	1
C	2	1	2
D	4	1	2

27. Carbon dioxide is formed in the **complete** combustion of a fuel.
Carbon monoxide is formed in the **incomplete** combustion of a fuel.

Which statement is **true** for both of these gases?

A both gases are toxic to animals
B carbon monoxide is an element and carbon dioxide is a compound
C neither compound will burn in air
D carbon dioxide gives a milky precipitate when bubbled into limewater, but carbon monoxide does not

28. Ethanol may be used as a fuel because it

A has a high heat of combustion.
B is easily converted to carbon.
C is easily converted to ethane.
D has a low heat of formation.

29. Which statement is generally **true** about metallic and non-metallic elements?

A solid, non-metallic elements are dull looking
B non-metallic elements are good conductors of electricity
C metallic elements are poor conductors of heat
D metallic elements have low melting points

30. The cathode, used in the extraction of aluminium from bauxite, is made of

A copper
B mercury
C iron
D carbon

31. Which period of the Periodic Table contains tin?

A Period 1
B Period 3
C Period 4
D Period 5

32. The elements in which Group of the Periodic Table can all have a valency of –1?

A Group I
B Group II
C Group VII
D Group VIII

33. Which metal element may have a valency of +2 or +3?

A aluminium
B copper
C iron
D mercury

34. When a mixture of substances reacts chemically, what does an increase in temperature indicate?

A bonds in the reactants are broken
B the reactants contain less energy than the products
C the products contain less energy than the reactants
D heat energy is being absorbed during the reaction

35. Which pure substance will turn anhydrous copper sulfate from the colour white to the colour blue?

A alcohol
B bromine
C ether
D water

36. Which substance may be responsible for the overgrowth of plant life in ponds and rivers?

A carbonates
B chlorides
C phosphates
D sulfates

37. Which statement about the volume occupied by 1 mole of any gas at s.t.p., is correct?

A volume varies with the density of the gas
B volume always contains the same number of molecules
C volume is inversely proportional to the relative molecular mass of the gas
D the volume of any gas will always take the same time to diffuse through a given hole under the same conditions

38. Which condition exists when a reversible reaction has reached equilibrium?

A the two reactants are present in equal amounts
B the amount of reactants and products are equal
C the forward and backward reaction rates are equal
D both the forward and backward reactions have stopped

39. The mineral aragonite is mined in The Bahamas.

Which element is contained in this mineral?

A calcium
B magnesium
C potassium
D sodium

40. Which ion contains four oxygen atoms?

A sulfide
B sulfite
C sulfate
D thiosulfate

41. What happens to the reactivity of the alkaline earth metals Be, Mg, Ca, with water; as the atomic number increases?

A decreases
B increases then decreases
C increases
D remains the same

42. What name is given to different forms of the same element that results from different molecular structures?

A allotrope
B amphoteric
C isotope
D isomer

43. Which process involves coating iron with zinc?

A anodizing
B galvanizing
C oxidizing
D vulcanizing

44. Which particle has the same electronic configuration as the neon atom?

A a fluorine atom
B an oxygen ion
C a potassium ion
D a sodium atom

45. What is the M_r of $Ca(NO_3)_2$?

A 3
B 9
C 102
D 164

The table gives some data about the relative amounts of gases in the atmosphere. Use this information to answer questions **46** and **47**.

	gases	amount in parts per million
A	carbon dioxide	4 000
B	carbon monoxide	350
C	ozone	120
D	sulfur dioxide	1 200

46. Which substance is mainly responsible for global warming?

A B C D

47. Which substance is responsible for acid rain?

A B C D

48. Which of these ions causes **hardness** of water?

A K^+ and Na^+
B Ca^{2+} and Mg^{2+}
C Fe^{2+} and Al^{3+}
D Cl^{1-} and O^{2-}

49. In a tourism-based country like The Bahamas, which substances are the more serious air pollutants?

A carbon dioxide and carbon monoxide
B methane and polymers
C nitrates and sulfur dioxide
D oxides of nitrogen and other automobile exhaust gases

50. What is the percentage amount of phosphorus in a 20-10-8 fertilizer?

A 8%
B 10%
C 20%
D 62%

END]

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