MODEL TEST PAPER XI
CHEMISTRY

Q.1

An aqueous solution of glucose is 10% in strength. The volume is which 1 g mole of it is dissolved will be

(a) 18 lit
(b) 9 lit
(c) 0.9 lit
(d) 1.8 lit

Q.2

Which of the following involve sp^3d hybridisation ?

(a) 1_3^-
(b) IBr_2-
(c) I_5-
(d) ICI_4-

Q.3

Phospholipids are esters of glycerol with

(a) Three carboxylic acid residues
(b) Two carboxylic acid residues and one phosphate group
(c) One carboxylic acid residues and two phosphate groups
(d) Three phosphate groups

Q.4

Which of the following molecules will not have a dipole moment ?

(a) CH_3CI
(b) CH_3OCH_3
(c) CH_2CI_2
(d) CCI_4

Q.5

The pair of radiation with lowest frequency, lowest wavelength respectively is represented by

(a) X-rays, microwaves
(b) X-rays, visible radiation
(c) Y –rays, microwaves
(d) Microwaves, y-rays

Q.6

If the formula mass of $Cr_2O_7^{2-}$ ion is M, then in the reaction

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$,

The equivalent mass of $Cr_2O_7^{2-}$ is

(a) M
(b) $\frac{M}{2}$
(c) $\frac{M}{6}$
(d) $\frac{M}{14}$

Q.7

The formula of potassium dicyanobis(oxalate) nickelate (II) is

(a) $K_4[Ni(CN)(Ox)_2]$
(b) $K_3[Ni_2(CN)_2(Ox)_2]$
(c) (c)$K_4[Ni(CN)_2(Ox)_2]$
(d) $K_2[Ni(CN)_2(Ox)_2]$

Q.8

The solubility product of $BaCrO_4$ is 2.4×10^{-10}.

The maximum concentration of $Ba(NO_3)_2$ possible without precipitation In a 6×10^{-10} M K_2CrO_4 solution is

(a) 4×10^{-7} M
(b) 1.2×10^{-10} M
(c) 6×10^{-4} M
(d) 3×10^{-4} M

Q.9

How many electrons are delivered at the cathode during electrolysis by a current of 1 amp. In 60 seconds?

(a) 6.0×10^{23}
(b) 6.0×10^{20}
(c) 3.74×10^{20}
(d) 7.48×10^{21}

Q.10

In the extraction of Cu, the reaction

$Cu_2O + FeS \rightarrow FeO + Cu_2S$ takes place during the

(a) Concentration
(b) Smelting
(c) Roasting
(d) Bassemerisation

Q.11

A buffer solution contains 0.1 M of acetic acid and 0.1 M of sodium acetate. What will be its *p*H ?

(pK_a of acetic acid is 4.75)

(a) 4.00
(b) 4.75
(c) 5.00
(d) 5.25

Q.12

Which of the following gases react with oxygen to form a brown colouredgas?

(a) CO
(b) (b)N_2
(c) (c)NO
(d) (d)Br_2

Q.13

Which of the following compounds will be formed when addition of HBr takes place with acetylene?

(a) Ethylidene bromide
(b) Ethylene bromide
(c) Ethyl bromide
(d) Vinyl bromide

Q.14

Which of the following species has the same number of electrons in the outermost and penultimate shells?

(a) Fluoride ion
(b) Sodium ion
(c) Magnesium ion
(d) Chloride ion

Q.15

Electrolysis of the sodium salt of which of the following acids will give ethylene ?

(a) Acetic acid
(b) Succinic acid
(c) Formic acid
(d) Fumaric acid

Q.16
Which of the following statements is not correct regarding lanthanides and actinides ?

(a) Oxidation state of + 3 is predominant in both the series
(b) In both the series, *f*-orbitals are being progressively filled.
(c) All the elements of both the series are radioactive.
(d) (d)Both the series show contraction as lanthanide contraction and actinide contraction

Q.17

Natural gas

(a) Is a mixture of gaseous paraffins
(b) Is a mixture of unsaturated compounds
(c) Is manufactured by the cracking of a fuel oil
(d) Is a mixture of aromatic compounds

Q.18

Action of heat on mixture of anhydrous sodium propanoate and soda lime produces

(a) Butane
(b) Ethane
(c) Methane
(d) Propane

Q.19

Which is the strongest carboxylic acid among the following ?

(a) $C1_3C.COOH$
(b) $Br_3C.COOH$
(a) $F_3C.COOH$
(b) $C1_2CH.COOH$

Q.20

Which of the following compounds will have most hindered rotation about C – C bond?

(a) 1,1,2,2-tetrabromo ethylene
(b) Hexabromoethane
(c) Hexachloroethane
(d) Ethane

Q.21

The olefin which on ozonolysis gives CH_3CH_2CHO and CH_3CHO is

(a) 1- butane
(b) 2- butane
(c) 1- pentene
(d) 2-pentene

Q.22

To prepare a pure sample of *n*-hexane using sodium metal as one reactant, the other reactant will be

(a) Ethyl chloride and *n*-butyl chloride
(b) Methyl bromide and *n*-pentyl bromide
(c) *n*-propyl bromide
(d) ethyl bromide and *n*-butyl bromide

Q.23

Fog is a colloidal system of

(a) Gas in liquid
(b) Liquid in gas
(a) (c)Gas in gas
(c) Gas in solid

Q.24

A flask containing air (open to atmosphere)is heated from 300 K to 500 K. The percentage of air escaped to the atmosphere is

(a) 66.6%
(b) 16.6%
(c) 33.3%
(d) 40%

Q.25

3 g of a hydrocarbon on combustion in excess of oxygen produce 8.8 g of CO_2 and 5.4 g of H_2O. the data illustrate the law of

(a) Conservation of mass
(b) Multiple proportions
(c) Constant proportions
(d) Reciprocal proportions

Q.26

Which of the following statements is not true about noble gases ?

(a) Their ionization energies are very high
(b) Their electron affinities are nearly zero
(c) They don't from any chemical compounds
(d) They are not easily liquefied

Q.27

Which of the following is an example of a covalent solid?

(a) CaF_2
(b) H_2O
(c) CI_2
(d) SiC

Q.28

Electrolysis of an aqueous solution of sodium salt of mono-carboxylic acid gives an

(a) Alkane
(b) Alkyne
(c) Ether
(d) Alkene

Q.29

Which one of the following theory can best explain the paramagnetic behaviour of oxygen ?

(a) VSEPR
(b) Valence bond theory
(c) Both VSEPR theory and
(d) Molecular orbital theory

Q.30

What of the following compounds is expected to be colored ?

(a) Ag_2SO_4
(b) MgF_2
(c) CuF_2
(d) CuCI

PHYSICS

Q.1

The time period T of small drop of liquid due to surface tension depends upon density ρ, radius r and surface tension S. The relation is

(a) $T \propto \rho r^3/S$
(b) $T \propto (\rho S/r^3)^{1/2}$
(c) $T \propto (S r^3/\rho)^{1/2}$
(d) $T \propto (\rho r^3/S)^{1/2}$

Q.2

A ball is thrown from the ground to clear a wall 3 m high at a distance of 6m and fall 18 m away from the wall. The angle of projection of ball is

(a) $\tan^{-1}3/2$
(b) $\tan^{-1}2/3$
(c) $\tan^{-1}1/2$
(d) $\tan^{-1}3/4$

Q.3

A machine gun fires a bullet of mass 40 g with a velocity of 1200 m/s. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can be fired per second at the most

(a) 1
(b) 4
(c) 2
(d) 3

Q.4

A spring of force constant k is cut into two pieces such that one piece is double the length of the other. The long piece will be proportional to

(a) 2k/3
(b) 3k/2
(c) 3k
(d) 6k

Q.5

A man is standing at the centre of a rotating turn table with his arms stretched. If he draws his arms inwards and thereby reduces his moment of inertia by a factor of k, the angular speed of turn table will

(a) Remain constant
(b) Increases by a factor of k
(c) Decreases by a factor of k
(d) Decreases of a factor of k^2

Q.6

Work done to bring four particles each having a mass of 0.1 kg from infinity to the vertices of square of side 0.2 m is

(a) 1.8×10^{-11} J
(b) 8.1×10^{-11} J
(c) -1.8×10^{-11} J
(d) -8.1×10^{-11} J

Q.7

The maximum average velocity of water in a tube of diameter 2 cm so that flow becomes laminar is (given the viscosity of water = 10^{-3} $Nm^{-2}s^{-1}$)

(a) 1 m/s
(b) 0.1 m/s
(c) 10 m/s
(d) 100 m/s

Q.8

A gas mixture consists of two moles of oxygen and four moles of argon at temperature T . Neglecting all vibrational modes, the total internal energy of the system is

(a) 4 RT
(b) 15 RT
(c) 9 RT
(d) 11 RT

Q.9

A closed compartment containing gas is moving with some acceleration in horizontal direction. Neglecting the effect of gravity, the pressure in the compartment is

(a) Same everywhere
(b) Lower in the front side
(c) Lower in the rear side
(d) Lower in the upper side

Following questions consists of two statements printed as Statement 1 and Statement 2. While answering these questions you are required to select any one of the responses indicated as

(a) If both Statement 1 and Statement 2 are true and Statement 2 is a correct explanation of Statement 1.
(b) If both Statement 1 and Statement 2 are true but the Statement 2 is not a correct explanation of Statement 1.
(c) If statement 1 is true but the Statement 2 is false.
(d) If Statement 1 is false but Statement 2 is true.

Q.10

Statement 1: Damped vibrations are due to air resistance or frictional forces

(a) 1
(b) 2
(c) 3
(d) 4

Q.11

A tube of diameter d and of length 1 unit is open at both ends. Its fundamental frequency of resonance is found to be n_1.. The velocity of sound in air is 330m/s. The lowest frequency of resonance of tube is n_2, if one end of the tube is closed. Considering the end correction, the value of n_1/n_2 is

(a) $\frac{(l+0.6d)}{(l+0.3d)}$
(b) $\frac{(l+0.3d)}{2(l+0.6d)}$
(c) $\frac{(l+0.6d)}{2(l+0.3d)}$
(d) $\frac{(d+0.3l)}{2(d+0.6l)}$

Q.12

The kinetic energy gained by an alpha particle is going from a point at 70V to another point at 50 V is

(a) 40 eV
(b) 40 KeV
(c) 40 meV
(d) 0 eV

Q.13

Three resistors of 4 Ω, 6 Ω and 10 Ω are connected in series with battery of 15 V. When a current of 0.6 A passes through 6 Ω resistor , the internal resistance of the battery is

(a) 3.82 Ω
(b) 2.35 Ω
(c) 5.29 Ω
(d) 5 Ω

Q.14

A solenoid of length 0.4 m and 500 turns of wire carries of current of 0.3 A. A thin coil having 10 turns of wire and of radius 0.01 m carries a current of 0.4 A. The torque required to hold the coil in the middle of solenoid with its axis perpendicular to the axis of the solenoid will be

(a) 6×10^{6} N
(b) 5.94×10^{-6}N
(c) 9.54×10^{6}Nm
(d) 5.9×10^{-8}Nm

Q.15

A proton moving with a constant velocity passes through region of space without any change in its velocity. If E and B represent the electric and magnetic fields respectively, this region of space may have

(a) $E = 0, B = 0$
(b) $E = 0, B \neq 0$
(c) $E \neq 0, B = 0$
(d) $E \neq 0, B \neq 0$

Q.16

In a transformer with efficiency of 100%, the input power is 60 watt. The number of secondary coils is 300. The output power will be

(a) 60
(b) 120
(c) 180
(d) 240

Q.17

In a circular conducting coil, when current increases from 2A to 18A in 0.5 seconds, the induced emf is 20 V. The self inductance of the coil will be

(a) 62.5 mH
(b) 6.25 mH
(c) 50 mH
(d) 5 mH

Q.18

In a place electromagnetic wave electric field oscillates sinusoidally with frequency 2x 10^{10} Hz and amplitude 48 V/m, the wavelenghth of the waves will be

(a) 2.2 x 10^{-4}m
(b) 1.5 x 10^{-2}m
(c) 5.1 x 10^{-3}m
(d) 5.1 x 10^{-2}m

Q.19

White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and the screen is at a distance d>>b from the slits. At a point on the screen directly in front of one of the slits, certain wavelengths are missing. Some of these are

(a) b^2/d
(b) $2b^2/d$
(c) $b^2/2d$
(d) $2b^2/3d$

Q.20

The refractive index of water is 4/3 and that of glass is 5/3. The critical angle of ray entering water from glass is

(a) $Sin^{-1}(4/5)$
(b) $Sin^{-1}(5/4)$
(c) $Sin^{-1}(1/2)$
(d) $Sin^{-1}(2/1)$

Q.21

A terrestrial telescope is made by introducing an erecting lens of local length f between the objective and the eyepiece lenses of an astronomical telescope. This cause the length of the telescope tube to increase by an amount equal to

(a) f
(b) 2f
(c) 3f
(d) 4f

Q.22

The X-ray beam coming from the X ray tube will be

(a) Monochromatic
(b) Having all wavelengths smaller than a certain maximum
(c) Having all wavelengths larger than a certain minimum wavelength
(d) Having all wavelengths lying between a minimum and maximum wavelength

Q.23

Magnetic moment due to orbital motion of an electron in an atom when orbital angular momentum is equal to one quantum unit is

(a) 2.9×10^{-2} A m^2
(b) 9.2×10^{-20} A m^2
(c) 9.2×10^{-24} A m^2
(d) 2.9×10^{-26} A m^2

Q.24

Consider alpha particle, beta particle and gamma rays, each having energy 0.5 MeV. The penetrating power of the radiations in increasing order will be

(a) α,β,γ
(b) α,γ,β
(c) β,γ,α
(d) γ,β,α

Q.25

The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480 nm is incident on it. The band gap for semiconductor in eV is

(a) 0.9
(b) 0.7
(c) 0.5
(d) 1.1

Read the following paragraph

In an npn transistor 10^{10} electrons enter the emitter in 10^{-6} s. 2% of electrons are lost in the base. Now answer the following questions

Q.26

Power gain is

(a) 9.63
(b) 6.93
(c) 3.96
(d) 3.69

Q.27

Emitter current is

(a) 1.6 mA
(b) 6.1 mA
(c) 3 mA
(d) 4.2 mA

Q.28

In the formula $X = 3YZ^2$, X and Z have dimension of capacitance and magnetic inductions respectively. What are the dimension of Y in MKSQ sysem ?

(a) $[M^{-3}L^{-1}T^3Q^4]$
(b) $[M^{-3}L^{-2}T^4Q^4]$
(c) $[M^{-2}L^{-2}T^4Q^4]$
(d) $[M^{-3}L^{-2}T^3Q]$

Q.29

A river is flowing from west to east at a speed of 5m/min. A man on the south bank of the river, capable of swimming at 10m/min in still water, wants to swim across the river in the shortest time. He should swim in a direction

(a) Due north
(b) 30° east of north
(c) 30° west of north
(d) 60° east of north

Q.30

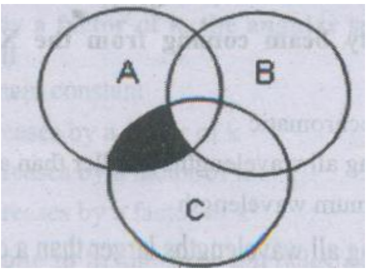
A particle of mass m is projected with a velocity v making an angle of 45° with the horizontal. The magnitude of the angular momentum of the projection about the point of projection when the particle is at its maximum height h is

(a) Zero
(b) $mv^3/(4\sqrt{2}g)$
(c) $mv^3(\sqrt{2}g)$
(d) $m(2gh^3)^{1/2}$

MATHEMATICS

Q.1

The shaded area in this diagram represents



(a) A∩ C
(b) (A ∩ B) − C
(c) (A ∩ C) − (A ∩ C)
(d) (A ∩ C) – B

Q.2

Tha range of the function f (x) = X – [x] is

(a) [0, 1]
(b) [0, 2]
(c) [0, 1]
(d) None of these

Q.3

Domain of (2,3), (4,5),(6,7) is

(a) (3, 4, 7)
(b) (2, 4, 6)
(c) (2, 5, 7)
(d) None of these

Q.4

If α and β are the roots of ax^2 + bx c, the equation whose roots are $\frac{1}{\alpha a+b}, \frac{1}{\alpha\beta+b}$ is

(a) $acx^2 + bx + 1 = 0$
(b) $acx^2 - bx + 1 = 0$
(c) $acx^2 + bx - 1 = 0$
(d) $acx^2 - bx - 1 = 0$

Q.5

If a > 0 and = $\sqrt{a + \sqrt{a + \sqrt{a + \sqrt{a + \because}}} \ldots \ldots \infty}$, the value of x is

(a) $\frac{\sqrt{4a}-1}{4}$
(b) $\frac{1+\sqrt{4a}+1}{4}$
(c) $1 + \frac{\sqrt{4a}-1}{4}$
(d) $\frac{1+\sqrt{4a}+1}{2}$

Q.6

The values of θ lying between 0 and (π/2) and satisfying the equation

$$\begin{vmatrix} 1+\sin^2\theta & \cos^2\theta & 4\sin4\theta \\ \sin^2\theta & 1+\cos^2\theta & 4\sin4\theta \\ \sin^2\theta & \cos^2\theta & 1+4\sin4\theta \end{vmatrix} = 0 \text{are}$$

(a) $\frac{\pi}{4}, \frac{3\pi}{4}$
(b) $\frac{5\pi}{4}, \frac{7\pi}{4}$
(c) $\frac{7\pi}{24}, \frac{11\pi}{24}$
(d) $\frac{5\pi}{24}, \frac{11\pi}{24}$

Q.7

If the system of equation $x - Ky - z = 0, Kx - y - z = 0, x + y - z = 0$ has a non-zero solution, then the possible values of K are

(a) – 1, 2
(b) 1, 2
(c) 0, 1
(d) 1, 1

Q.8

In how many ways 3 girls and 9 boys can be seated in two vans, each having numbered seats, 3 in the front and 4 at the back, if 3 girls sit together in a back row on adjacent seats ?

(a) ${}^{11}C_9$ x 4! x 3!
(b) ${}^{11}P_9$ x 4!
(c) ${}^{11}P_9$ x 3!
(d) None of these

Q.9

The number of ways in which 5 beads of different colours form a necklace is

(a) 12
(b) 24
(c) 120
(d) 60

Q.10

$\left(\frac{a}{a+x}\right)^{\frac{1}{2}} + \left(\frac{a}{a-x}\right)^{\frac{1}{2}} =$

(a) $2 + \frac{3x^2}{4a^2} + \cdots$
(b) $2 + \frac{5x^2}{4a^2} + \cdots$
(c) $1 + \frac{3x^2}{4a^2} + \cdots$
(d) None of these

Q.11

If the sun of the corfficients in the expansion of $(1 - 3x + 10x^2)^n$ is a sum of the coefficients in

(a) a = 3b
(b) $a = b^3$
(c) a = 2b
(d) 3a = b

Q.12

The n^{th} term of the two series 3 + 10 + 17 + ………and 60 + 65 + 67 +………are equal. Then the value of n is

(a) 9
(b) 13
(c) 19
(d) None of these

Q.13

If a, b, c, are in A. P, and (b−a), (c−b), a are in G.P, then a : b : c is

(a) 1 : 2 : 3
(b) 3 : 2 : 1
(c) 2 : 3 : 4
(d) None of these

Q.14

$\lim_{x\to 0}\frac{(1-x)^n-1}{x}$ is equal to

(a) n!
(b) \(n-1)!
(c) –n
(d) n

Q.15

if f(x) = |x|, then $f'(2) =$

(a) 2
(b) 1
(c) Does not exist
(d) None of these

Q.16

The curve $y - e^{xy} + x = 0$ has a vertical tangent at the point

(a) (1, 1)
(b) At no point
(c) (0, 1)
(d) (1, 0)

Q.17

$\int e^{-logx} dx =$

(a) $e^{-\log x}$
(b) $xe^{\log x}$
(c) $log|x|$
(d) None of these

Q.18

$\int_0^{\frac{\pi}{2}} \sin^2 x dx =$

(a) π/4
(b) π/3
(c) π/2
(d) None of these

Q.19

If $\frac{dr}{dt} = -rt \text{ and } r(0), = r_0$, then

(a) $r = r_0 e^{\frac{t2}{2}}$
(b) $r = e^{\frac{-t2}{2}}$
(c) $r = r_0 e^{\frac{-t2}{4}}$
(d) $r = r_0 e^{\frac{-t2}{2}}$

Q.20

If $\frac{dy}{dx} + \left(\frac{1-y^2}{1-x^2}\right)^{1/2} = 0$, then which of the following

(a) $\sqrt{1-x^2} + \sqrt{1-y^2} = c$
(b) $y\sqrt{1-y^2} + x\sqrt{1-x^2} = c$
(c) $y\sqrt{1-x^2} + x\sqrt{1-y^2} = c$
(d) $y\sqrt{1-y} + \sqrt{1-x^2} = c$

Q.21

The solution of the equation $\left(x\sqrt{1+y^2}\right) dx + \left(y\sqrt{1+x^2}\right) dy = 0$ is

(a) $\left(\sqrt{1+y^2}\right) + \left(\sqrt{1+x^2}\right) = 0$
(b) $\left(x\sqrt{1+y^2}\right) + \left(y\sqrt{1+x^2}\right) = 0$
(c) $log\left(\sqrt{1+y^2}\right) + log\left(\sqrt{1+x^2}\right) = 0$
(d) $\left(\sqrt{1+y^2}\right) + \left(\sqrt{1+x^2}\right) = 0$

Q.22

The line y = 2x + c is a tangent to the parabola $y^2 = 16x$ if c equals

(a) 2
(b) $1/2$
(c) 0
(d) None of these

Q.23

If α,β,γ are the directional angles that a line makes with x-axis, y-axis and z-axis respectively, then $\sin^2 a + \sin^2 \beta + \sin^2 \gamma =$

(a) 1
(b) 2
(c) 0
(d) -2

Q.24

The ratio in which the plane $\vec{r}.\left(\hat{\imath} + 2\hat{\jmath} + 2\hat{k}\right) = 17$ divides the line joining the points with position vectors $\left(-2\hat{\imath} + 4\hat{\jmath} + 7\hat{k}\right)$ and $\left(\hat{3\imath} - 5\hat{\jmath} + 8\hat{k}\right)$, is

(a) 1 : 5 (b) 1 : 10
(b) (c) 3 : 5 (d) 3 : 10

Q.25

Three forces $\vec{P}, \vec{Q},$and $\vec{R}$acting along IA, IB and IC, where I is the incentre of ΔABC, are in equilibrium then $\vec{P}, \vec{Q}, \vec{R}$is

(a) $\cos\frac{A}{2} : \cos\frac{B}{2} : \cos\frac{C}{2}$
(b) $\cot\frac{A}{2} : \cot\frac{B}{2} : \cot\frac{C}{2}$
(c) $\sin\frac{A}{2} : \sin\frac{B}{2} : \sin\frac{C}{2}$
(d) $\mathrm{cosec}\frac{A}{2} : \mathrm{cosec}\frac{B}{2} : \mathrm{cosec}\frac{C}{2}$

Q.26

Two numbers a and b are chosen at random from the set of first 30 natural numbers. The probability that $a^2 - b^2$ is divisible by 3 is

(a) 9/87
(b) 12/87
(c) 38/87
(d) 47/87

Q.27

The principal value of $\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right)$ is

(a) -2π/3
(b) -π/3
(c) -π/6
(d) π

Q.28

The equation $\frac{x^2}{1-r} + \frac{y^2}{r-3} + 1 = 0$ represents an ellipse only if

(a) r> 1
(b) r < 3
(c) 1 < r < 3
(d) None of these

Q.29

If e_1 and e_2 are eccentricities of the two hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{x^2}{b^2} - \frac{y^2}{a^2} = 1$, then

(a) $e_1 = e_2$
(b) $e_1 e_2 = 1$
(c) $e_1^2 e_2^2 = 1$
(d) $\frac{1}{e_1^2} + \frac{1}{e_2^2} = 1$

Q.30

The point(s) on the curve $y^3 + 3x^2 = 12y$ where the tangent is vertical, is (are)

(a) $\left(\mp \frac{7}{\sqrt{3}}, 2\right)$
(b) $(0, 1)$
(c) $(\frac{4}{\sqrt{2}}, 2)$
(d) $\left(\mp \frac{4}{\sqrt{3}}, 2\right)$