### PART A

The Sun	
medical condition disease and music	<ul> <li>Mozart (complete name is Wolfgang Amadeus Mozart) lived in Austria and died at just the age of 35. He would work through the night and sleep during the day. Mozart suffered illness throughout his life, including kidney disease, smallpox, typhoid fever, tonsillitis and strep throat.</li> <li>Almost all the above diseases have Vitamin D connection. This vitamin is a hormone derived from the steroid, cholesterol, but is not a steroid as the ring structure of cholesterol is opened. The unsaturation in Vitamin D is more than that of cholesterol and there is only a difference of two units in the molecular weights. Both these molecules have a hydrophobic and hydrophilic portion. Vitamin D is produced when skin is exposed to ultraviolet rays, and linked to many as and increases the risk of developing influenza, pneumonia, certain cancers, cardiovascular suloskeletal pain</li> </ul>

Based on the text answer questions  ${\bf 1}$  to  ${\bf 10}$ 

- 1. Identify one among the following statements which is incorrect.
  - A. Austria is darker than most of the Europe B. Mozart was a composerC. Vitamin D is called 'sunshine vitamin'D. In general day time sleeping

vitamin D deficiency.

- **D**. In general day time sleeping causes
- 2. Identify the structure of vitamin D from the molecules given below.



- **3.** From the molecules given in Question No.**2** the molecule \_\_\_\_\_ cannot undergo neither peroxidation( responsible for rancidity) nor bromination
- 4. The molecule which has both water repelling and water attractive potions is \_\_\_\_\_



c. H<sub>2</sub>SO<sub>3</sub>

 $d_1$   $H_2SO_4$ 

- **5.** Identify the molecule which can easily undergo *cis-trans* isomerism from the molecules given in question No.**2**
- 6. The UV radiation which is a part of electromagnetic spectrum is

**A.** More energetic than radiofrequency region **B**. Less energetic than radiofrequency region

C. Less energetic than IR region D. More energetic than X-rays

- **7.** From the molecules given in **QN 2** predict the one which can give absorption in the higher wavelength.
- **8.** The energy of a molecule which has a  $\lambda$ max 253 nm in the UV-Vis spectrum is \_\_\_\_\_\_ **A.** .09X10<sup>-25</sup>J **B.** 1X10<sup>-26</sup>J **C.** 0.078X10<sup>-26</sup>J
- 9. The reaction between cholesterol and fattyacid is an example of
  - A. Saponification B. Anhydride formation
  - **C.** EsterificationAl **D.** kylation.
- **10.** The deficiency of Vitamin D causes rickets .To facilitate the synthesis of Vitamin D in the body
  - A. External Vitamin D intake B. Avoid Animal fat intake
  - **C.** No need of medication **D.** Need medicine for genetic disorder
- 11. Identify the molecule which can be directly derived from an  $\alpha$  amino acid





The color of the blood

The Hemoglobin (Hb) is the oxygen transport protein used in the blood of vertebrates.Oxygen diffuses from the lungs into the capillaries of the bloodstream and then into the red blood cells, where it binds to hemoglobin. The efficient binding and release of oxygen by haemoglobin undergoes where the partial pressure (pO2) is about 13.3 kPa and is about 4 kPa respectively with maximum oxygen saturation.

- 12. From the given graph identify the curve which represents normal oxygen binding.A. Curve aB. Curve bC. Curve cD. Curve d
- **13.** The most common vision problems are refractive errors, more commonly known as Myopia (nearsightedness), Hypermetropia (farsightedness) and astigmatism. From the given diagrams identify the situation where concave lens is a remedy.



- **14.** The production of oxytocin, a pituitary hormone, leads to the following situations (one among the several factors). Choose the correct statement.
  - a. abnormal rise leading to normal delivery during matured pregnancy
  - b. abnormal rise leading to abortion during premature labor
  - c. abnormal decrease leading to cesarean during matured pregnancy
  - d. abnormal increase promotes lactation

A.a and b only B. a and c only C. c only D. all are correct

- **15.** There are two situations .a seafish is transferred to fresh water b.a fresh water fish is moved to sea water. Identify the correct situation (assuming that the fish is alive).
  - a. the sea fish looses weight in fresh water
  - b. the freshwater fish looses weight in sea water
  - c. the seafish increases weight in fresh water
  - d. the freshwater fish increases weight in sea water

A. a only B. a and d C. b and c D. d only

## Up above the sky

Some details of three of the moons of Pluto are as given below.

Satellite Mean distance from Pluto (km) Orbital Period (days)

Charon	17500	6.3	
Nix	48500	24.8	
Hydra	64500	38	
S/2011 P1	59000	?	

Motion of a minor body in the gravitational field of a major body obeys Kepler's laws. Kepler's third law states that the square of the period of the minor body is proportional to the cube of its distance from the major body. A fourth moon of Pluto was discovered this month -S/2011 P1. Pluto itself has an orbital period of 248 years. Also its mass is approximately a fifth of the mass of Earth's moon and its radius is one over cube root of three times the radius of Earth's moon. The Earth -Sun distance is called the Astronomical Unit (AU) and is a unit of distance used in astronomy.

**16.** The orbital period of S/2011 P1 in days is approximately

<b>A.</b> 32	<b>B.</b> 26	<b>C.</b> 37	<b>D.</b> 39

- 17. The average distance of Pluto from the sun in AU is approximatelyA. 248B. 36C. 1200D. 1400
- **18.** The density of Pluto is ----- times that of the Moon

   **A.** 1.67
   **B.** 0.2
   **C.** 5
   **D.** 0.6
- **19.** If you observe a moon for Pluto having a period of 12 days at what distance from Pluto would you expect to find it.
  - **A.** 35000 **B.** 60000 **C.** 24000 **D.** 20000
- 20. Choose the correct statement
  - A. A scientific law is fact
  - B. Once a theory is constructed it is considered fact
  - C. A hypothesis is a speculation that is difficult to test
  - D. An observation explains why nature does something
  - E. A scientific law summarizes a series of related observations
- **21.** Out of the following an ionic compound is **A.**SCl<sub>2</sub> **B.** Mg<sub>3</sub>(PO)<sub>4</sub> **C.**Cl<sub>2</sub>O **D.** CH<sub>2</sub>O
- **22.** Which of the following solutions will have the highest electrical conductivity

<b>A.</b> 0.045M Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	<b>B.</b> 0.050M (NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub>	<b>C.</b> 0.10M LiBr
<b>D</b> .0.10M Nal	<b>E.</b> 0.10 M KF	

E.PF<sub>5</sub>

23. How many milliliters of a 0.266M LiNO3 are required to make 150.0ml of 0.075M LiNO3 solution

**A.** 53.2mL **B.** 42.3mL **C.** 8.8mL **D.**23.6mL **E.**35.1mL

- 24. Which of the following will cause the volume of an ideal gas to triple in value
  - **A.** Raising the temperature from 25°C to 75°C at constant pressure
  - **B.** Lowering the absolute temperature by a factor of 3 at constant pressure
  - **C.** Raising the absolute temperature by a factor of 3 while increasing the pressure by a factor of 3
  - **D.** Lowering the absolute temperature by a factor of 3 while increasing the pressure by a factor of 3
  - E. Lowering the pressure by a factor of 3 while the temperature stays constant
- 25. The compound that contains at least one polar covalent bond , but is nonpolar
  - **A.** HCN **B.** CF<sub>4</sub> **C.** SeBr<sub>4</sub> **D.** ICl<sub>3</sub>
  - E. Both b and c are non polar and contain a polar covalent bond
- 26. Commercial grade HCl solution is typically 39.0% (by mass) HCl in water. The molarity of HCl if the solution has a density of 1.2g/mL is.....
  A. 7.79M B. 10.7M C. 12.8M D. 9.35M E. 13.9M
- **27.** Order the following alkanes in terms of increasing boiling point

(give numbers 1-4, 1 for lowest and 4 for highest boiling point)

a /// b / c /// d //

- **A.** a<d<c<br/> **B.** d<b<c<a<br/> **C.** b<d<c<a<br/> **D.** a<c<d<br/>
  b<br/>
- **28.** In each of the following alkene pairs indicate, which of the alkenes is more stable:



- A. (A)Endocyclic (B) Exocyclic (C) Trans (D) Endocyclic
- **B.** (A) Exocyclic (B) Exocyclic (C) Cis (D) Exocyclic
- **C.** (A) Exocyclic (B) Endocyclic (C) Cis (D) Endocyclic
- **D.** (A)Endocyclic (B) Endocyclic (C) Trans (D) Endocyclic

**29.** Arrange the following compounds in terms of increasing basicity:



**30.** Arrange the following carboxylic acid derivatives in terms of increasing reactivity (lowest reactivity = 1, highest reactivity = 4)



**31.** If *L*, *C* and *R* represent the inductance, capacitance and resistance of a circuit, the quantity which has the dimensions of frequency is

**A.** 
$$\frac{1}{RC}$$
 **B.** *RC* **C.** *LC* **D.**  $\frac{1}{LC}$ 

- **32.** Two equal and opposite point charges are kept at (0, 0, -d) and (0, 0, d), along the z-axis. Consider a spherical Gaussian surface whose center coincides with the origin. If the radius of the sphere is much larger than d, which of the following statements is TRUE?
  - **A.** The electric field at any point on the Gaussian surface is zero.
  - B. The electric field over the Gaussian surface is non uniform.
  - C. The electric field over the Gaussian surface is non zero, but is the same at all points.
  - **D.** The total flux of electric field through the Gaussian surface is non zero.
- **33.** A thin conducting disc of radius R rotates with an angular frequency of  $\omega$  about its axis. If there is a uniform magnetic field B in the region, the induced emf between the centre and a point on the circumference of the disc is

A. 
$$\frac{\omega BR^2}{2}$$
 B. zero C.  $\omega BR^2$  D.  $\omega BR$ 

**34.** A point charge is located at the centre P of the outer ring of a hemisphere. If the flux passing through the curved surface of the hemisphere is  $\Phi$ , the magnitude of the charge at P is



**D.** 
$$\frac{2\varepsilon_0\Phi}{3}$$

35. The force that holds nuclei together is NOT

A. responsible for beta decay of nucleus	B. short ranged
C. attractive	<b>D.</b> charge independent

**36.** Emission of which of the following would leave both the atomic number and mass number of a nucleus unchanged?

A. gamma raysB. beta particleC. alpha particlesD.neutron

**37.** While propagating in vacuum, visible light, X-ray and infra red waves have the same

A. Speed B. Wavelength C. Energy D. Frequency

**38.** The minimum wave length of continuous X-rays coming out of a X-ray tube depends on

A. the accelerating voltage	<b>B.</b> atomic number of the target eleme	
C. filament current	<b>D.</b> mass number of the target element	

**39.** Magnetic monopoles do not exist. Which of the following relations expresses this fact?

**A.** 
$$\overline{\nabla}.\overline{E} = \frac{\rho}{\varepsilon_0}$$
 **B.**  $\overline{\nabla}.\overline{B} = 0$  **C.**  $\overline{\nabla} \times \overline{B} = \mu_0 \overline{J}$  **D.**  $\overline{\nabla} \times \overline{B} = \mu_0 (\overline{J} + J_D)$ 

40. A uniform magnetic field existing in a circular region of radius *R* changes with time. Given that the direction of the field is perpendicular to the plane of the circular region. For a given rate of change of the field, the magnitude of the induced electric field at a point in the same plane and at a distance *r* (>*R*) from the centre of the circular region

A. is zero
B. increases linearly with *r*

**C.** increases as  $r^2$  **D.** decreases as (1/r)

- **41.** A parallel plate capacitor with a glass slab (with dielectric constant *k*) in between the conducting plates is charged to a potential *V*. If now the connecting wires are disconnected and then the glass slab is removed, the potential difference between the plates will be
  - **A.** V **B.** kV **C.** V/k **D.** Zero
- **42.** If the ratio of the diameters of two wires made of the same material and having the same length is 1:2, the ratio of their electrical resistivities is

**A.** 1:4 **B.** 1:2 **C.**1:1 **D.** 1: $\sqrt{2}$ 

- **43.** The sum of all two digit natural numbers which leave a remainder 5 when they are divided by 7 is equal to
  - **A.** 715 **B.** 702 **C.** 615 **D.** 602
- **44.** The number of positive integers less than 40,000 that can be formed by using all the digits 1,2,3,4 and 5 is equal to
- **A.** 24 **B.** 78 **C.** 32 **D.** 216 **45.** If  $1, \omega, \omega^2$  are the cube roots of unity and if

 $\begin{bmatrix} 1+\omega & 2\omega \\ -2\omega & -b \end{bmatrix} + \begin{bmatrix} a & -\omega \\ 3\omega & 2 \end{bmatrix} = \begin{bmatrix} 0 & \omega \\ \omega & 1 \end{bmatrix}$ , then  $a^2 + b^2$  is equal to **A.**  $1+\omega^2$  **B.**  $(1+\omega)^2$  **C.**  $1+\omega$  **D.**  $\omega^2 - 1$ 

- **46.** If the three linear equations x + 4ay + az = 0, x + 3by + bz = 0, x + 2cy + cz = 0have a non-trivial solution, where  $a \neq 0, b \neq 0, c \neq 0$ , then ab + bc is equal to
- **A.** 2ac **B.** -2ac **C.** ac **D.** -ac **47.** If  $\cos^{-1}(\frac{5}{13}) - \sin^{-1}(\frac{12}{13}) = \cos^{-1}x$ , then x is equal to **A.** 1 **B.** 0 **C.**  $\frac{1}{\sqrt{2}}$  **D.**  $\frac{\sqrt{3}}{2}$

**48.** If the position vectors of three consecutive vertices of a parallelogram are  $\hat{i} + \hat{j} + \hat{k}$ ,  $\hat{i} + 3\hat{j} + 5\hat{k}$  and  $7\hat{i} + 9\hat{j} + 11\hat{k}$ , then the co-ordinates of the fourth vertices are

- **A.** (2,1,3) **B.** (8,8,8) **C.** (6,7,8) **D.** (7,7,7)
- **49.** If  $f: R \to R$  and  $g: R \to R$  are defined by f(x) = x 3 and  $g(x) = x^2 + 1$  then the values of x for which g(f(x)) = 10 are
- **A.** 0, -6 **B.** 2,-2 **C.** 1,-1 **D.** 0,6 **50.** If  $f(x) = \begin{cases} k-2x, & \text{if } x \le -1 \\ 2x+3, & \text{if } x > -1 \end{cases}$  has a local minimum at x = -1, then a possible value of k is equal to:
  - **A.** −1/2 **B.** −1 **C.** 1 **D.** 0
- **51.** If two tangents drawn from a point P to the parabola  $y^2 = 4x$  are at right angles, then the locus of P is:

**A.** x = -1 **B.** 2x - 1 = 0 **C.** x = 1 **D.** 2x + 1 = 0

**52.** The area bounded by the curves  $y = \sin x$  and  $y = \cos x$  between the ordinates x = 0 and  $x = 3\pi/2$  is:

- **A.**  $4\sqrt{2} 1$  **B.**  $4\sqrt{2} + 1$  **C.**  $4\sqrt{2} 2$  **D.**  $4\sqrt{2} + 2$
- **53.** The family of curves  $y = e^{a \sin x}$ , where *a* is an arbitrary constant, is represented by the differential equation
  - A.  $\log y = \tan x \frac{dy}{dx}$ B.  $y \log y = \tan x \frac{dy}{dx}$ C.  $y \log y = \sin x \frac{dy}{dx}$ D.  $\log y = \cos x \frac{dy}{dx}$

**54.** The solution of the differential equation  $\frac{dy}{dx} + 1 = e^{x+y}$  is

**A.** 
$$e^{x+y} + x = C$$
  
**B.**  $x - e^{x+y} = C$   
**C.**  $x - e^{-(x+y)} = C$   
**D.**  $x + e^{-(x+y)} = C$ 

**55.** Let  $f(x) = \frac{ax^2}{(x+1)}$ ,  $x \neq -1$ . The value of  $\alpha$  for which f(a) = a,  $(a \neq 0)$  is

**A.** 
$$1 - \frac{1}{a}$$
 **B.**  $1 + \frac{1}{a}$  **C.**  $\frac{1}{a}$  **D.**  $\frac{1}{a} - 1$ 

- **56.** Let  $A = \{x, y, z\}$  and  $B = \{a, b, c, d\}$ . Which one of the following is not a relation from A to B?
  - A.  $\{(x, a), (x, c)\}$ B.  $\{(y, d), (y, c)\}$ C.  $\{(z, a), (z, d)\}$ D.  $\{(z, b), (y, b), (a, d)\}$

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57. If (x + iy)^{1/3} = 2 + 3i, then 3x + 2y is equal to
                                            C. -120
       A. -20
                        B. -60
                                                           D. 60
58. What is the output of the following program
         void main()
                  {
                   int a=10,b=20; char x=1,y=0;
                  if(a,b,x,y)
                            {
                             printf("EXAM");
                            }
                  }
   A. EXAM is printed
                             B. exam is printed
                                                   C. Compiler Error D. Nothing is printed
59. What is the output of the following program
```

#include<stdio.h>

```
int main()
              {
               int a=0;
               #if (a==0)
                     printf("Equal");
                #else if
                     printf("Not equal");
               #endif
              return 0;
              }
                                           C. Null
       A. Equal
                     B. Not equal
                                                         D. Compilation error
60. What will be output if you execute following c code?
   #include<stdio.h>
   int main(){
  for(;NULL;)
       printf("cquestionbank");
       return 0;
       }
   A. c
              B. bank
                            C. cquestionbank
                                                  D. Compilation error
61. Array passed as an argument to a function is interpreted as
       A. Address of the array
                                           B. Values of the first elements of the array
       C. Address of the first element of the array D. Number of element of the array
62. Which of the following is the correct way of declaring a float pointer:
```

**63.** Consider a linked list implemented of a queue with two pointers: front and rear. What is the time needed to insert element in a queue of length of n?

**C.** \*float ptr;

**D.** None of the above

**A.** float ptr;

**B.** float \*ptr;

Α.	O(log2n)	<b>B.</b> O(n).	<b>C.</b> O(1).	<b>D.</b> O(n log2n).
<b>64.</b> W	hat does XML s <b>A.</b> eXtra Mod	tand for? ern Link	<b>B.</b> eXtensible Marku	p Language
	<b>C.</b> Example Ma	arkup Language	D. X-Markup Langua	ge
<b>65.</b> W	hich of the follo	owing languages is a su	bset of C++ language	?
	A. Clanguage	e <b>B.</b> Java Langu	age <b>C.</b> C# langua	ge <b>D.</b> B language
<b>66.</b> W	hat does STL st	and for?		
	A. Simple Ten C. Static Type	nplate Library <b>B.</b> Star Library <b>D.</b> Sing	ndard Template Librar gle Type-based Library	ТУ /
<b>67.</b> If 2	X is the name o	f the class, what is the	correct way to declar	e copy constructor of X?
	<b>A.</b> X(X arg)	<b>B.</b> X(X* arg) <b>C.</b> X(co	onst X* arg) D. X(	const X& arg)
<b>68.</b> W	hich of these is	a correct format of IP	address?	
	<b>A.</b> 192.168.1.	1 <b>B.</b> 192.168.111.12	<b>C.</b> 192.168.90	<b>D</b> . 192.900.168.1
<b>69.</b> W	hat Does BIOS	Stand For?		
	A. Better Inte	grated Operating Syste	em <b>B.</b> Basic Input Ou	tput System

C. Battery Integrated Operating Setup D. Backup Input Output System

70. The term 'Pentium' is related to what?

A. Mouse B. Hard Disk C. Microprocessor D. DVD

71. A Pixel is

- A. A computer program that draws picture **B.** A picture stored in secondary memory
- C. The smallest resolvable part of a picture **D**. None of these
- **72.** If you have a PowerPoint show you created and want to send using email to another teacher you can add the show to your email message as a (an)

A. Inclusion B. Attachment C. Reply D. Forward

73. A stone dropped from a cliff has fallen 20m. Its velocity is

A. 10m/s B. 196 m/s C. 20 m/s D. 392 m/s

74. In which of the flowing examples is the motion of the car is not accelerated

- A. A car turns corner a at the constant velocity of 20 km/h
- **B.** A car that climbs steep hill at constant speed of 20 km/h
- C. A car that climbs steep hill whose velocity is dropping from 60 km/h to 20km/h
- **D.** A car that climbs the steep hill with constant speed goes over the top and come down at the other end with same velocity.

75. According to Lenz's law an induced current

- **A.** Give raise to a magnetic field of its own that opposes the flux change that created it
- **B.** Give raise to a magnetic field of its own that reinforces the flux change that created it
- C. Appears when a wire moves parallel to a magnetic field
- **D.** Appears when a wire moves perpendicular to a magnetic field

**76.** Electric field at a point is equal in magnitude to

- **A.** Number of electric field lines there
- **B.** The electric charge there
- **C.** The force that charge of 1C would experience there
- **D.** The force that an electron would experience there
- **77.** Neglecting earth's magnetic field, the direction of magnetic field below a power cable in which current is flowing north is

A. North B. South C. East D. West

**78.** The farad is not equivalent to which of the following combinations of units

**A.**
$$C^2/J$$
 **B.**  $C/V$  **C.**  $CV^2$  **D.**  $J/V$ 

**79.** A resistance R connected to a battery dissipates energy at the rate P. If another resistor is connected in parallel with R, the power dissipated by R

A.Less than P B. P C. More than P

**D.** Any of the above depending on the value of resistance

**80.** Heat flows through a slab of some material at a rate that depends on which of the following

A.The thickness of the slab
B.The area of the slab
C.The specific heat capacity of the slab material
D.The temperature difference between faces of the slab

- **81.** A heat engine takes in heat at one temperature and turns
  - **A.** All into work
  - **B.** Some into work and rejects the rest at a lower temperature
  - **C.** Some into work and rejects the rest at same temperature
  - **D.** Some into work and rejects the rest at a higher temperature

82.	. The volume of a gas increased while its temperature is held constant. The	ne gas exerts	а
	lower pressure on the walls of its container partly because its molecule s	strikes the wa	alls

A. Less often	B. With lower velocities
C. With less energy	<b>D.</b> With less force

**83.** The cell voltage for the cell Pt, H<sup>2</sup>/H<sup>+</sup>(0.01M)//H<sup>+</sup>(1M)/H<sup>2</sup>, Pt is 76.8 mV. Suppose the 0.05 molar solution of hydrogen ion is replaced by a solution of 0.0025 molar hydrogen ion solution, then the cell voltage would be

A. 38.4 mVB. 153.6 mVC. 76.8 mVD. 1536 mV

84. The half life period of a first order reaction is 2.4 min. This reaction will be 90% complete in
A. 4.8 min
B. 80 min
C. 16 min
D. 8 min

**85.** If 10<sup>-4</sup> dm<sup>3</sup> of water is introduced into a 1.0 dm<sup>3</sup> flask at 300K, how many moles of water are in the vapour phase when equilibrium is established.

- (Given: Vapour pressure of H<sub>2</sub>O at 300K is 3170Pa; R = 8.314 JK<sup>-1</sup>mol<sup>-1</sup>) **A.** 5.56 x 10<sup>-3</sup> mol **B.** 1.53 x 10<sup>-2</sup> mol **C.** 4.46 x 10<sup>-2</sup> mol **D.** 1.27 x 10<sup>-3</sup> mol
- **86.** What is the solubility of  $Al(OH)_3$  in a solution having pH of 4.0.

(	Given: solubility pro	duct, K <sub>sp</sub> , of A	Al(OH) <sub>3</sub> = 1 x 10 <sup>-33</sup>	)
				/

<b>A.</b> 10 <sup>-3</sup> M	<b>B.</b> 10 <sup>-6</sup> M	<b>C.</b> 10 <sup>-4</sup> M	<b>D.</b> 10 <sup>-10</sup> M

**87.** When 100 ml of 0.4 M CH3COOH is mixed with 100 ml of 0.2M NaOH, the pH of the buffer solution will be about

**A.** 4.74 **B.** 5.14 **C.** 5.44 **D.** 5.05

**88.** An electrolytic cell contains a solution of  $Ag_2SO_4$  and has Pt electrodes. A current is passed till 1.6 g of  $O_2$  has been liberated at anode. The amount of silver deposited at cathode will be

**A.** 107.88g **B.** 1.6g **C.** 0.8g **D.** 21.6g

**89.** Under the same reaction conditions, initial concentration of 1.386 mol dm<sup>-3</sup> of a substance becomes half in 40 seconds and 20 seconds through first order and zero order kinetics respectively. Ratio  $(k_1/k_0)$  of the rate constants for first order  $(k_1)$  and zero order  $(k_0)$  of the reaction is

**A.**  $0.5 \text{ mol dm}^{-3}$  **B.**  $1.0 \text{ mol dm}^{-3}$  **C.**  $1.5 \text{ mol dm}^{-3}$  **D.**  $2.0 \text{ mol dm}^{-3}$ 

**90.** The time required to deposit 2g copper from copper sulphtae solution by passing a current of 0.5 ampere is approximately

A. 12157 sec B. 102 sec C. 510 sec D. 642

**91.** The molar heat capacity of Al is 27 J mol<sup>-1</sup>K<sup>-1</sup>. The heat absorbed by Al sheet of 6 kg mass placed in sun which shows increase in its temperature from 25°C to 45°C is

<b>A.</b> 60 kJ <b>B.</b> 120 kJ <b>C.</b> 240 kJ <b>D.</b> 392.4
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92. pH of a solution is increased from 3 to 6. Its H+ ion concentration will be

- A. reduced to half B. doubled C. reduced by 1000 times
- **D.** increased by 1000 times



# The Fantasy of graphene

For the invention of the new material **graphene** The Nobel Prize in Physics 2010 have been given to **Andre K. Geim** and **Konstantin S. Novoselov**, both at the University of Manchester, UK. It is predicted that the graphene based technology is going to replace almost all existing technologies and is called the wonder material of the future.

- **93.** Given below are some true and some false statements. Choose the correct answers.
  - a. Both Graphite and Graphene are the same.
  - b. Graphene is nothing to do with graphite.
  - c. fullerenes and graphene are nano particles.

d. the thickness (not diameter) of the so called carbon nanotube and and graphene are the same .

e. Graphene is a silicon based material.

f. Graphene, fullerenes, graphite and diamond are allotropic forms of carbon.

- A. Statements a,d and f are true. B. Statements b,c,e and f are false
- **C.** Statements c,d,and f are true. **D.** Statement 'e' is true
- 94. Which of the following is/are greenhouse gases?
  - **A.** Hydrofluoro carbons, Methane and Carbon Monoxide
  - B. Perfluoro carbons, Sulfur Hexa Fluoride and Sulfur Dioxide
  - C. Sulfur Hexafluoride, Perfluro Carbons, Carbon Dioxide, Methane and Nitrous Oxide
  - **D.** Sulfur Dioxide, Methane, Carbon Dioxide, Hydrogen Sulphide
  - E. Carbon Dioxide alone
- **95.** Keeping of all the solid waste in sealed trenches or concrete tanks preventing seepage is called .....
  - A. Safe solid disposal
  - B. open landfill
  - **C.** sanitary land fill
  - **D.** incineration
  - E. none of the above

96. Match the following and select the correct combination from choices given

- 1. Adaptive radiation 5. Homology
- 2. Convergent evolution 6. analogy
- 3. Divergent evolution 7. Dark-winged moth
- 4. Industrial Evolution 8. Finches of Galapagos island

**A.**1-8, 2-6, 3-5, 4-7 **B.** 1-5, 2-6, 3-7, 4-8 **C.** 1-2, 2-1, 3-8, 4-7

**D.** 1-8, 2-7, 3-3, 4-1 **E.** 1-8, 2-5, 3-7, 4-8

97. The five factors that can affect Hardy-Weinberg equilibrium include

- A. Gene flow, genetic drift, mutation, genetic recombination and natural selection
- **B.** migration, mutation, evolution, genetic drift and genetic recombination
- **C.** Gene flow, migration, genetic drift, evolution and genetic recombination
- **D.** genetic drift, evolution, mutation, gene flow and genetic recombination
- E. Genetic recombination, genetic drift, evolution, migration and mutation
- **98.** Specific proteins formed in virus infected cells that sensitize neighboring cells against spread of viral infection is .....

A. Anti-Virion B. interferon C. Co-feron D. Immunoferon E. Interleukin

99. Match the following and select the correct combination from choices given

1.	Biolistics	5. Gel electrophoresis
2.	Ti plasmid	6. Restriction endonuclease
3.	Palindrome	7. Cloning vector
4.	separation of genes	8. High velocity micro-particles

**A.** 1-8, 2-7, 3-6, 4-1 **B.**1-8, 2-7, 3-5, 4-6 **C.**1-5, 2-6, 3-7, 4-8 **D.** 1-7, 2-8, 3-6, 4-5 **E.** 1-6, 2-5, 3-8, 4-7

- **100.** The basic difference in growth between living and nonliving is .....
  - A. Only the living grows but nonliving does not grow
  - B. Growth is diffused in the living but localized in the nonliving
  - C. Growth by apposition in the living but by intussusceptions in the nonliving
  - D. Growth by intussusceptions in the living and by apposition in the nonliving
  - E. Growth by accretion in the living and apposition in the nonliving

- **101.** Study the statements related to soil nitrification and say which is false
  - A. High percentage of organic matter in soils depresses nitrification
  - B. Neutral soil reaction favours Nitrification
  - **C.** Addition of phosphorus depresses nitrification
  - D. Good aeration favours nitrification
  - **E.** Optimum temperature for nitrification is 37°C

### Popular belief and the Nano Wonder land

Nanotechnology R&D is directed toward understanding and creating improved materials, devices, and systems that exploit the unique properties of nano particles. With lots of expectation ~10 yrs ago the nanotechnology emerged in USA. However, nanotechnology is not quite as fashionable as it was five or six years ago. The nanotechnology did not develop quite as fast as anticipated. Many firms in US have closed down. And commercial development of the technology has long way to go. So far, it failed to generate nano tech related jobs or products.

**102.** Choose the correct option with the recently marked nano-car(TATA)

A.Nano based technology is used for fuel efficiency

**B.**Nano based technology is used in break system

C. Nano based technology is used in Engine system

D. Nano based technology is used for Pollution control E. None of the above

## **103.** In nano umbrella

- A. Nano technology prevents UV radiation
- B. Nano technology prevents diffusion of water through cloth
- **C.** The size of the umbrella is in the nano range. **D.**None of the above
- **104.** Choose the correct combination
  - i. There are several nanotechnology related drugs marketed by Pfizer
  - ii. Most of the synthetic nanoparticles are biologically hazard
  - iii. Nanotechnology has been used extensively in medical sciences
  - iv. The size of the Virus is in the nano range
    - **A.** ii and iv are correct B. i and iii are correct
      - **C.** ii and iii are correct **D.** iii and iv are correct.

## **Biological manipulations**

Genetically modified food is one of the applications of genetic engineering which involve the manipulation of gene. However the people in the west are not encouraging this technology not only due to religious sentiments but of potential health hazard. However India has become a hub for all experiments related to this technology.

105. Genetic modification is done on

A.Nucleic acid Sugar partC.Nucleoside

**B.**Nucleotide**D.**Nucleic acid Base

- 106.An example of genetically modified species isA.IR-8 rice varietyB.Golden riceC.TxD coconutD.DxT coconut
- 107. Genetically modified species can be analyzed with
   A.DNA finger print technology
   C.Amino acid sequence
   D.Simple microscope

### The Bread and Beer - A cultural disaster

The production and consumption of alcohol is one of the oldest (5000 BC) practices of human civilization (Indus valley civilization in India). From the earlier "bread and beer" practice, now it has became a social disaster in Kerala. A dependency of alcohol causes life shattering addiction that leads not only to physical illness, social boycott, but also demoralizing erosions of self esteem.

Fermentation is a process used to produce alcoholic beverages such as wine, beer etc. Methanol is not at all produced in this process. Spurious alcohols contain methanol and which is fatal in high concentration and leads to blindness in low concentration. The acid produced from methanol is responsible for the damage of retina.

### **108.** Identify the correct statement

- a. Fermentation can be carried out under air.
- b. Fermentation can be carried out under nitrogen atmosphere
- c. Fermentation can be carried out only in closed container.
- d. A carbohydrate is not necessary for the production of ethyl alcohol.

A. a only B. a and c C. c only D. b and c

**109.** The acid obtained from methanol is

#### A.Acetic acid

C.Butanoic acid

**B.**Propionic acid

**D.**None of the above.



**110.** Methanol is not formed during fermentation. Choose the correct answer.

- a. It is a non enzymatic process
- b. It is an enzymatic process
- c. Microbial process

d. Lack of one and two carbon source in the carbohydrate.

**C.** d only

A. a and b

**B.** a and c

**D.** b and c

PART B

#### **Subjective Questions** (Total marks 90)

**QNo I.** In 1896, Waco, Texas, William Crush of the "Katy" railroad parked two locomotives at opposite ends of a 6.4km track, fired them up, tied their throttles open, and then allowed them to crash head-on at full speed (crash site after crash shown in fig), in front of 30,000 spectators. Hundreds of people were hurt by flying debris; several

were killed. Assuming the weight of each locomotive was  $1.2 \times 10^{\circ}$  N and its acceleration

prior to the collision was a constant 0.26m/s, the total kinetic energy of the two locomotives just before the collision can be found out using equations of motion

The speed v can be found using  $v^2 = u^2+2a(x-x_0)$ But  $v_0 = 0$  and  $x-x_0 = 3.2x10^3$  m (half the initial separation), so we can get  $v^2=0+2x0.26m/s^2x3.2x10^3m$ Hence v=40.8 m/s To find mass we can divide the weight by g M=1.2 x 10<sup>6</sup>/9. 8=1.22x10<sup>5</sup>Kg Now using KE=(1/2)mv<sup>2</sup>, we can calculate Total KE = 2x1.22x10<sup>5</sup>x40.8<sup>2</sup> = 2.0x10<sup>8</sup>J

- I. Now using the above equations find the acceleration required to get a final velocity 80 m/s (other parameters same as above)
- II. What would be the kinetic energy if the weights of the locomotives were just half(other parameters same as above)
- III. What would have happened if the track length was increased to 10 kms. (other parameters same as above) (Marks = 3+3+4)

**QNo.II.** A uniform charged solid sphere of radius **R** has a volume charge density  $\mathbf{p}$ . It has a spherical cavity of radius **r** and the centers of the sphere and the cavity are separated by a distance **d**. Find out the electric field in the cavity.

**QNO.III.** A particle moves in a circular orbit under the action of a central force. Show that its angular momentum is conserved.

**QNO.IV.** Find all the possible values of the total angular momentum quantum number (J) for two electrons with  $I_{1=} 1$  and  $I_2=2$ , under LS coupling scheme.

**QNo.V.** If the area of the triangle formed by the points z, iz and z + iz is 50 square units, then find the value of |z|.

**QNO.VI.** If  $e_1$  is the eccentricity of the ellipse  $\frac{x^2}{16} + \frac{y^2}{7} = 1$  and  $e_2$  is the eccentricity of the hyperbola  $\frac{x^2}{9} - \frac{y^2}{7} = 1$ , then evaluate  $e_1 + e_2$ .

**QNO.VII.** A ball is dropped from a feet above a flat surface. Each time the ball hits the ground after falling a distance h it rebounds a distance rh, where r is a positive fraction less than one. Find the total distance the ball travels.

**QNO.VIII.** Evaluate the integral  $\int \frac{\sin\theta \, d\theta}{\cos^2\theta - 5\cos\theta + 4}$ .

**QNO.IX.** A particle projected vertically upward with a speed of *a* ft/sec reaches an elevation  $s = at -16t^2$  ft at the end of *t* sec. What must the initial velocity be in order for the particle to travel 49 ft upward before it starts coming back down?

# Dissolving Kidney Stone

Oxalic acid is a dicarboxylic acids and is a reducing agent. The oxalate ion is a very strong chelating agent also. Around 80% of the urinary stones formed in human are calcium oxalate, a poorly soluble salt. The major inhibitor of the formation of Calcium oxalate stone is citrate. It is recommended that patients suffering from kidney stones should cut down the consumption of fruits such as strawberries, apples, blueberry etc, which contain vit.C(ascorbic acid.) and consume fruits which contain citric acid.

Acids	pKa values
Oxalic acid	1.23, 3.83
Citric acid	3.09, 4.75, 6.41
Vitamin C	4.1

**QNO.IX.** i. Based on the provided 1<sup>st</sup> pKa values arrange the acids in the increasing order of acidity

ii. Identify and write the name of the molecules just below of the molecule.



iii. Draw the structures of (a) oxidized product of oxalic acid (b) calcium salt of oxalic acid (c) calcium salt of citric acid.

iv. Write down the hydrolysed product f vitamin C which is expected to give a decreased pKa value

v. Identify the optically active compound and give the structure of all optical isomers(enantiomers and diastereomers)

**QNo.XI.** For the reaction

 $C_2H_5I + OH^- \rightarrow C_2H_5OH + I^-$ 

k = 5.03 x 10-2  $M^{-1}$ sec<sup>-1</sup> at 298 K and k = 6.71  $M^{-1}$ sec<sup>-1</sup> at 333 K. What is the activation energy of the reaction? What is the rate constant at 305 K?

**QNo.XII.** In a container of constant volume at a particular temperature N2 and H2 are mied in the molar ratio of 913. The following two equilibrium are found to be coexisting in the container.

 $\begin{array}{l} N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g) \\ N_2(g) + 2H_2(g) \leftrightarrow N_2H_4(g) \end{array}$ 

The total equilibirium pressure is found to be 3.5 atm while partial pressure of  $NH_3$  (g) and  $H_2$  (g) are 0.5 atm and 1 atm respectively. Calculate equilibrium constant of the above two reactions

**QNo.XIII.** A thermally isolated vessel contains 100g of water at 0°C. When air above the water is pumped out, some of the water freezes and some evapourates at 0°C itself. Calculate the mass of the ice formed such that no water is left in the vessel. Latent heat of vapourization of water at 0°C =  $2.10 \times 10^6$  j/kg and latent heat of fusion of ice =  $3.36 \times 10^5$  j/kg

The Question Ends.

Space for rough work