Techior Solutions Pvt. Ltd.

MHTCET PCM Sample Paper

Total Time: 3 Hr | Total Marks: 200.0

Physics

1) A ray of light undergoes deviation of 30° when incident on an equivalent prism of refractive index $\sqrt{2}$. The angle made by the ray inside the prism with the base of the prism is **1**

A) 15°
B) 0°
C) 45°
D) 30°

2) The distance between an object and its image in a plane mirror is: **1**

A) Twice the distance of the object from the mirror
B) Equal to the distance of the object from the mirror
C) Half the distance of the object from the mirror
D) The same as the distance of the object from the mirror plus the distance of the image from the mirror

3) An aeroplane flying 490 m above ground level at 100 m/s, releases a block. How far on ground will it strike **1**

A) 0.1 km
B) 1 km
C) 2 km
D) None

4) What is the magnitude of a unit vector? **1**

A) It has no magnitude
B) Zero
C) Constant but not zero
D) Unity

5) In a uniform electric field, a charge of 3 C experiences a force of 3000 N. The potential difference between two points 1 cm apart along the electric lines of force will be **1**

A) 10 V
B) 3 V
C) 0.1 V
D) 20 V

6) In a U-tube the radii of two columns are respectively r_1 and r_2. When a liquid of density $\rho\,(\theta = 0^o)$ is filled in it, a level difference of h is observed on two arms, then the surface tension of the liquid is **1**

A) $\frac{\rho g h r_1 r_2}{2(r_2 - r_1)}$

B) $h \rho g (r_2 - r_1)$

C) $\frac{h \rho g (r_2 - r_1)}{2}$

D) $\frac{h \rho g}{2(r_2 - r_1)}$

7) Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Lengths of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperatures, which one of the following relations holds good? **1**

A) $\alpha_1^2 l_2 = \alpha_2^2 l_1$

B) $\alpha_1 l_1 = \alpha_2 l_2$

C) $\alpha_1 l_2 = \alpha_2 l_1$

D) $\alpha_1 l_2^2 = \alpha_2 l_1^2$

8) Two wires, one made of copper and other of steel are joined end to end. (as shown in figure). The area of cross-section of copper wire is twice that of steel wire. **1**

They are placed under compressive force of magnitudes F. The ratio of their lengths such that change in lengths of both wires are same is:

$(Y_S = 2\times10^{11}\ N/m^2$ and $Y_C = 1.1\times10^{11}\ N/m^2)$

A) 2.1

B) 1.1

C) 1.2

D) 2

9) Which of the following forces should typically be included in a free body diagram? **1**

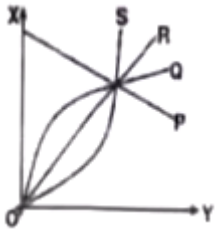
A) Only the forces applied by the object

B) Only external forces acting on the object

C) All forces acting on the object

D) Only gravitational force

10) Which of the graph correctly represent forwards bias characteristic of diode ? **1**



A) P
B) Q
C) R
D) S

11) The ratio of the radii of gyration of a circular disc and a circular ring of the same radii about a tangential axis in the plane is: **1**

A) 1 : 2
B) $\sqrt{5}:\sqrt{6}$
C) 2 : 3
D) 2 : 1

12) If a rolling object has a higher moment of inertia, what effect does it have on its rolling motion? **1**

A) It will roll faster
B) It will roll slower
C) It will not roll at all
D) It will have no effect

13) A sphere has a mass 10 kg and radius 1m. What is radius of gyration of a sphere about its tangent? **1**

A) 1.18 m
B) 11.8 m
C) 0.118 m
D) 0.0118 m

14) A wire has resistance $12\,\Omega$. It is bent in the form of a circle. The effective resistance between the two points on any diameter is equal to **1**

A) 12 ohm
B) 6 ohm
C) 3 ohm
D) 24 ohm

15) Two point charges $+4\mu C$ and $+2\mu C$ repel each other with a force of 8 N. If a charge of $-4\mu C$ is added to each of these charges, the force would be **1**

A) zero

B) 4 N

C) 8 N

D) 12 N

16) A narrow slit of width w mm is illuminated by monochromatic light of wavelength 500 nm. The distance between the first minima on either side on a screen at a distance of 1 m is **1**

A) 5 mm

B) 0.5 mm

C) 1 mm

D) 10 mm

17) A diatomic ideal gas is used in a car engine as the working substance. If during the adiabatic expansion part of the cycle, volume of the gas increases from V to 32 V, the efficiency of the engine is **1**

A) 0.5

B) 0.75

C) 0.99

D) 0.25

18) The ratio of minimum wavelength of Lyman and Balmer series will be **1**

A) 10

B) 5

C) 0.25

D) 1.25

19) When the period of oscillation of a body executing simple harmonic motion is doubled. Its energy becomes **1**

A) double

B) one fourth

C) half

D) four times

20) The temperature of sink of a Carnot engine is 27°C. If the efficiency of engine be 25%, then the temperature of source must be **1**

A) 27°C

B) 127°C

C) 227°C

D) 327°C

21) In an adiabatic change, the pressure and temperature of a monatomic gas are related as $P \propto T^c$, where c equals **1**

A) $\frac{2}{5}$

B) $\frac{5}{2}$

C) $\frac{3}{5}$

D) $\frac{5}{3}$

22) If R is the radius of the dics and B the magnitude of the magnetic field induction in which positive charges (q) of mass m escape from the cyclotron, then their maximum speed v_{max} is **1**

A) $\frac{qR}{Bm}$

B) $\frac{qm}{BR}$

C) $\frac{qBR}{m}$

D) $\frac{m}{qBR}$

23) What is the primary function of an electric generator? **1**

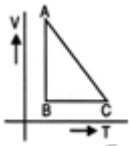
A) To convert mechanical energy into electrical energy

B) To convert electrical energy into mechanical energy

C) To store electrical energy

D) To increase electrical resistance

24) One mole of an ideal gas is taken from A to B, from B to C and then back to A. The variation of its volume with temperature for that change is as shown. Its pressure at A is P_0, volume is V_0. Then, the internal energy **1**



A) at A and B are equal

B) at A is more than at B

C) at C is less than at B

D) at B is more than at A

25) The law of conservation of angular momentum is obtained from Newton's II law in rotational motion when **1**

A) External torque is maximum

B) External torque is minimum

C) External torque is zero

D) External torque is constant

26) If two waves represented by $y_1 = 4 \sin \omega t$ and $y_2 = 3 \sin (\omega t + \pi/3)$ interfere at a point, the amplitude of the resulting wave will be about **1**

A) 7 units

B) 6 units

C) 5 units

D) 3.5 units

27) The fundamental frequency of a vibrating string is also known as: **1**

A) First overtone

B) Second harmonic

C) First harmonic

D) Third harmonic

28) What fraction of K.E. of rolling circular disc is translational? **1**

A) 3/2

B) 2/3

C) 1/2

D) 2

29) The total KE of all the molecules of helium having a volume V exerting a pressure P is 1500 J. The total KE in joules of all the molecules of N_2 having the same volume V and exerting a pressure 2P is **1**

A) 3000

B) 4000

C) 5000

D) 6000

30) A metal emits no electrons if the incident light energy falls below certain threshold. For photo-emission, you would decrease **1**

A) the intensity of light

B) the frequency of light

C) the wavelength of light

D) the collector potential

31) A monoatomic gas $(\gamma = 5/3)$ is suddenly compressed to 1/8 of its original volume adiabatically, then the pressure of the gas will change to **1**

A) $\frac{24}{5}$

B) 8

C) $\frac{40}{3}$

D) 32 times its initial pressure

32) In the propagation of electromagnetic waves the angle between the direction of propagation and plane Polaroid after polarization would be **1**

A) 0 °

B) 45 °

C) 90 °

D) 180 °

33) The energy equivalent to 1 mg of matter in MeV is **1**

A) 56.25 x 10^{22}

B) 56.25 x 10^{24}

C) 56.25 x 10^{26}

D) 56.25x 10^{28}

34) 1 poise = _____ Ns/m^2. Fill in the blanks. **1**

A) 0.01

B) 0.1

C) 1

D) 10

35) The angle of incidence for total internal reflection is always: **1**

A) Less than the critical angle

B) Equal to the critical angle

C) Greater than the critical angle

D) Zero

36) A potentiometer wire is supplied a constant voltage is 3 V. A cell of emf 1.08 V is balanced by the voltage drop across 216 cm of the wire. Find the total length of the potentiometer wire **1**

A) 300 cm

B) 400 cm

C) 600 cm

D) 500 cm

37) The period of a particle executing SHM is 8 s. At t = 0 it is at the mean position. The ratio of the distances covered by the particle in the 1st second to the 2nd second is **1**

A) $\sqrt{2}:1$

B) $\frac{1}{\sqrt{2}+1}$

C) $\sqrt{2}$

D) $\frac{1}{\sqrt{2}}$

38) Which is only vector quantity from the following ? **1**

A) current flowing in a metallic conductor

B) electrostatic potential

C) charge on a capacitor

D) magnetic induction

39) The temperature coefficient of resistance for a wire is 0.00125/°C. At 300*K* its resistance is 1 *ohm* . The temperature at which the resistance becomes 2 *ohm* is **1**

A) 1154 K

B) 1100 K

C) 1400 K

D) 1127 K

40) A particle of mass M at rest decays into two particles of masses m_1 and m_2, having non-zero velocities. The ratio of the de-Broglie wavelengths of the particles, λ_1 / λ_2, is **1**

A) m_1/m_2

B) m_2/m_1

C) 1.0

D) $\sqrt{m_2} / \sqrt{m_1}$

41) In a diffraction grating, if the number of lines per centimeter is increased, the angular width of each diffraction maximum: **1**

A) Increases

B) Decreases

C) Remains constant

D) Becomes zero

42) The latent heat of vaporisation of water is 2240 *J/gm.* If the work done in the process of expansion of 1 *g* is 168 *J*, then increase in internal energy is **1**

A) 2408 *J*

B) 2240 *J*

C) 2072 *J*

D) 1904 *J*

43) Eight spherical rain drops of equal size are falling vertically through air with a terminal velocity of 0.1 m s^{-1} . What should be the velocity if these drops were to combine to form a large spherical drop? **1**

A) 0.4 ms^{-1}

B) 0.3 ms^{-1}

C) 0.2 ms^{-1}

D) 0.1 ms^{-1}

44) What unit is current measured in when using an ammeter? **1**

A) Volts

B) Ohms

C) Amperes

D) Watts

45) A charge of 6.75 microcoulomb in an electric field is acted upon by a force of 2.5 N. The potential gradient at this point is **1**

A) 3.71×10^{10} V/m

B) 3.71×10^{5} V/m

C) 3.71×10^{6} V/m

D) 3.71×10^{12} V/m

46) Two coherent sources of intensity ratio 1: 4 produce an interference pattern. The fringe visibility will be **1**

A) 1

B) 0.8

C) 0.4

D) 0.6

47) A capacitor of plate separation 0.02 mm is completely filled with a dielectric material of strength 20 kV/mm. The maximum voltage rating of the capacitor is **1**

A) 100 V

B) 200 V

C) 400 V

D) 800 V

48) The momentum of photon having frequency 1.5×10^{13} Hz is **1**

A) 3.3×10^{-29} kg ms^{-1}

B) 3.3×10^{-34} kg ms^{-1}

C) 6.6×10^{-34} kg m s^{-1}

D) 6.6×10^{-30} kg m s^{-1}

49) The self inductance of a inductor coil having 100 turns is 20 mH. The magnetic flux through the cross-section of the coil corresponding to a current of 4 mA is **1**

A) 2×10^{-5}Wb

B) 4×10^{-7}Wb

C) 8×10^{-3}Wb

D) 8×10^{-5}Wb

50) When a γ-ray photon is emitted by an unstable nucleus, **1**

A) Z increases

B) Z decreases

C) A increases

D) Z and A remain the same

Chemistry

1) What is the energy of the Lyman series transitions related to? **1**

A) Transitions from n=1 to higher levels
B) Transitions from n=2 to higher levels
C) Transitions from n=3 to higher levels
D) Transitions from higher levels to n=1

2) Which of the following species is the least stable **1**

A) O_2
B) O_2^{-2}
C) O_2^{+1}
D) O_2^{-1}

3) The unimolecular elimination involves formation of_____ **1**

A) A free radical
B) A carbanion
C) A carbocation
D) A biradical

4) Silicon (IV) oxide which is found in mineral quartz is very similar to **1**

A) graphite
B) diamond
C) iron
D) copper

5) Sodium nitroprusside when added to an alkaline solution of sulphide ions produces **1**

A) Red colouration
B) Blue colouration
C) Brown colouration
D) Violet colouration

6) The Williamson synthesis involves_____ **1**

A) SN_1 displacement
B) A nucleophilic addition
C) An electrophilic substitution
D) SN_2 displacement

7) If 1 ML of water contains 20 drops, the number of molecules in a drop of water is **1**

A) 6.023×10^{23}
B) 1.376×10^{26}
C) 1.673×10^{21}
D) 4.346×10^{20}

8) Select the correct statement **1**

A) Molality and mole fraction are independent of temperature

B) Molality of a very dilute solution approaches molarity, if density of the solution approaches unity

C) Normality of 1 M H_3PO_2 solution is 1N

D) All the above are correct statements

9) The F - F bond is weak because **1**

A) The repulsion between the nonbonding pairs of electrons of two fluorine atoms is large

B) The ionization energy of the fluorine atom is very low

C) The length of the F-F bond much larger than the bond lengths in other halogen molecules

D) The F-F bond distance is small and hence the inter nuclear repulsion between the two F atoms is very low

10) The material used in the preparation of Nicol prism is **1**

A) calcium bicarbonate

B) calcium carbonate

C) calcium phosphate

D) calcium sulphate

11) Glucose gives a condensation reaction with **1**

A) acetyl chloride

B) acetic anhydride

C) hydroxylamine

D) both ‘a’ and ‘b’ above

12) The number of bond pair and lone pair on oxygen atom in ether is respectively **1**

A) 1 and 2

B) 2 and 1

C) 2 and 3

D) 1 and 3

13) Which of the following ions has the maximum magnetic moment ? **1**

A) Mn^{2+}

B) Fe^{2+}

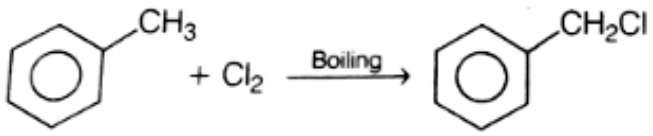
C) Ti^{2+}

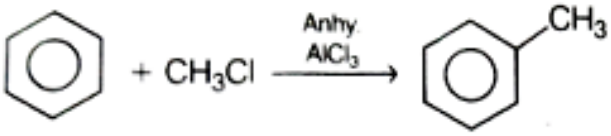
D) Cr^{2+}

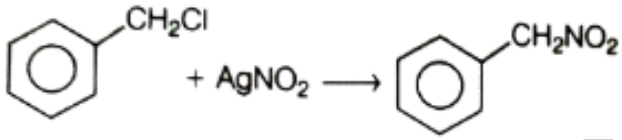
14) What is the Van't Hoff factor for a 0.1 M solution of calcium chloride ($CaCl_2$)? **1**

A) 1
B) 2
C) 3
D) 4

15) Which of the following is a free radical substitution reaction? **1**

A) 

B) 

C) 

D) $CH_3CHO + HCN \rightarrow CH_3CH(OH)CN$

16) The yield of the laser ablation is _____ **1**

A) 30%
B) 70%
C) 80%
D) 90%

17) In a semiconductor, which of the following factors can influence the size of the band gap? **1**

A) Temperature only
B) Pressure only
C) Temperature and pressure
D) Magnetic field

18) Which of the following is commonly called synthetic cellulose? **1**

A) dacron
B) terylene
C) rayon
D) nylon

19) Terylene is also known as **1**

A) mylor
B) cronar
C) terene
D) all of these

20) Maltose is made up of_____ **1**

A) α-D-glucose
B) D-glucose
C) α-D-glucose and b-D-glucose
D) glucose and fructose

21) EDTA is a **1**

A) Monodentate ligand
B) Bidentate ligand
C) Tridentate ligand
D) Hexadentate ligand

22) Starch and cellulose have same **1**

A) molecular formula
B) molecular weight
C) empirical formula
D) structural formula

23) Fatty acids contains : **1**

A) even number of carbon atom
B) unbranched, straight chain of carbon
C) one carboxyl group
D) all of these

24) Which buffer solution has maximum pH ? **1**

A) Mixture which is 0.1 M in CH_3COOH and 0.1 M in CH_3COONa [pK_a (CH_3COOH) = 4.74]
B) Mixture which is 0.2 M in CH_3COOH and 0.2 M in CH_3COONa
C) Mixture which is 0.1 M in NH_4Cl and 0.1 M in NH_4OH [pK_a (NH_4^+) = 9.26]
D) All the solutions have equal pH which is 4.74

25) For a chemical reaction at constant P and V ΔH is equal to **1**

A) ΔE

B) Zero

C) $\Delta E + P\,\Delta V$

D) P/T

26) The non-protein part in conjugated protein is called **1**

A) dipeptide

B) protease

C) prosthetic group

D) peptide group

27) Easily available house hold antiseptic is **1**

A) turmeric powder

B) resorcinol

C) dettol

D) iodoform

28) SCN^- is a **1**

A) monodentate ligand

B) bidentate ligand

C) tridentate ligand

D) hexadentate ligand

29) Chemical properties of ethers depend upon **1**

A) nature of alkyl group

B) lone pair of electron on oxygen atom

C) cleavage of C-O bond

D) all of these

30) Consider the endothermic reaction $X \rightarrow Y$ with the activation energies E_b and E_f for backward and forward reactions, respectively. In general **1**

A) $E_b < E_f$

B) $E_b > E_f$

C) $E_b = E_f$

D) there is no the following statements for order of reaction is

31) Phenol, though acidic, cannot decompose sodium bicarbonate because phenol is a **1**

A) weaker acid than carbonic acid
B) stronger acid than carbonic acid
C) weaker acid than carboxylic acid
D) stronger acid than sodium bicarbonate

32) Which of the following is not an antiseptic drug ? **1**

A) Iodine
B) Phenol
C) Gammaxene
D) Iodoform

33) Nitrogen shows different oxidation states in the range **1**

A) 0 to + 5
B) –3 to +5
C) –5 + 3
D) –3 to +3

34) For the reduction of silver ions with copper metal, the standard cell potential was found to be + 0.46 V at 25° C. The value of standard Gibb's energy, $\Delta G°$ will be ($F = 96500\ C\ mol^{-1}$) **1**

A) - 89.0 kJ
B) - 89.0 J
C) - 44. 5 kJ
D) - 98.0 kJ

35) When a lead storage battery is discharged **1**

A) SO_2 is evolved
B) lead sulphate is consumed
C) lead is formed
D) sulphuric acid is consumed

36) Which one of the following 1 M solution will show greater conductivity? **1**

A) acetic acid
B) citric acid
C) hydrochloric acid
D) sulphuric acid

37) Which of the following compounds shows the highest acidity? **1**

A) Acetaldehyde
B) Acetone
C) Acetic acid
D) Acetophenone

38) Which of the following pairs has heat of neutralization equal to $-57.1 kJ$? **1**

A) HNO_3 KOH
B) HCl, NH_4OH
C) H_2SO_4, NH_4OH
D) CH_3COOH, NaOH

39) The range of microbes attacked by antibiotics is known as **1**

A) spectrum
B) bands
C) bacteria
D) all of these

40) Glucose is found to exist in two different α and β crystalline forms. These forms can be obtained by. **1**
(i) The α form of glucose is obtained by crystallisation from concentrated solution of glucose to 303 K
(ii) The β form of glucose is obtained by crystallisation from concentrated solution of glucose at 303 K
(iii) The β form is obtained by crystallisation from hot and started aqueous solution of 371 K
(iv) The α form is obtained by crystallisation from hot and saturated aqueous solution at 371 K

A) (i) and (iii)
B) (ii) and (iv)
C) (ii) and (iii)
D) (i) only

41) Which transition metal is utilized in the production of superalloys, known for their high strength and resistance to extreme temperatures? **1**

A) Titanium (Ti)
B) Tungsten (W)
C) Molybdenum (Mo)
D) Nickel (Ni)

42) During chemical reaction, at constant pressure, ΔH is given by _____ **1**

A) $\Delta H = \Delta E$

B) $\Delta H = \Delta E - P \Delta V$

C) $\Delta H = \Delta E + P \Delta V$

D) $\Delta H = P \Delta V$

43) A weak acid (HA) is 4% ionized at 1 M. per cent ionization is 1% in presence of A^- of : **1**

A) 0.04 M

B) 0.16 M

C) 0.02 M

D) 0.10 M

44) Some statements are given below **1**

(A) For a first order reaction $t_{1/2}$ = constant

(B) For a zero order reaction $t_{1/2} \propto$ Initial conc.

(C) For a zero order reaction Rate $\propto$ conc. of reactant

(D) For a first order reaction, the plot of rate Vs. conc. is linear with slope = $-k$

Among the above the false statements are

A) B, C and D

B) B and D

C) A, B and D

D) C and D

45) What is the effect of increasing the temperature on the solubility of most salts? **1**

A) Solubility decreases

B) Solubility remains constant

C) Solubility increases

D) Solubility first increases and then decreases

46) During the polymerization of Ethylene hybridization of 'C' changes from – to – **1**

A) SP^2. SP

B) SP^2. SP^3

C) SP. SP^2

D) SP^3. SP^2

47) Which scientist proposed the EAN rule? **1**

A) Linus Pauling
B) Alfred Werner
C) Gilbert Lewis
D) Linus Carl Pauling

48) Cu^{2+} is more stable than Cu^{+}. This is due to **1**

A) extensive hydration of Cu^{2+} ion
B) greater reduction potential of Cu^{2+}
C) both (1) and (2)
D) none of these

49) The number of ions formed when one mole of Cuprammonium sulphate is dissolved in water is **1**

A) One
B) Two
C) Four
D) Zero

50) A system evolves 152.5 cal energy. In the process, work done becomes 54.3 cal. Its change in internal energy will be _____ **1**

A) 206.8 cal
B) −206.8 cal
C) 98.2 cal
D) −98.2 cal

Mathematics

1) Let $A \equiv \{1, 2, 3, 4\}; B \equiv \{a, b, c\}$, then number of functions from $A \to B$, which are not onto is **2**

A) 8

B) 24

C) 45

D) 6

2) The four points (3, 2), (11, 8), (8, 12) and (0, 6) are the vertices of a **2**

A) rectangle

B) parallelogram

C) square

D) rhombus

3) An urn A contains 8 black and 5 white balls. A second urn B contains 6 black and 7 white balls. A blind folded persons is asked to draw a ball selecting one of the urns, the probability that the ball drawn is white is **2**

A) $\frac{5}{13}$

B) $\frac{6}{13}$

C) $\frac{7}{13}$

D) $\frac{9}{13}$

4) When the origin is shifted to a point P, the point (2, 0) is transformed to (0, 4) then the co-ordinates of P are **2**

A) (2, -4)

B) (-2, 4)

C) (-2, -4)

D) (2, 4)

5) Select the correct answer from the given alternatives: **2**

If f(x) = [x] for x $\in$ (-1, 2) then f is discontinuous at

A) x = -1, 0, 1, 2

B) x = -1, 0, 1

C) x = 0, 1

D) x = 2

6) What is the value of $\omega^2+\omega+1$, where ω is a cube root of unity? **2**

A) 0

B) -1

C) 1

D) ω^2

7) The locus of the mid point of the chords of the circle $x^2+y^2+4x-6y-12=0$ which subtend an angle of $\pi/3$ radians at its circumference is **2**

A) $(x+2)^2+(y-3)^2=6.25$

B) $(x-2)^2+(y+3)^2=6.25$

C) $(x+2)^2+(y-3)^2=18.75$

D) $(x+2)^2+(y+3)^2=18.75$

8) Total number of words formed by using 2 vowels and 3 consonants taken from 4 vowels and 5 consonants is equal to **2**

A) 60

B) 120

C) 720

D) none of these

9) If A and B are two events such that $P(A\cup B)=\frac{5}{6}, P(A\cap B)=\frac{1}{3}, P(A)=\frac{2}{3}$, then A and B are **2**

A) Dependent events

B) Independent events

C) Mutually exclusive events

D) Mutually exclusive and independent

10) If a denotes the number of permutations of x + 2 things taken all at a time, b the number of permutations of x things 11 at a time and c the number of permutations of $x-11$ things taken all at a time such that a = 182 bc, then the value of x is **2**

A) 15

B) 12

C) 10

D) 18

11) A, B, C, D and E are 5 points in a plane. Show that the sum $\overline{AC}, \overline{AD}, \overline{AE}, \overline{CB}, \overline{DB}, \overline{EB}$ is **2**

A) $4\overline{AB}$

B) $2\overline{AB}$

C) $3\overline{AB}$

D) none

12) A is the point (1, 4) and B is a point (9, 12) on the parabola $y^2 = 16x$. The area enclosed between the parabola and the chord AB is revolved about x-axis, then the volume so generated is **2**

A) $\frac{256}{9}\pi$ cu

B) $\frac{256}{3}\pi$ cu

C) 256π cu

D) none

13) The minimum value of $z = 3x + 2y$ subject to $2x + 3y \geq 6, 2x + y \geq 4, 0 \leq x \leq 4, 0 \leq y \leq 6$ is **2**

A) 13/2

B) 15/2

C) 12

D) 15

14) Let $A = \begin{bmatrix} 0 & 2 & -3 \\ -2 & 0 & 4 \\ 3 & -4 & 0 \end{bmatrix}$. Then $A^T =$ **2**

A) A

B) −A

C) 2A

D) none

15) $\int \sin^{-1}(\cos x)\,dx =$ **2**

A) $\cos^{-1} x + c$

B) $\frac{(\sin^{-1} x)^2}{2} + c$

C) $\frac{\sin x}{2} + c$

D) $\frac{\pi}{2}x - \frac{x^2}{c} + c$

16) $\int \sec^4 x \tan^3 x \, dx$ is **2**

A) $\frac{\tan^3 x}{3} + c$

B) $\frac{\tan^4 x}{4} + \frac{\tan^6 x}{6} + c$

C) $\frac{\sec^4 x}{3} + c$

D) $\frac{\sec^5 x}{5} + c$

17) $\int \frac{\sin^2 2x}{(1+\cos 2x)^2} dx =$ **2**

A) tan x + x + c

B) $\cot - x - x + c$

C) $\tan x - x + c$

D) none

18) If $\bar{a} + \bar{b} = \bar{c}$ and $|\bar{a}| = 1, |\bar{b}| = 1, |\bar{c}| = \sqrt{2}$, then angled between $\bar{b}$ and $\bar{c}$ is **2**

A) $\cos^{-1}\sqrt{2}$

B) $\pi/2$

C) $\sqrt{63}$

D) none

19) Let O be the centre of a regular hexagon. The sum of the vectors $\overline{OA}, \overline{OB}, \overline{OC}, \overline{OD}, \overline{OE}$ and $\overline{OF}$ is **2**

A) $2\overline{AB}$

B) $\overline{AB}$

C) $\bar{0}$

D) none

20) Point on the curve $y = x^4 + 5$, the normal at which is perpendicular to the line $4x - y - 1 = 0$ is **2**

A) (2, 21)

B) (0, 5)

C) (−1, 6)

D) (1, 6)

21) In a pack of 52 cards, all 26 red and 26 black cards are separated. A person wants to select 10 red and 7 black cards. The probability that selection of 10 red cards include a pair of king and queen of same suit & selection of 7 black cards include a pair of king and queen of same suit is - **2**

A) $\frac{{}^{26}C_{10} \times {}^{24}C_7}{{}^{52}C_7}$

B) $\frac{4\left({}^{24}C_8\right)\left({}^{24}C_5\right)}{{}^{52}C_7}$

C) $\frac{4\left({}^{24}C_8\right)\left({}^{24}C_5\right)}{{}^{26}C_{10} \times {}^{26}C_7}$

D) none

22) The slope of the tangent at each point of curve is equal to the sum of the coordinates of the point. Then the curve that passes through the origin is **2**

A) $x + y = e^x - 1$

B) $e^x = x + y$

C) $y = e^x$

D) $y = e^x + 1$

23) If $x = \sec\theta,\ y = b\tan\theta$, then $\frac{dy}{dx}$ is **2**

A) $\frac{a}{b}$

B) $\frac{a}{b}\operatorname{cosec}\theta$

C) $\frac{b}{a}\operatorname{cosec}\theta$

D) $\frac{a}{b}\tan\theta$

24) If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of parallel lines, then : **2**

A) $\frac{a}{h} = \frac{h}{b} = \frac{g}{f}$

B) $\frac{a}{h} = \frac{b}{h} = \frac{g}{f}$

C) $\frac{a}{h} = \frac{h}{b} = \frac{f}{g}$

D) none of these

25) The minimum value of z = 20x + 30y subject to $3x+2y \geq 12$, $4x+y \geq 8$, $x \geq 0$, $y \geq 0$ occurs at **2**

A) (2, 3)

B) (4/5, 24/5)

C) (4, 0)

D) (0, 8)

26) If $p \vee q$ is true and $p \leftrightarrow q$ is false, then the truth value of $p \wedge \sim q$ is **2**

A) T, T

B) F, F

C) T, F

D) none

27) The line of intersection of the planes $\bar{r} \cdot \left(3\bar{i} - \bar{j} + \bar{k} \right) = 1$ and $\bar{r} \cdot \left(\bar{i} + 4\bar{j} - 2\bar{k} \right) = 2$ is parallel to the vector **2**

A) $-2\bar{i} - 7\bar{j} + 13\bar{k}$

B) $2\bar{i} + 7\bar{j} + 13\bar{k}$

C) $2\bar{i} + 7\bar{j} + 13\bar{k}$

D) $-2\bar{i} + 7\bar{j} + 13\bar{k}$

28) $\int \frac{\sin x}{\sin(x-a)} dx =$ **2**

A) $x \cos a - \sin a \log|\sin(x-a)| + c$

B) x sin a + c

C) $x \sin a + \sin a \log|\sin(x-a)| + c$

D) $x \cos a + \sin a \log|\sin(x-a)| + c$

29) A cylindrical vessel of radius 0.5 mts is filled with oil at the rate of 0.25 π c. mts/min. The rate at which the surface of the oil is increasing is **2**

A) 1 mts / min

B) 2 mts/ min

C) 5 mts/ min

D) 1.25 mts /min

30) The matrix X such that **2**

$$X\begin{bmatrix}7 & 6 & -1\\ 4 & 2 & 3\\ 1 & 3 & 0\end{bmatrix}=\begin{bmatrix}4 & 2 & 3\\ 1 & 3 & 0\\ 7 & 6 & -1\end{bmatrix}$$ is

A) $\begin{bmatrix}1 & 0 & 0\\ 0 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}$

B) $\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 1 & 0 & 0\end{bmatrix}$

C) $\begin{bmatrix}0 & 0 & 1\\ 1 & 0 & 0\\ 0 & 1 & 0\end{bmatrix}$

D) none

31) The length of perpendicular form (1, 6, 3) to the line **2**

$$\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$$ is

A) 3

B) $\sqrt{11}$

C) $\sqrt{13}$

D) 5

32) If $A=\begin{bmatrix}-1 & -1\\ 1 & 0\end{bmatrix}$, then A^{-1} is **2**

A) 2A

B) A^2

C) $-A$

D) none

33) $\int\frac{(\cos x-\sin x)dx}{1+\sin 2x}$ is **2**

A) $-\frac{1}{\cos x+\sin x}+c$

B) $\frac{1}{\cos x-\sin x}+c$

C) $\frac{1}{\sin 2x}+c$

D) $\frac{1}{\cos 2x}+c$

34) The compound statement $p \leftrightarrow q$ means **2**

A) "if p then q and if q then p"

B) "q if p"

C) "p only if q"

D) "q is necessary for p"

35) If O is the circumcentre , G is the centroid and H is the orthocenter of $\triangle ABC$, then $\overline{OA} + \overline{OB} + \overline{OC} =$ **2**

A) $\overline{HO}$

B) $\overline{OG}$

C) $\overline{OH}$

D) $\overline{HG}$

36) The maximum value of $z = 5x + 2y$, subject to the constraints $x + y \leq 7,\ x + 2y \leq 10\ ,\ x, y \geq 0$ is **2**

A) 10

B) 26

C) 35

D) 70

37) The measure of acute angle between the lines whose direction ratios are 2, 3, 6 and $1, -2, 2$ is **2**

A) $\cos^{-1}\left(\frac{8}{21}\right)$

B) $\cos^{-1}\left(\frac{1}{21}\right)$

C) $\cos^{-1}\left(\frac{20}{21}\right)$

D) none

38) If $\bar{a} \cdot \bar{i} = 4$, then $\left(\bar{a} \times \bar{j}\right) \cdot \left(2\bar{j} - 3\bar{k}\right) =$ **2**

A) 12

B) 2

C) 0

D) -12

39) Foot of perpendicular of point (2, 2, 2) in the plane x + y + z = 9 is **2**

A) (1, 1, 1)

B) (3, 3, 3)

C) (9, 0, 0)

D) (2, 6, 1)

40) If $\cos 2\theta = \sin \alpha$, then the most general relation between θ and α (for $n \in I$) is **2**

A) $2\theta + \alpha = \frac{\pi}{2}$

B) $\theta = n\pi \pm \left(\frac{\pi}{4} + \frac{\alpha}{2}\right)$

C) $\theta = n\pi \pm \left(\frac{\pi}{4} - \frac{\alpha}{2}\right)$

D) $\theta = 2n\pi \pm \left(\frac{\pi}{2} - \alpha\right)$

41) The function $f(x) = 2x^3 - 9x^2 + 12x + 5$ has minimum at x = **2**

A) -6

B) 6

C) 1

D) 2

42) The differential equation found by the elimination of the arbitrary constant *K* from the equation $y = (x + K)e^{-x}$ is **2**

A) $\frac{dy}{dx} - y = e^{-x}$

B) $\frac{dy}{dx} - ye^{x} = 1$

C) $\frac{dy}{dx} + ye^{x} = 1$

D) $\frac{dy}{dx} + y = e^{-x}$

43) Point on the curve $y^2 = 2(x - 3)$ at which the normal is parallel to the line $y - 2x + 1 = 0$ is **2**

A) $\left(-\frac{1}{2}, -2\right)$

B) $(5, -2)$

C) $\left(\frac{3}{2}, 2\right)$

D) (5, 2)

44) If $S = 4t^3 - 3t^2 + 2$, then acceleration is 42 units/sec^2 at the time t = **2**

A) 1 sec

B) 2 sec

C) 4 sec

D) 8 sec

45) If x = a cos nt - b sin nt, then $\frac{d^2x}{dt^2}$ = **2**

A) $n^2 x$

B) $-n^2 x$

C) $-n x$

D) n x

46) Negation of $(p \vee \sim q) \wedge r$ is **2**

A) $(\sim p \wedge q) \vee \sim r$

B) $(p \wedge \sim q) \vee \sim r$

C) $(p \wedge q) \vee \sim r$

D) $(\sim p \vee q) \wedge \sim r$

47) $y = \operatorname{cosec}^{-1}\left(\frac{x+1}{x-1}\right) + \cos^{-1}\left(\frac{x-1}{x+1}\right)$ **2**

A) 0

B) 1

C) $\frac{x-1}{x+1}$

D) $\frac{x+1}{x-1}$

48) $\frac{d^2y}{dx^2} + 3\sqrt{1-\left(\frac{dy}{dx}\right)^2} - y = 0$ **2**

A) order = 2 degree = 1

B) order = 2 degree = $\frac{1}{2}$

C) order = 1 degree = 2

D) order = 2 degree = 2

49) $\int \frac{dx}{2x + x^5}$ is **2**

A) $\frac{1}{4}\log\left|\frac{x^4}{x^4+1}\right| + c$

B) $\frac{1}{8}\log\left|\frac{x^4}{x^4+2}\right| + c$

C) $\log|2x + x^5| + c$

D) $\frac{\log\left|2x + x^5\right|}{5} + c$

50) If C if the mid-point of AB and P is any point outside AB, then **2**

A) $\overline{PA} + \overline{PB} = \overline{PC}$

B) $\overline{PA} + \overline{PB} = 2\overline{PC}$

C) $\overline{PA} + \overline{PB} + \overline{PC} = \bar{0}$

D) $\overline{PA} + \overline{PB} + 2\overline{PC} = \bar{0}$