MM : 360 Term Exam Test – 3 **Time : 3 Hrs.**

(*for* Second Step JEE (Main & Advanced) - 2018

Topics covered :

Physics : Ray Optics and Optical Instruments, Wave Optics.

Chemistry : Haloalkanes and Haloarenes, Alcohols, Phenols and Ethers.

Mathematics : Integrals, Applications of Integrals, Differential Equations.

Instructions :

(i) Duration of Test is 3 hrs.

(ii) The Test booklet consists of 90 questions. The maximum marks are 360.

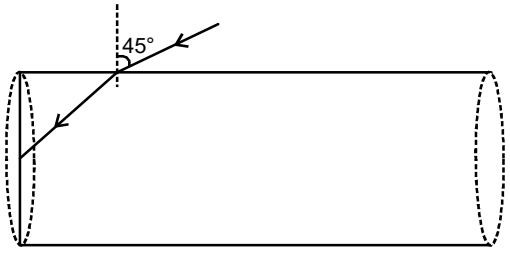
(iii) There are **three** parts in the question paper A, B, C consisting of **Physics**, **Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each question is allotted 4 **(four)** marks for each correct response.

(iv) From total score one fourth (¼) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

[PART - A : PHYSICS]

Choose the correct answer :

1. A light ray falls on a cylindrical slab at an angle 45°. The minimum refractive index of transparent cylinder so that no ray emerges out from the vertical surface of cylinder



(1) $\frac{3}{2}$ (2) $\sqrt{\frac{3}{2}}$

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{3}{\sqrt{2}}$

2. A converging beam is intercepted by an equi-concave lens made up of a glass $\left(\mu = \frac{3}{2}\right)$ and radius of curvature is 10 cm. If the beam originally focus at 8 cm from certain position. Now if this equi-concave lens is placed in this position, beam is now converged at

(1) 20 cm (2) 30 cm

(3) 40 cm (4) 25 cm

3. The angle of minimum deviation produced by an equilateral prism is 46°. The refractive index of material of the prism.

(1) 1.6 (2) 1.5

(3) 1.4 (4) 1.8

4. A thick transparent glass slab $(\mu_2 = 1.55)$ is to be viewed in reflected white light. It is desired to coat the slab with a thin layer of a material having reflective index (μ_1) = 1.4 so that the wavelength λ = 6000 Å is suppressed. The minimum thickness of coating required is

(1) 2143 Å (2) 1071 Å

(3) 1935 Å (4) 3871 Å

5. The polarising angle of diamond is 67°. The critical angle of the diamond is nearest to

(1) 25.12° (2) 53°

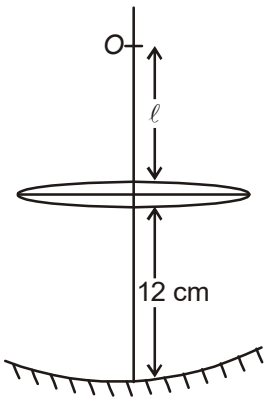
(3) 45° (4) 60°

6. The objective of a telescope is aberration free converging lens of focal length 150 cm. Its eyepiece is also a converging lens of focal length of 5 cm. The magnifying power of the telescope for the normal adjustment is

(1) 10 (2) 20

(3) 30 (4) 50

7. Figure shows a convex lens of focal length 40 cm is held coaxially 12 cm above a concave mirror of focal length 18 cm. A point object held ℓ cm above the lens gives rise to an image coinciding with it.



Then the value of *l* is equal to

(1) 12 cm (2) 15 cm

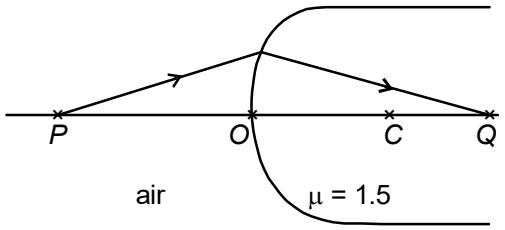
(3) 18 cm (4) 30 cm

8. A light ray strikes a refracting face of a prism at an angle θ and emerges out normally from the other face. If the angle of prism is 5° and the refractive index of prism material is 1.5, the angle of deviation from first surface is

(1) 7.5° (2) 5°

(3) 15° (4) 2.5°

9. Figure shows the refracting spherical glass surface. It is given that *PO* = *OQ* and *OC* = *R* where *R* is the radius of curvature of spherical surface. Find *PO.*



(1) 2*R* (2) 3*R*

(3) 4*R* (4) 5*R*

10. Monochromatic light of wavelength λ is incident upon a slit of width *d*. The resulting diffraction pattern is observed on a screen at a distance *D*. The linear width of the principal maximum is found to be equal to the width of the slit, if *D* equals

(1) $\frac{d^2}{\lambda}$ (2) $\frac{2\lambda}{d^2}$

(3) $\frac{d^2}{2\lambda}$ (4) $\frac{2\lambda^2}{d}$

11. For a rectangular glass slab, the lateral shift per unit thickness for angle of incidence equal to 45° is $\frac{1}{\sqrt{3}}$, the angle of refraction is

(1) $\tan^{-1}\sqrt{\frac{2}{\sqrt{3}-1}}$

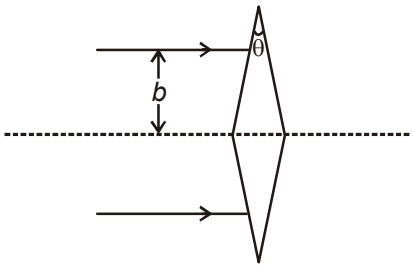
(2) $\sin^{-1}\left(1-\sqrt{\frac{2}{3}}\right)$

(3) $\tan^{-1}\frac{\sqrt{3}}{2}$

(4) $\tan^{-1}\left(1-\sqrt{\frac{2}{3}}\right)$

(Space for Rough Work)

12. Two identical thin isosceles prisms of refracting angle θ and refractive index μ are placed with their bases touching each other. A parallel beam of width $2b$ is incident on this system as shown. The distance of the point of convergence from the prism.



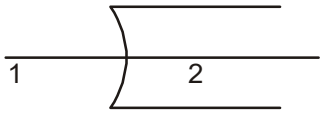
(1) $\frac{b}{(\mu-1)\theta}$

(2) $\frac{b}{2(\mu-1)\theta}$

(3) $\frac{2b}{(\mu-1)\theta}$

(4) $\frac{b\theta}{(\mu-1)}$

13. A converging spherical surface of radius of curvature 10 cm, separates two optical media 1 and 2 of refractive index $\frac{4}{3}$ and $\frac{3}{2}$ respectively as shown in figure. If the object is placed along the principal axis in medium 1, then



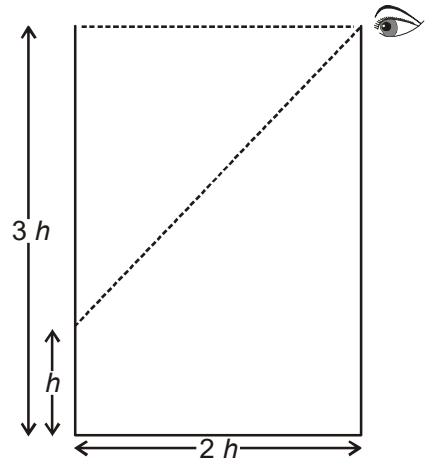
(1) Image is always real

(2) Image is real if the object distance is greater than 90 cm

(3) Image is always virtual

(4) Image is virtual only if the object distance is less than 90 cm.

14. An observer can see through a pin hole, the top end of a thin rod of height h, placed as shown in the figure. The beaker height is $3h$ and its radius is h. When the beaker is filled with a liquid upto a height $2h$, he can see the lower end of the rod. Then the refractive index of the liquid is



(1) $\frac{5}{2}$ (2) $\sqrt{\frac{5}{2}}$

(3) $\sqrt{\frac{3}{2}}$ (4) $\frac{3}{2}$

15. A parallel beam of white light falls on a convex lens. Images of blue, red and green light are formed on the side of lens at distances p, q and r respectively from the optical centre of the lens. Then,

(1) $p > q > r$

(2) $p < q < r$

(3) $p > r > q$

(4) $q > r > p$

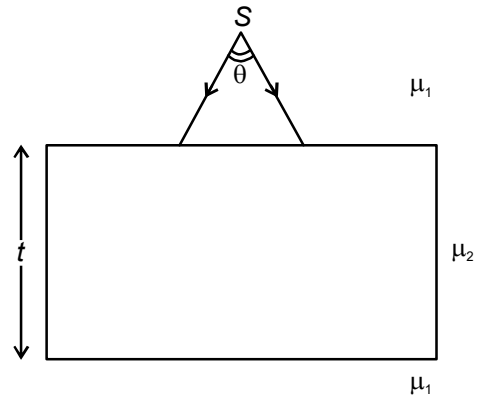
16. In YDSE, slit width d = 7000 Å, λ = 2000 Å. The number of bright fringes on the screen

(1) 12 (2) 7

(3) 18 (4) 4

(Space for Rough Work)

17. A divergent beam of light from a point source falls symmetrically on a glass slab, as shown in figure. If the thickness of the glass slab is t, then the angle of divergence of emerging light is



(1) θ (2) 2θ

(3) $\sin^{-1}\left(\frac{\mu_1}{\mu_2}\right)$ (4) $2\sin^{-1}\left(\frac{\mu_2}{\mu_1}\right)$

18. If the distance between first maxima and fifth minima on one side of central maxima of YDSE pattern is 7 mm and the slits are separated by 0.15 mm with the screen 50 cm from the plane of slits, then the wavelength of the light used is

(1) 600 nm (2) 420 nm

(3) 525 nm (4) 467 nm

19. In this question there are two statements 1 and 2. Read them and then answer accordingly.

Statement-1 : A light ray is incident on a glass slab, some portions of it is reflected and some other is refracted. Reflected and refracted components are always perpendicular to each other

Statement-2 : Angle of reflection is equal to the angle of incidence.

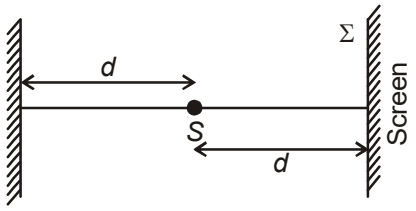
(1) If both statement-1 and statement-2 are true and the reason is the correct explanation of the assertion, then mark **(1)**.

(2) If both statement-1 and statement-2 are true but the reason is not the correct explanation of the assertion, then mark **(2)**.

(3) If statement-1 is true and statement-2 is false, then mark **(3)**.

(4) If statement-1 is false and statement-2 is true, then mark **(4)**.

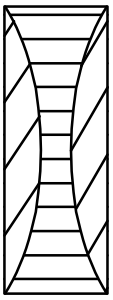
20. An isotropic point source S of light is placed in front of a perfectly reflecting mirror as shown in figure. $\sum$ is a screen. The intensity at the centre of screen is found to be I, if now mirror is removed then the intensity at the centre of screen would be



(1) I (2) $\frac{9I}{10}$

(3) $\frac{10I}{9}$ (4) $\frac{I}{2}$

21. Two plano-convex lenses each of focal length 10 cm and refractive index $\frac{3}{2}$ are placed as shown. The gap between them is filled with water of refractive index $\frac{4}{3}$. The whole arrangement is placed in air. The optical power of the system (in diopter) is



(1) $+\frac{20}{3}$ (2) $-\frac{20}{3}$

(3) $+\frac{25}{3}$ (4) $-\frac{25}{3}$

(Space for Rough Work)

22. The human eye can be regarded as a single spherical surface of radius of curvature 7.8 mm. If a parallel beam of light comes to focus at 3.075 cm behind the refracting surface, the refractive index of the liquid in the eye is

(1) 1.34

(2) 1

(3) 1.5

(4) 1.86

23. If aperture width is 3 mm and wavelength of light is 4000 Å, for what distance is ray optics a good approximation?

(1) 2.25 m (2) 22.5 m

(3) 25.2 m (4) 25 m

24. Resolving power of a microscope, does not depend on

(1) Wavelength of light

(2) Least distance of distinct vision

(3) Refractive index of medium in which object is placed

(4) Diameter of objective lens

25. Two identical glass $\left({}_a\mu_g = \frac{3}{2}\right)$ equiconvex lens of focal length *f* are kept in contact. The space between the two lens is filled with water $\left({}_a\mu_w = \frac{4}{3}\right)$. The focal length of the combination

(1) $\frac{4f}{3}$

(2) $\frac{3f}{4}$

(3) f

(4) $\frac{f}{2}$

26. In a single slit diffraction pattern obtained using a beam of blue light. What happens if the blue light is replaced by green light?

(1) No change

(2) Diffraction bands become narrower and crowded together

(3) Bands become broader and farther apart

(4) Bands disappear

27. A point object is approaching a convex lens of focal length 0.3 m with a speed of 0.01 ms^{-1}. The rate of change of lateral magnification of the image when the object is at a distance of 0.4 m from the lens.

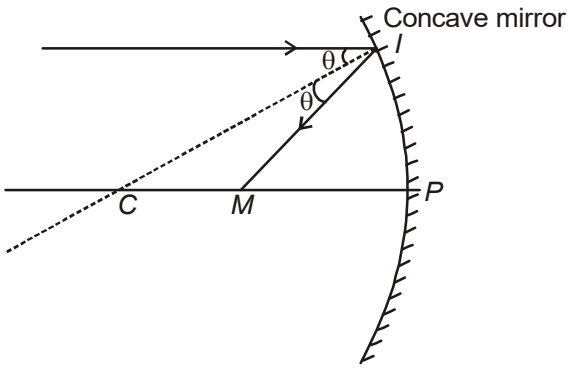
(1) 0.30 s^{-1}

(2) 0.09 s^{-1}

(3) 0.06 s^{-1}

(4) 0.04 s^{-1}

28. A marginal ray strikes the mirror (*R* radius of curvature) shown. The distance *CM*



(1) $\frac{R}{2\cos\theta}$

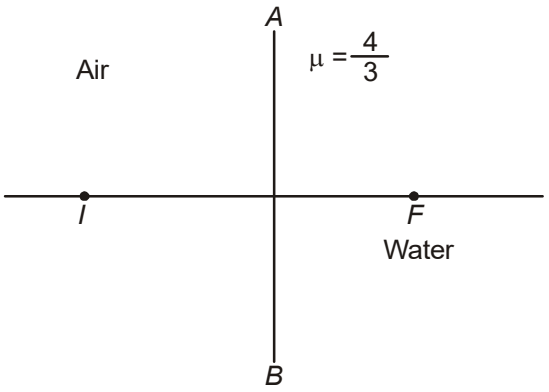
(2) $\frac{R\cos\theta}{2}$

(3) $\frac{R}{2}$

(4) $\frac{R}{2\sin\theta}$

(Space for Rough Work)

29. An insect *I* and fish *F* approach each other with equal speed 3 cm/s in air and water separated by a boundary *AB*. The approach speed of insect as observed by fish



(1) 6 cm s^{-1} (2) 7 cm s^{-1}

(3) 8 cm s^{-1} (4) 9 cm s^{-1}

30. An unpolarized beam of light is incident on a pair of polarizing sheets, such that the pass axes are inclined at angle 30° with each other. The fraction of light that is transmitted

(1) $\frac{9}{16}I_0$

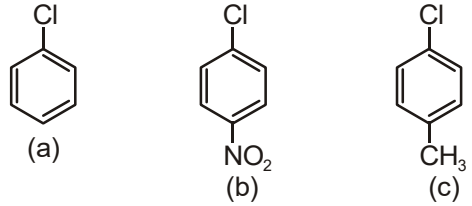
(2) $\frac{9}{32}I_0$

(3) $\frac{3}{8}I_0$

(4) $\frac{27}{128}I_0$

[PART - B : CHEMISTRY]

31. For the following compounds, the correct order of rate of nucleophilic substitution reaction is



(1) (a) > (b) > (c)

(2) (b) > (a) > (c)

(3) (b) > (c) > (a)

(4) (a) > (c) > (b)

32. Which is the correct increasing order of boiling points of the following compounds?

Ethylene glycol, Methanol, Ethanol, Propyl alcohol

(1) Ethylene glycol < Methanol < Ethanol < Propyl alcohol

(2) Methanol < Propyl alcohol < Ethanol < Ethylene glycol

(3) Methanol < Ethanol < Propyl alcohol < Ethylene glycol

(4) Ethylene glycol < Propyl alcohol < Ethanol < Methanol

33. Consider the below reactions

$$\underset{\text{(Alkyl bromide)}}{A} \xrightarrow{Mg} B \xrightarrow{C_2H_5OH} C$$

$$A \xrightarrow{Na/ether} \underset{\text{(Major product)}}{C_4H_{10}}$$

The correct statement is

(1) IUPAC name of A is 1-bromobutane

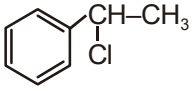
(2) Structure of B is $CH_3–CH_2–CH_2MgBr$

(3) 'C' is C_2H_6

(4) 'A' is $CH_3–\underset{\underset{Br}{|}}{CH}–CH_3$

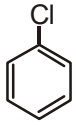
(Space for Rough Work)

34. Which of the following compound can show S_N1 as well as S_N2 reaction?

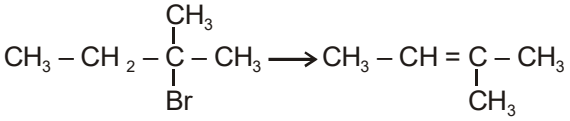
(1) 

(2) 

(3) $CH_2 = CH - F$

(4) 

35. The best reagent for the below conversion is



(1) $H_2\ddot{O}$ at low temperature

(2) $CH_3 - O^{\ominus}$ / CH_3OH / Δ

(3) NaCl

(4) NaI / Acetone

36. Which of the following is correct statement?

(1) Haloarenes may show Friedel-Crafts reaction

(2) Haloarenes never react with electrophile

(3) Haloarenes are more reactive than methyl halide in S_N2 reaction (if halogen is – Cl)

(4) Haloarenes are highly soluble in both polar and non-polar solvents.

37. Saturated Alcohol $\xrightarrow[573\ K]{Cu}$ Alkene
(A)

Saturated Alcohol $\xrightarrow[573\ K]{Cu}$ Aldehyde
(B)

Which of the following is correct statement?

(1) 'A' give immediate white turbidity in Lucas test

(2) 'B' give immediate white turbidity in Lucas test

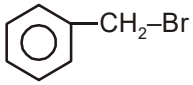
(3) 'A' never give white turbidity with Lucas test

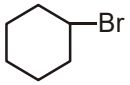
(4) B is 3° alcohol

38. Which of the following halide have maximum rate of S_N1 reaction?

(1) $CH_3 - Cl$

(2) $CH_3 - CH_2 - Cl$

(3) 

(4) 

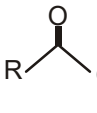
39. In which of the following reaction 2-propanol can be prepared as a major product?

(1) $HCHO \xrightarrow[(ii)\ H_3O^+]{(i)\ CH_3CH_2MgBr}$

(2) $CH_3-\underset{\underset{O}{\|}}{C}-H \xrightarrow[(ii)\ H_3O^+]{(i)\ CH_3CH_2MgBr}$

(3) $CH_3-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow[(ii)\ H_3O^+]{(i)\ CH_3MgBr}$

(4) $CH_3-\underset{\underset{O}{\|}}{C}-H \xrightarrow[(ii)\ H_3O^+]{(i)\ CH_3MgBr}$

40.  $+ Br_2 \xrightarrow[CCl_4]{\Delta} A + CO_2 + AgBr.$

Compound A is

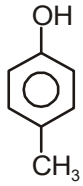
(1) RH

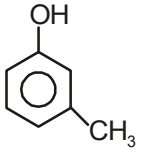
(2) R – Br

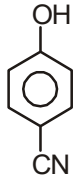
(3) RCH_3

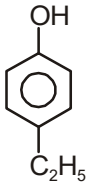
(4) $ROCH_3$

41. Which of the following is more acidic than phenol?

(1) 

(2) 

(3) 

(4) 

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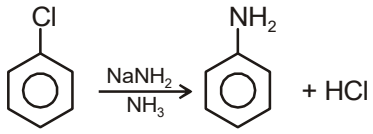
42. 

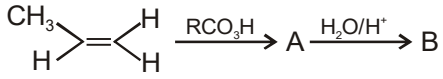
The correct statement is

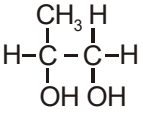
(1) Reaction intermediate is carbocation.

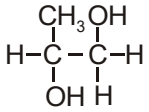
(2) Reaction intermediate is carbanion.

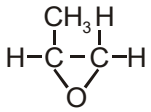
(3) Reaction intermediate is carbon free radical.

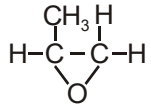
(4) Reaction intermediate is benzyne.

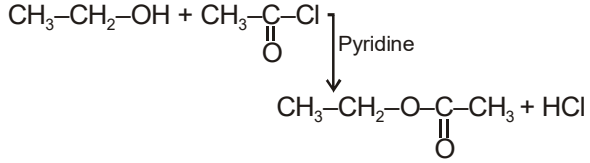
43. 

(1) A can be 

(2) A can be 

(3) A can be 

(4) B can be 

44. 

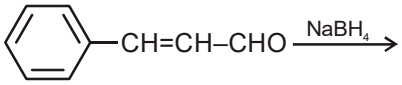
The use of pyridine in this reaction is

(1) It neutralizes the HCl so that chance of backward reaction decreases.

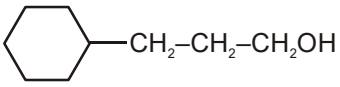
(2) Pyridine activate the alcohol so rate of reaction increases.

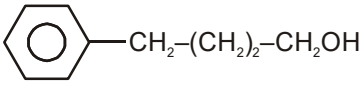
(3) Pyridine activate the acid chloride so rate of reaction increases.

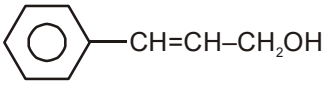
(4) Pyridine dissolve the ester formed in the reaction.

45. 

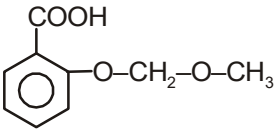
(1) No reaction

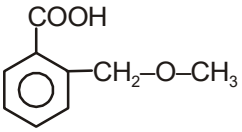
(2) 

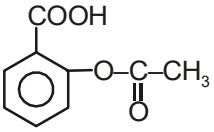
(3) 

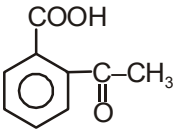
(4) 

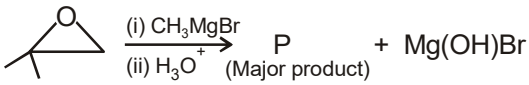
46. Which of the following is correct structure of Aspirin?

(1) 

(2) 

(3) 

(4) 

47. 

The correct statement about P is

(1) P is 3° alcohol

(2) P is 2° alcohol

(3) P is 1° alcohol

(4) P is saturated open chain ether

(Space for Rough Work)

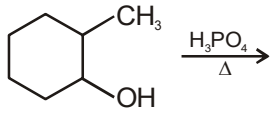
48. Which of the following is correct?

(1) Generally alcohols are weaker acids than water

(2) Alcohols behave as acids due to the presence of polar O–H bond

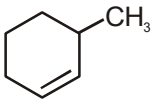
(3) Ethyl alcohol can produce H_2 gas on reaction with Na metal

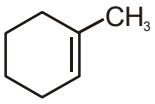
(4) All of these

49. 

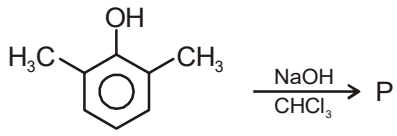
Which is the correct statement ?

(1) Major product is optically active

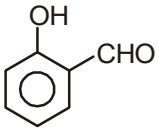
(2)  is the major product

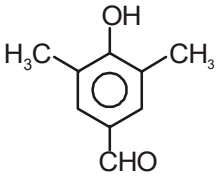
(3)  is the major product

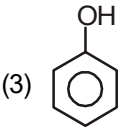
(4) Major product is ketone

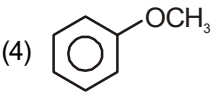
50. 

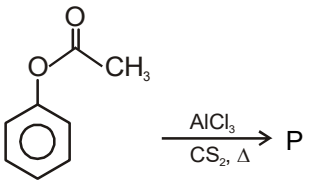
The correct structure of P is

(1) 

(2) 

(3) 

(4) 

51. 

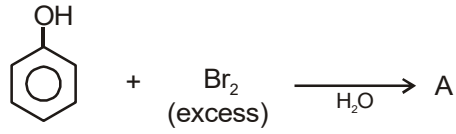
Which is correct about the product?

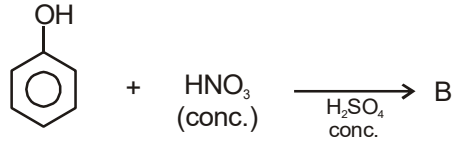
(1) Product P is less acidic than phenol

(2) P can react with NaOH

(3) P is more reactive than phenol in sulphonation

(4) P is more reactive than phenol in Friedel-Craft reaction

52. **I** : 

II : 

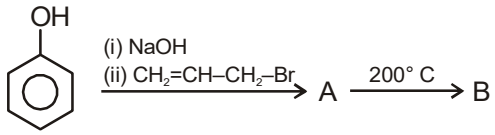
(1) Both A and B are tri substituted phenols

(2) A is mono substituted while B is tri substituted phenol

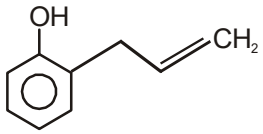
(3) A is tetra substituted while B is mono substituted phenol

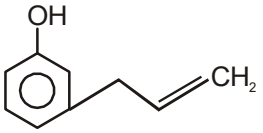
(4) A and B both are mono substituted phenol

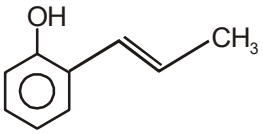
(Space for Rough Work)

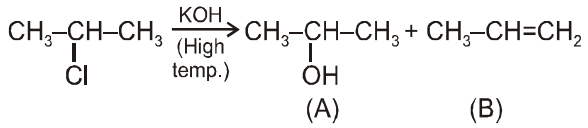
53. 

(1) The above reaction is Fries rearrangement

(2) B = 

(3) A = 

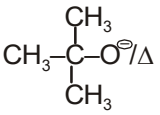
(4) A = 

54. 

Which of the following factor increase percentage of A in the product?

(1) Increase in temperature

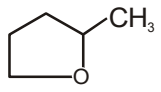
(2) Decrease in temperature

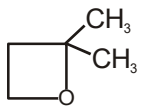
(3) If KOH is replaced by 

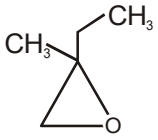
(4) All of these

55. A chiral $C_5H_{10}O$ ether reacts with excess of HI to give a $C_5H_{10}I_2$ product. Treatment of this with hot KOH in ethanol produces 1, 3-pentadiene as major product. What is the structure of the original ether?

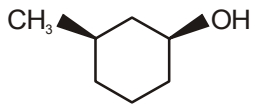
(1) 

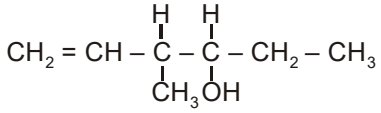
(2) 

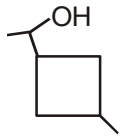
(3) 

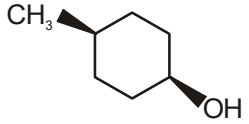
(4) 

56. A compound with formula $C_7H_{14}O$ optically active alcohol is oxidised by Jones reagent to an optically inactive ketone. The molecule is

(1) 

(2) 

(3) 

(4) 

57. Which is incorrect statement?

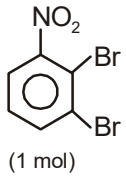
(1) Ethers are unreactive towards most bases hence used as solvents

(2) Ethers are cleaved by heating with HBr

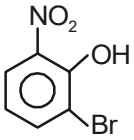
(3) Ethers are reactive towards most bases

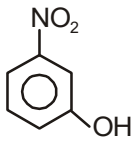
(4) Ethers react under acidic conditions

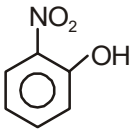
(Space for Rough Work)

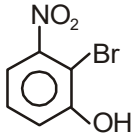
58. 
(1 mol) + NaOH (1 mol) $\xrightarrow{\Delta}$ T (Major product) + NaBr

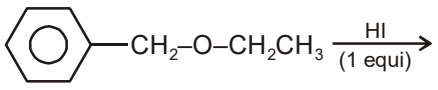
Major product T is

(1) 

(2) 

(3) 

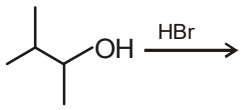
(4) 

59. 

What is the major product obtained in above reaction?

(1) CH_3CH_2I (2) $Ph–CH_2–I$

(3) $Ph–CH_2–OH$ (4) $Ph–OH$

60. 

Select the incorrect statement about above reaction.

(1) Rearranged product is major product

(2) Major product obtained is optically active

(3) Reaction proceed through S_N1 mechanism

(4) Carbocation intermediate is formed

[PART - C : MATHEMATICS]

61. $\int \frac{1}{5+\sin 2x}dx$ equals

(1) $\frac{1}{2\sqrt{2}}\cdot\tan^{-1}\left(\frac{5\tan x-1}{2\sqrt{2}}\right)+c$

(2) $\frac{1}{3\sqrt{6}}\cdot\tan^{-1}\left(\frac{5\tan x-1}{3\sqrt{6}}\right)+c$

(3) $\frac{1}{2\sqrt{6}}\cdot\tan^{-1}\left(\frac{5\tan x+1}{2\sqrt{6}}\right)+c$

(4) $\frac{1}{2\sqrt{3}}\cdot\tan^{-1}\left(\frac{5\tan x-1}{2\sqrt{3}}\right)+c$

62. $\int \frac{dx}{(3x-5)\sqrt{(3x-4)(3x-6)}}\left(\text{where } x>\frac{5}{3}, x\neq 2\right)$

is equal to

(1) $\frac{1}{3}\sec^{-1}(3x-5)+c$

(2) $\cos^{-1}(3x^2-5)+c$

(3) $\tan^{-1}(3x^2+11x-2)+\sin^{-1}(x^2-1)+c$

(4) $\frac{\sin^2 x}{5}-\frac{\sin 2x}{10}+c$

(Space for Rough Work)

63. $\int \frac{x^5 \cdot dx}{(5x^2-3)^4} = \frac{1}{k_1} \cdot x^6 (5x^2-3)^{-k_2} + c$, then $k_1 + k_2$ equals

(1) 15 (2) 21

(3) –15 (4) –21

64. $\int \frac{x+5}{(x+2)^2} dx$ is equal to

(1) $\ln(x+2) + \frac{3}{(x+2)} + c$

(2) $2\ln(x+2) - \frac{3}{(x+2)} + c$

(3) $\ln(x+2) - \frac{3}{x+2} + c$

(4) $2\ln(x+2) + \frac{3}{x+2} + c$

65. $\int x^2 \cdot e^{x^3} \cdot \tan\left(e^{x^3}\right) dx$ is equal to

(1) $\log\left|\sec\left(e^{x^3}\right)\right| + c$

(2) $\frac{1}{3}\log\left|\sec e^{x^3}\right| + c$

(3) $\log\left|\sec e^{x}\right| + c$

(4) $2 \cdot \log\left|\sec e^{x^3}\right| + c$

66. If $\int \frac{5}{(x-1)(x-3)} dx = A \log_e (x-3) + B \log_e (x-1) + c$, then

(1) $A + B = 5$ (2) $A - B = 5$

(3) $AB = \frac{-25}{2}$ (4) $AB = \frac{25}{2}$

67. If $\int \left(\sqrt{\tan x} - \sqrt{\cot x}\right) dx = f(x) + c$, then $f(x)$ is equal to

(1) $\log\left|\frac{\tan x + 1 - \sqrt{2\tan x}}{\tan x + 1 + \sqrt{2\tan x}}\right|$

(2) $\log\left|\frac{\tan x + 1 - \sqrt{\tan x}}{\tan x + 1 + \sqrt{\tan x}}\right|$

(3) $\frac{1}{\sqrt{2}} \log\left|\frac{\tan x + 1 - \sqrt{\tan x}}{\tan x + 1 + \sqrt{\tan x}}\right|$

(4) $\frac{1}{\sqrt{2}} \cdot \log\left|\frac{\tan x + 1 - \sqrt{2\tan x}}{\tan x + 1 + \sqrt{2\tan x}}\right|$

68. The value of the integral $\int_0^{\log 2} \frac{e^x \sqrt{e^x - 1}}{e^x + 4} dx$, is

(1) $2\left[\log 2 - 5\tan^{-1}\frac{\log 2}{5}\right]$

(2) $\left[\log 4 - 5\tan^{-1}\frac{\log 2}{5}\right]$

(3) $2\left(1 - \sqrt{5}\tan^{-1}\frac{1}{\sqrt{5}}\right)$

(4) $\log\frac{6}{5}$

69. $\int_0^{33} \{3x\} dx$ equals to (where { } denotes fractional part of x)

(1) 33 (2) 66

(3) 99 (4) $\frac{33}{2}$

(Space for Rough Work)

70. If $I_n = \int_0^{\pi/4} \tan^n x\,dx$ then $I_9 + I_7$ is equal to

(1) $\frac{1}{9}$ (2) $\frac{1}{7}$

(3) $\frac{1}{10}$ (4) $\frac{1}{8}$

71. The value of the integral

$\int_0^{12}\left(\tan^{-1}\frac{x^2}{2x+1}+\tan^{-1}\frac{2x+1}{x^2}\right)dx$ is equal to

(1) Zero (2) 6π

(3) 7π (4) $\frac{7\pi}{4}$

72. Let $f(x)=\int_{x^2}^{x^3}(t-1)dt$. Then the real solutions of the equation $f'(x) - 2x(1 - x^2) = 0$ are

(1) –1 or 1 (2) –2 or 2

(3) $-\frac{1}{2}$ or $\frac{1}{2}$ (4) 0 or 1

73. If $I_1=\int_1^{\cos\theta}\frac{x}{1+x^2}dx$ and $I_2=\int_1^{\sec\theta}\frac{1}{x(x^2+1)}dx$, then the value of

$\begin{vmatrix} I_1 & e^{I_1+I_2} & 1 \\ I_1^2 & I_2^2 & I_1^2+I_2^2 \\ I_2 & -1 & -1 \end{vmatrix}$ is

(1) $\cos\theta$ (2) $\sec\theta$

(3) 0 (4) 1

74. Value of $\int_1^2 e^{x-\frac{1}{x}}\cdot\frac{(x^4-x^2+1)}{(x^2+x-1)^2}\cdot\left(\frac{x^2+1}{x^2}\right)dx$ is equal to

(1) $1-\frac{e^{3/2}}{15}$ (2) $1+\frac{e^{3/2}}{5}$

(3) $1+\frac{e^{5/2}}{15}$ (4) $1-\frac{e^{3/2}}{35}$

75. If $\int_{\tan x}^{5} t\cdot f(t)dt = 1+\sin x\,\forall x\in\left(0,\frac{\pi}{2}\right)$, then the value of $\left[f\left(\frac{1}{\sqrt{3}}\right)\right]$ is ([.] denotes the greatest integer function)

(1) 2 (2) 1

(3) –1 (4) –2

76. The area inside the parabola $y^2 = 3x$ but outside the parabola $y^2 = 4(x - 3)$ is

(1) 12 (2) 24

(3) 8 (4) 16

77. Area of the region bounded by the curves $y = \sin x, x = \frac{\pi}{3}, x = \frac{2\pi}{3}$ and x-axis is

(1) $\frac{1}{2}$ (2) $\frac{-1+\sqrt{3}}{2}$

(3) 1 (4) $\frac{1+\sqrt{3}}{2}$

78. Area bounded by the curve $x = 3y - 2y^2$ and y-axis is

(1) $\frac{9}{8}$ (2) $\frac{9}{4}$

(3) $\frac{9}{2}$ (4) $\frac{9}{16}$

(Space for Rough Work)

79. The area of the closed figure bounded by $x = -2$, $y = 0$, $y = x^2 + x + 1$ and the tangent to the curve $y = x^2 + x + 1$ at (0, 1) is

(1) $\frac{10}{3}$ (2) $\frac{8}{3}$

(3) $\frac{13}{6}$ (4) $\frac{19}{6}$

80. Area between the curve $y = 2x^4 - x^2$ and x axis is

(1) $\frac{\sqrt{2}}{15}$ (2) $\frac{\sqrt{2}}{4}$

(3) $\frac{2}{15}$ (4) $\frac{2\sqrt{2}}{15}$

81. Area of the region bounded by $x = 0$, $y = 0$, $x = 3$, $y = 3$, $y \le e^x$ and $y \ge \ln x$ is

(1) 6 log 3 – 2 (2) 13 – 6 log 3

(3) 3 log 3 – 2 (4) 13 – 3 log 3

82. Area enclosed between the curves $y = [x]$ and $y = \{x\}$ $x \in R$, where $[\cdot]$ and $\{\cdot\}$ represent the greatest integer and fractional part functions, respectively is

(1) $\frac{1}{2}$ (2) $\frac{1}{4}$

(3) 1 (4) 2

83. The order and degree of the differential equation of all tangent lines to the parabola $2y = x^2$ respectively are

(1) 1, 1 (2) 1, 2

(3) 2, 1 (4) 2, 2

84. The solution of the differential equation $y \log y + 2x \frac{dy}{dx} = 0$, where $y(1) = e$ is

(1) $x \log y = 1$ (2) $\sqrt{x} \log y = 1$

(3) $x^2 y \log y = 1$ (4) $\log y + x^2 \log 2 = 1$

85. The solution of $2\left(x^2 \frac{dy}{dx} - xy\right) = 1 + \cos\frac{y}{x}$ is

(1) $\tan\frac{y}{2x} + \frac{1}{4x^2} = c$ (2) $\tan\frac{y}{x} + \frac{1}{2x^2} = c$

(3) $\tan\frac{y}{2x} + \frac{1}{8x^2} = c$ (4) $\tan\frac{y}{x} + \frac{1}{4x^2} = c$

86. The solution of equation $\frac{dy}{dx} = \frac{x^2 + y^2 + 1}{xy}$ satisfying $y(1) = 1$ is given by

(1) $y^2 + 1 = x^2 \log x$

(2) $y^2 - 1 = 2 \log x$

(3) $y^2 - 1 = 2 \log x^2$

(4) $y^2 + 1 = 2x^2 (\log x + 1)$

87. Integrating factor of differential equation $\cos^2 x \cdot \frac{dy}{dx} + y \sin 2x = 1$ is

(1) $\log|\sec x|$ (2) $\sec x$

(3) $\sec^2 x$ (4) $2 \log|\sec x|$

88. The family of curves represented by $\frac{dy}{dx} = \frac{x^2 + 1}{y^2 + 1}$ and $\frac{dy}{dx} + \frac{y^2 + 1}{x^2 + 1} = 0$

(1) Touch each other (2) Are one and the same

(3) Are orthogonal (4) Are of second degree

89. $y = \frac{ax}{1 + bx}$ is a solution of $\frac{dy}{dx} = \frac{y^2}{x^2}$, then

(1) $a \in R$, $b = 1$ (2) $a \in R$, $b = 2$

(3) $a = 1$, $b \in R$ (4) $a = 2$, $b \in R$

90. Family of curves $y = Ax - A^2$ is represented by the differential equation of degree

(1) 3 (2) 2

(3) 1 (4) Not defined

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(Space for Rough Work)