PHYSICS

1. A convex mirror and a concave mirror of radius 10 cm each are placed 15 cm apart facing each other. An object is placed midway between them. If the reflection first takes place in the concave mirror and then in convex mirror, the position of the final image is
   (a) on the pole of the convex mirror
   (b) on the pole of the concave mirror
   (c) at a distance of 10 cm form convex mirror
   (d) at a distance of 5 cm from concave mirror

2. A concave mirror of focal length l forms an erect image of twice the size of the object. The object distance from the mirror is
   (a) f/2   *(b) f/4*
   (c) 3f/2   *(d) 2f*

3. A concave mirror is placed on a horizontal table with its axis directed vertically upwards. Let O be the pole of the mirror and C its centre of curvature. A point object is placed at C. It has a real image, also located at C. If the mirror is now filled with water, the image will be
   (a) real and will remain at C
   (b) real and located at a point between C and O
   (c) real and located at a point between C and O
   (d) real and located at a point between C and O

4. An object is placed at a distance of f/2 from a convex lens of focal length f. The image will be
   (a) at one of the foci, virtual and double its size
   (b) at 3f/2 real and inverted
   (c) at 2f. virtual and erect
   (d) none of these

5. A plane glass mirror of thickness 3 cm of material of $\mu = 3/2$ is silvered on the back surface. When a point object is placed 9 cm from the front surface of the mirror, then the position of the brightest image from the front surface is
   (a) 9 cm   (b) 11 cm
   (c) 12 cm   (d) 13 cm

6. A plane mirror is placed 22.5 cm in front of a concave mirror of focal length 10 cm. Find where an object can be placed between the two mirrors, so that the first image in both the mirrors coincides.
   (a) 20 cm from concave mirror
   (b) 15 cm from the concave mirror
   (c) 5 cm from plane mirror
   (d) 7.5 from plane mirror

7. An object is placed 21 cm in front of a concave mirror of radius of curvature 20 cm. A glass slab of thickness 3 cm and refractive index 1.5 is placed close to the mirror in the space between the object and the mirror. Find the position of the final image formed. The distance of the nearer surface of the slab from the mirror is 10 cm.
   (a) The final image is formed at object position
   (b) The final image will formed 20 cm in front of concave mirror
   (c) The final image will formed 20 cm behind of concave mirror
   (d) The final image will formed 40 cm in front of concave mirror

8. Converging rays strike a spherical convex mirror such that they can form the image (in the absence of mirror) between pole and focus. Now what can you say about final image formed by mirror?

   (a) real   (b) virtual
   (c) erect   (d) inverted

9. A plane mirror and an object has speeds of 5 m/s and 10 m/s respectively. If the motion of mirror and object is along the normal of the mirror then the speed of image may be:
(a) 0 m/s
(b) 10 m/s
(c) 20 m/s
(d) 25 m/s

10. In the figure shown consider the first reflection at the plane mirror and second at the convex mirror. AB is object.
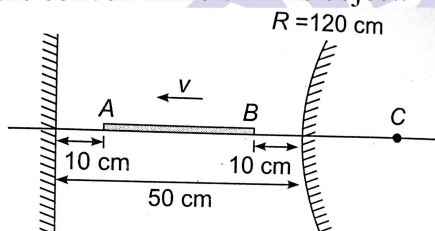
(a) the second image is real and inverted with magnification 1/5
(b) the second image is virtual and erect with magnification 1/5
(c) the second image moves towards the convex mirror
(d) the second image moves away from the convex mirror

11. When a ray of light enters a glass slab from air
(a) its wavelength decreases
(b) its wavelength increases
(c) its frequency increases
(d) neither its wavelength nor its frequency changes

12. When a ray of light enters a medium of refractive index μ, it is observed that the angle of refraction is half the angle of incidence then angle of incidence is
(1) $2\cos^{-1}(\mu/2)$
(2) $\cos^{-1}(\mu/2)$
(3) $2\cos^{-1}(\mu)$
(4) $2\sin^{-1}(\mu/2)$

13. Refractive index μ is given as $\mu = A + B/\lambda^2$) where A and B are constants and λ is wavelength, then dimensions of B are same as that of
(1) wavelength
(2) volume
(3) pressure
(4) area

14. A particle is moving towards a fixed spherical mirror. The image

(1) must move away from the mirror
(2) must move towards the mirror
(3) may move towards the mirror
(4) will move towards the mirror only if the mirror is convex

15. A point object at 15 cm from a concave mirror of radius of curvature 20 cm is made to oscillate along the principal axis with amplitude 2mm. The amplitude of its image will be
(1) 2 mm
(2) 4 mm
(3) 8 mm
(4) none of these

CHEMISTRY

1. Which of the following pairs of compounds can be used as starting material in the synthesis of 2-phenyl-2-pentanol?

(a) $CH_3-(CH_2)_2-CH_2Br$ and C_6H_5COOH
(b) $(CH_3)_2CHCH_2$ Br and $PhCOCH_3$
(c) $PhBr$ and $CH_3CH_2CH_2COCH_3$
(d) $PhBr$ and $(CH_3)_2$ $CHCH_2$ $COCH_3$

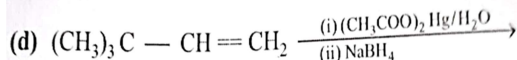2. What is the product of the reaction of methyl cyclohexene with B_2H_6 in THF followed by the oxidation with alkaline H_2O_2?
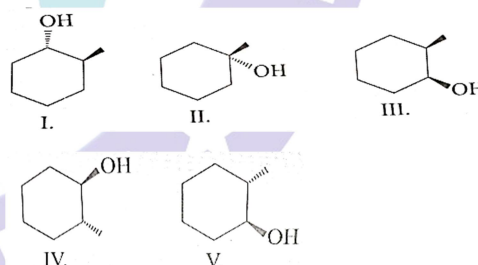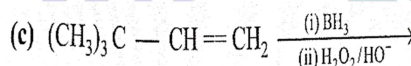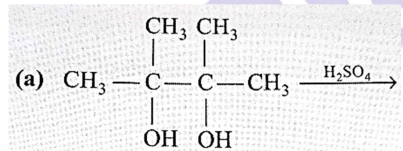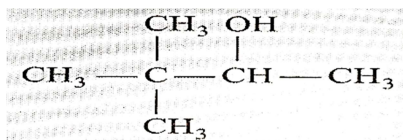

(a) Both II and III
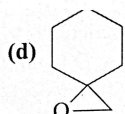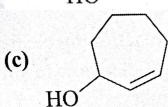(b) only II
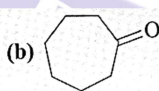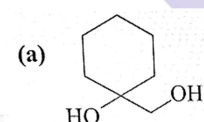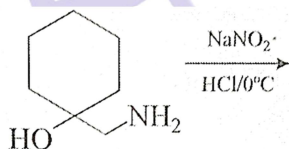(c) Both III and IV
(d) Both I and IV

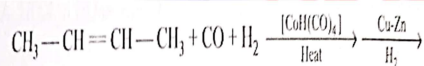3. Choose the reagent and reactant that would produce 2-methyl-2-butanol as the major pooduct.
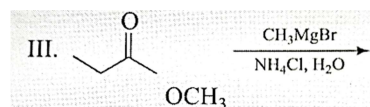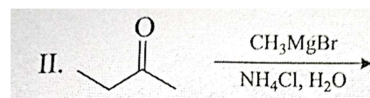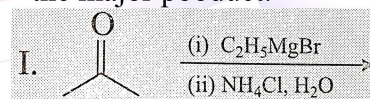
(a) I,II and III
(b) Both I and III
(c) Only I
(d) Only III

4. How the following compound can be synthesized?

$$CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - \underset{\underset{CH_3}{}}{\overset{OH}{|}}{CH} - CH_3$$

(a) $CH_3 - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_3 \xrightarrow{H_2SO_4}$

(b) $(CH_3)_3 C - CH == CH_2 \xrightarrow[H_2O]{H_2SO_4}$

(c) $(CH_3)_3 C - CH == CH_2 \xrightarrow[(ii) H_2O_2/HO^-]{(i) BH_3}$

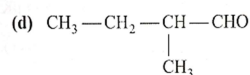(d) $(CH_3)_3 C - CH == CH_2 \xrightarrow[(ii) NaBH_4]{(i) (CH_3COO)_2 Hg/H_2O}$
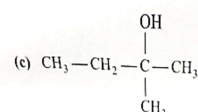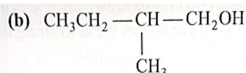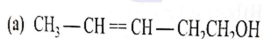
5. What is the correct structure for the major compound produced by the following reaction sequence ?

6. In the reaction given below ,

$CH_3 - CH == CH - CH_3 + CO + H_2 \xrightarrow[Heat]{[CoH(CO)_4]} \xrightarrow[H_2]{Cu-Zn}$

The final major organic product is

(a) $CH_3 - CH == CH - CH_2CH_2OH$

(b) $CH_3CH_2 - \underset{\underset{CH_3}{|}}{CH} - CH_2OH$

(c) $CH_3 - CH_2 - \underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}} - CH_3$

(d) $CH_3 - CH_2 - \underset{\underset{CH_3}{|}}{CH} - CHO$

7. Primary alcohol can easily be prepared from primary alkyl halide vis S_N2 reaction with aqueous NaOH. However, similar method does not work for the preparation tertiary alcohol (tertiary butanol) from tertiary butyl bromide?

(a) $(CH_3)_3 CBr + KOH \xrightarrow{C_2H_5OH} \xrightarrow{H_2SO_{4/Heat}}$

(b) $(CH_3)_3, CBr + CH_3COOAg(aq) \xrightarrow{H_3O^+}$

(c) $(CH_3)_3 CBr \xrightarrow{Mg/(C_2H_5)_2O(i)O_2/H_3O^+}$

(d) $(CH_3)_3 CBr \xrightarrow{KOH/Ethanol(i)B_2H_6/(ii)H_2O_2/NaOH}$
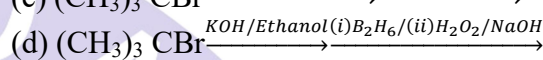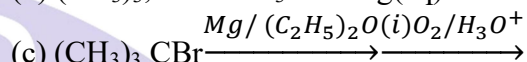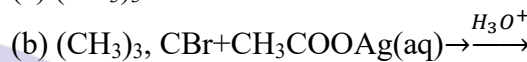
8.

What is the major product in the following reaction?

$C_6H_5 - CH == CH - CH_3 \xrightarrow[H_2O]{(i)(CH_3COO)_2 Hg} \xrightarrow[H_3O^+]{(ii) NaBH_4}$

(a) $C_6H_5 - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$

(b) $C_6H_5 - \underset{\underset{OH}{|}}{CH} - CH_2CH_3$
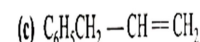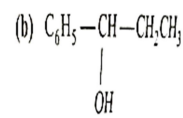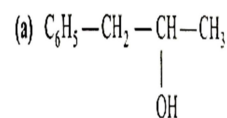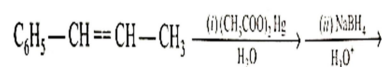
(c) $C_6H_5CH_2 - CH == CH_2$

(d) $C_6H_5 - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_3$
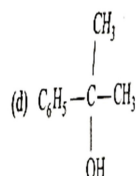
9. Which of the following does not give effervescence when added to ethanol?
(a) $CH_3 MgBr$
(b) NaH
(c) $NaNH_2$
(d) $NaHCO_3$

10. Which compound given below has the highest solubility in water?
(a) CH_3OH
(b) CH_3CH_2OH
(c) $OH - CH_2CH_2 - OH$
(d) $OH - CH_2 - CH(OH) - CH_2OH$

11. An organic compound $C_4H_{10}O$ (X) on reaction with I_2 / red - P gives C_4H_9I which on further reaction with $AgNO_2$ gives $C_4H_9NO_2$(Y) Y on treatment with HNO_2 forms a blue solution which turns to red on making solution slightly alkaline The possible identify of X is
(a) 1-butanol
(b) 2-methyl-1-pentanol
(c) 2-butanol
(d) Either (a) or (b)

12. The correct statement regarding 3-ethyl-3-hexanol is
(a) It changes colour of CrO_3/H_2SO_4
(b) It is oxidised on heating with copper metal, producing ketone
(c) It gives yellow precipitate with $NaOH/I_2$
(d) It changes colour of cerric nitrate [Ce $(NO_3)_4$] from yellow to red

13. An alcohol has molecular formula $C_6H_{12}O$ X and it gives immediate turbidity with cold, concentrated HCI even in the absence of $ZnCl_2$ X can also be obtained by treatment of an other with excess of CH_3 MgBr followed by acid hydrolysis. Hence, the correct statement regarding X is
(a) It is 3-methyl-3-pentanol
(b) It is 2-methyl-3-pentanol
(c) It is 2-methyl-2-pentanol
(d) Either (b) or (c)

14. Arrange the following alcohols in the increasing order of reactivity with HBr
(I) benzyl alcohol
(II) p-methyl benzyl alcohol
(III) p-nitrobenzyl alcohol
(IV) p-chlorobenzyl alcohol
(a) I<II<III<IV
(b) IV <III <II<I
(c) II<I<IV<III
(d) III<IV<I<II

15. Which is the most appropriate reagent for the following oxidation reaction?
CH_3-CH=CH-$CH_2OH \rightarrow CH_3$-CH=CH-COOH
(a) KMnO4/H_2SO_4
(b) $KMnO_4$/ NaOH
(c) CrO3/HCl/Pyridine
(d) CrO_3/Acetone/H_2O

MATH'S

1. Find the valu of $\int_{-\pi/2}^{2\pi} sin^{-1}(sin x)dx$.

2. Evaluate $\int_0^{1/\sqrt{2}} \frac{sin^{-1}x}{(1-x^2)^{3/2}}$ dx.

3. Evaluate $\int_0^{1.5}[x^2]dx$, wheree $[.]$ denotes the greatest integer function.

4. Evaluate
$$\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}}\, dx.$$

5. If [x] denotes the greatest integer less or equal to x Then find the value of the integral $\int_0^2 x^2[x]\, dx$.

6. The value of
$$\int_0^1 \log x dx \text{ is}$$
(a) 1   (b) 2
(c) -2   (d) -1

7. $\int_0^2 \sqrt{\frac{2+x}{2-x}}dx =$
(a) $\pi + 2$ (b) $\pi + \frac{3}{2}$
(c) $\pi + 1$ (d) None of these

8. If f(x) = $\begin{cases} 4x + 3, if\ 1 \le x \le 2 \\ 3x + 5, if\ 2 < x \le 4 \end{cases}$ then $\int_1^4 f(x)dx =$
(a) 80   (b) 20
(c) -20   (d) 37

9. The value of $\int_0^1 \frac{dx}{x+\sqrt{1-x^2}}$ is
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{2}$
(c) $\frac{1}{2}$ (d) $\frac{\pi}{4}$

10. $\int_0^1 sin^{-1}\left(\frac{2x}{1+x^2}\right) dx =$
(a) $\frac{\pi}{2}$-2log$\sqrt{2}$ (b)$\frac{\pi}{2}$+2log$\sqrt{2}$
(c) $\frac{\pi}{4}$-log$\sqrt{2}$ (d) $\frac{\pi}{4}$+log$\sqrt{2}$

11. $\int_1^2 e^x \left(\frac{1}{x} - \frac{1}{x^2}\right) dx =$
(a) $\frac{e^2}{2} + e$ (b) e $-\frac{e^2}{2}$
(c) $\frac{e^2}{2} - e$ (d) None of these

12. $\int_0^{\pi/2} |sinx - \cos x| dx =$
(a) 0   (b) 2($\sqrt{2}$-1)
(c) $\sqrt{2} - 1$ (d) 2($\sqrt{2} + 1$)

13. The value of $\int_0^{\pi/2} \frac{2^{sinx}}{2^{sinx}+2^{\cos x}} dx$ is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$

(c) π (d) 2π

14. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin|x| dx$ *is equal to*

(a) 0   (b) 1

(c) 2   (d) -π

15. $\int_0^{\pi/2} \frac{\sin^n\theta}{\sin^n\theta + \cos^n\theta} d\theta$ is equal to

(a) 1   (b) 0

(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$