Dear Parents/Students,

- ✓ Thank you for participating in the **STAR (Student Talent academic Reward) Exam.**
- ✓ All attempts have been made in making sure that you experience an **error-free** exam. However, in case if you find any discrepancy in any question/option, feel free to inform us through message on our Whatsapp No. **7976711979**. Our Expert panel will surely review your suggestions.

Regards,
Shubham Galav
Head, Young Scholar's Programme and STAR Cell
The Radiant Academy Udaipur

CLASS : XII

PHYSICS, CHEMISTRY & MATHEMATICS

SAMPLE PAPER

ANSWER KEY

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	A	D	C	A	A	D	A	B	A	C	A	B	A	D	B
Ques.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	B	C	B	A	D	B	C	D	C	B	B	D	B	A	A
Ques.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	D	D	D	A	B	B	D	D	D	B	D	C	B	D	D
Ques.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	C	C	B	D	A	A	B	B	B	A	B	B	B	B	A

SOLUTIONS

1. $$I = I_0\left(1-e^{-\frac{1}{r}}\right)$$

$$\frac{9}{10}I_0 = I_0\left(1-e^{-\frac{t_1}{r}}\right)$$

$$\Rightarrow e^{-\frac{t_1}{r}} = \frac{1}{10}$$

$$\Rightarrow e^{\frac{t_1}{r}} = 10$$

$\Rightarrow t_1 = r \ln 10$ ...(i)

and $$\frac{99}{100}I_0 = I_0\left(1-e^{-\frac{t_2}{r}}\right)$$

$$\Rightarrow e^{-\frac{t_2}{r}} = \frac{1}{100}$$

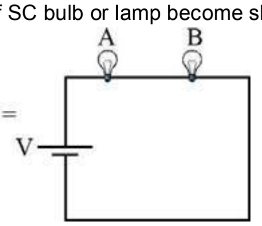
$\Rightarrow t_2 = r \ln 100 = 2r \ln 10$ ...(2)

from equations (1) and (2), we have

$$\Rightarrow \Rightarrow \frac{t_1}{t_2} = \frac{1}{2}$$

3. After closing of SC bulb or lamp become short circuited

$\therefore$ new circuit =



potential across A and B before closing of S = V/3
potential across A and B after closing of S = V/2
As $P \propto V^2$

$$\therefore \frac{P_i}{P_f} = \frac{4}{9}$$

$$P_f = \frac{P_i \times 9}{4} = 2.25\, P_i$$

5. Since unpolarised light is passing through the first polarizer, hence the intensity of light after crossing the first polarizer will be

$$I_1 = \frac{1}{2} I_0 = 16 Wm^{-2}$$

Let us assume that the angle between the transmission axis of the first and second polarizer is θ, then from Malus law we can find out the intensity of light after it crosses the second polarizer.

$I_2 = I_1 \cos^2\theta = 16 \cos^2\theta$

Similarly, the intensity of light after crossing the third polarizer is

$I_3 = I_2 \cos^2 (90^\circ - \theta) = 16 \cos^2\theta \sin^2\theta$

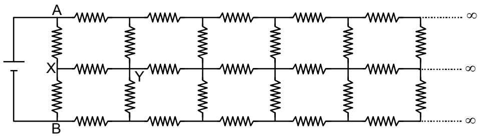
$\Rightarrow I_3 = 16 \cos^2\theta \sin^2\theta = 3$

$\Rightarrow 4 \cos^2\theta \sin^2\theta = 3/4$

$\Rightarrow \sin^2 (2\theta) = 3/4$

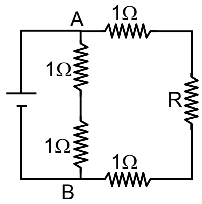
$\theta = 30^\circ$

6.



By symmetry we can say that current through an will be equal to current through XB so current through XY will be zero.

Now lets say equivalent resistance between A and B is P.



$$R = \frac{2 \times (2 + R)}{2 + (2 + R)}$$

$4R + R^2 = 4 + 2R$

$R^2 + 2R - 4 = 0$

$R = (\sqrt{5} - 1)\,\Omega$

7. The total flux, before and after the position change of the switch, remains the same

$L_1 i_1 = L_2 i_2$

$L_1 = 5H$, $i_1 = 4$ A and $L_2 = 15$ H

$5 \times 4 = 15 \times i$

$$\Rightarrow i = \frac{4}{3} = \frac{a}{b}$$

$\Rightarrow a + b = 7$

8. Two coils carry current in opposite directions, hence net magnetic field at centre will be difference of the two field.

$$\text{ie, } B_{net} = \frac{\mu_0}{4\pi} . 2\pi N \left[\frac{i_1}{r_1} - \frac{i_2}{r_2}\right]$$

$$= \frac{10\mu_0}{2}\left[\frac{0.2}{0.2} - \frac{0.3}{0.4}\right]$$

$$= \frac{5}{4}\mu_0$$

9. When an electron jumps down from any higher energy level to the first energy level, then the emitted lines form the Lyman series

$$\frac{1}{\lambda_L} R\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$$, where R is the Rydberg constant.

Similarly, when an electron jumps down from any higher energy level to the second energy level, then the emitted lines form the Balmer series

$$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$$

For maximum wavelength, the energy gap should be the smallest

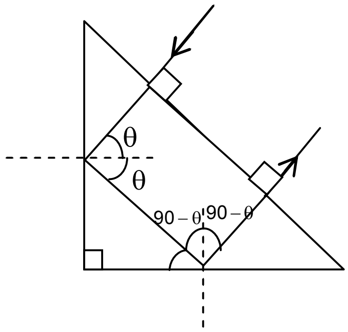
$$n = 2, \frac{1}{\lambda_L} = R\left(1 - \frac{1}{2^2}\right) = R\left(1 - \frac{1}{4}\right) = \frac{3R}{4}$$

$$n = 3, \frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5R}{36}$$

$$\frac{\lambda_L}{\lambda_B} = \frac{5}{27}$$

10. $$\vec{E}_P = \left(\frac{\sigma}{2\epsilon_0} + \frac{2\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0}\right)(-\hat{k})$$

11.



$\theta = 45^0$

$\mu_P \sin 45^0 = \mu \sin 90^0$

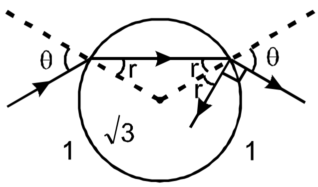
$$\mu_P = \frac{\mu}{\sin 45^0} = \sqrt{2}\,\mu$$

12. Use $$\Delta X_{mirror} = \frac{\Delta X_{object} + \Delta X_{image}}{2}$$, and

$\Delta X_{mirror} = 3$, $\Delta X_{object} = -2$,

we get $\Delta X_{image} = 8$

13.



$1 \sin\theta = \sqrt{3} \sin r$

$1 \sin\theta = \sqrt{3} \cos\theta$

$\tan\theta = \sqrt{3}$

$$\theta = \frac{\pi}{3}$$

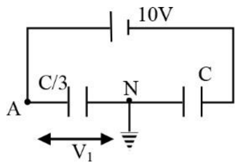
14. $\varepsilon_1 = 300\,\alpha$ ......

$-\varepsilon_2 + \varepsilon_1 = 100\,\alpha$ ......

where, α is the potential gradient

$$\therefore \frac{\varepsilon_2}{\varepsilon_1} = \frac{2}{3}.$$

15.



$$V_A - V_N = \frac{10 \times C}{C + \frac{C}{3}} = \frac{30C}{4C} = 7.5$$

$V_A - 0 = 7.5$
$V_A = 7.5$ V

16. A → u ←v/2 C
2m m
Applying conservation of linear momentum
2mu = mu – mu/2
So,

$$\lambda_A = \frac{h}{2mu} \lambda B = \frac{h}{mv} = \frac{\lambda_A}{2} \lambda_C = \frac{h}{m\frac{v}{2}} = \lambda_A$$

17. Probability for a particular nucleus to decay in any time intercal dt is

$$\frac{dN}{N} = \lambda dt$$

$$= \frac{0.693}{T_{1/2}} \times 4$$

$= 12.4 \times 10^{-4}$

18. Since unpolarized light is passing through the first polarizer, hence the intensity of light after crossing the first polarizer will be

$$I_1 = \frac{1}{2} I_0 = 16 Wm^{-2}$$

Let us assume that the angle between the transmission axis of the first and second polarizer is θ, then from Malus law we can find out the intensity of light after it crosses the second polarizer.

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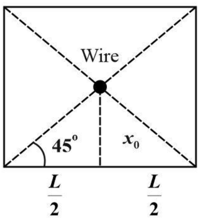
$\theta = 30^\circ$

19. 0.50



If we arrange three more rectangular plates (similar to the one which is given) around the wire, then we get a rectangular box open at both ends. We bring two more plates and use them to close this rectangular box. We can see from the figure that we have a symmetric system for which the total flux is

$$\phi = \frac{\lambda \ell}{\varepsilon_0}$$

Hence the flux through one plate is

$$\phi = \frac{\lambda \ell}{4\varepsilon_0} = 0.5$$

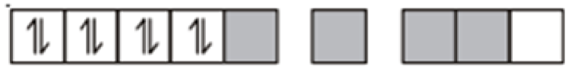
20. $X_L = 31\Omega$, $X_C = 25\Omega$, $R = 8\Omega$
Impedance of series LCR is

$$Z = \sqrt{(R^2) + (X_L - X_C)^2}$$

$$= \sqrt{(8)^2 + (31-25)^2} = \sqrt{64+36} = 10\Omega$$

Power factor, $\cos\phi = R/Z = 8/10 = 0.8$

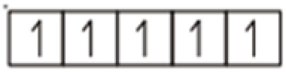
21. $[Ni(CN)_4]^{2-} \Rightarrow 3d^6$

⇒ 

B
m

⇒ dsp^2
⇒ Square planar

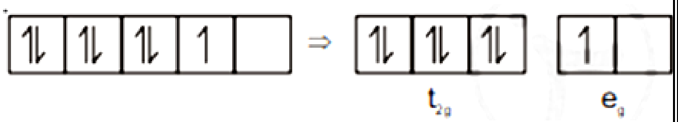
22. $[FeF_6]^{3-} \Rightarrow Fe^{3+} \Rightarrow 3d^5$

⇒  (∵ F^- is a weak field ligand)

⇒ Five unpaired electrons

$\Rightarrow \mu = \sqrt{5(5+2)}$ BM = $\sqrt{35}$ BM = 5.92 BM

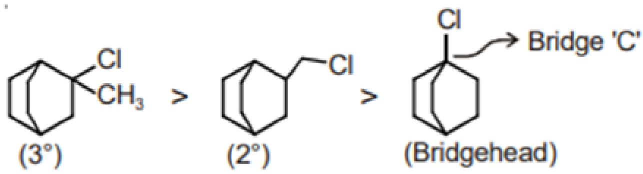
23. d^7 configuration in strong field ligand



CFSE $= (-0.4 \times 6 + 0.6)\Delta_0$
$= (-2.4 + 0.6)\Delta_0$
$= -1.8\,\Delta_0$

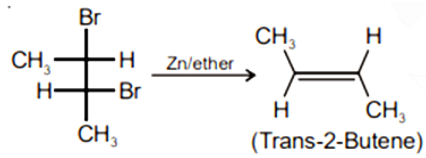
24. In case of high spin complexes $\Delta_0 < P$

25. For SN1 reaction the correct order of reactivity would be

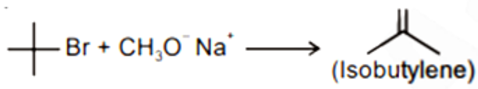


Note: Bridge-head carbocation is highly unstable, because sp2 hybridisation is not possible al bridge 'C' atom

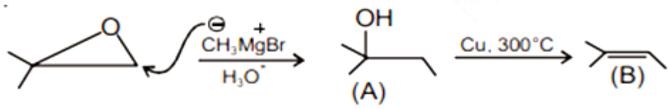
26.



27.



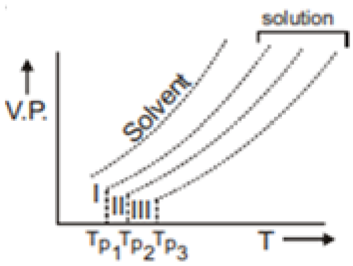
28.



∴ In basic medium the opening of epoxide is S_N2 type. So, nucleophile CH_3 attack less hindered 'C' of epoxide

29. Hydrolysis of cyclic ester will produce carboxylic acid

31. When nonvolatile solute is added in volatile solvent $\rightarrow$ vapour pressure of solvent decreases and B.P. increases



$T_{b_3} > T_{b_2} > T_{b_1}$

T_b = boiling point of solution

As vapour pressure decrease $\Rightarrow$ B.P. of solution increases

So, III have minimum V.P. = maximum B.P. = Elevation in B.P.

32. $2A \xrightarrow{\text{dimerises}} (A)_2$

t = 0 1 0

t = t_1 1 - α $\frac{\alpha}{2}$

$$i = 1 - \alpha + \frac{\alpha}{2} = 1 - \frac{\alpha}{2}$$

$$\Delta T_b = iK_b \times m$$

$$0.52 = \left(1 - \frac{\alpha}{2}\right)(0.52 \times 2)$$

$$1 - \frac{\alpha}{2} = \frac{1}{2}$$

$$\frac{\alpha}{2} = 1 - \frac{1}{2}; \qquad \frac{\alpha}{2} = \frac{1}{2}$$

α = 1 or (100%)

33. $4A \xrightarrow{\text{tetramerises}} (A)_4$

t = 0 1 0

t = t_1 1 - α $\frac{\alpha}{4}$

$$\alpha = \frac{80}{100} = 0.8$$

$$i = 1 - \alpha + \frac{\alpha}{4}$$

$$\Rightarrow 1 - 0.8 + \frac{0.8}{4}$$

$$\Delta T_f = i(K_f \times m)$$

$$0.3 = 0.4\left[1.86 \times \frac{2.5 \times 1000}{M \times 100}\right]$$

$$M = 62\,g$$

34. $$E = E^\circ + \frac{0.059}{2}\log\frac{[Sn^{+2}]}{[Pb^{+2}]}$$

$$0 = -0.01 + \frac{0.059}{2}\log\frac{[Sn^{+2}]}{[Pb^{+2}]}$$

$$0.01 = \frac{0.059}{2}\log\frac{[Sn^{+2}]}{[Pb^{+2}]}$$

$$\log\frac{[Sn^{+2}]}{[Pb^{+2}]} \Rightarrow \frac{0.01 \times 2}{0.059} \Rightarrow 0.33$$

35. According to given reactions

- B_2 can oxidise A^-, and cannot oxidise C^-
- A_2 can oxidise D^-

So reduction potential $C_2 > B_2 > A_2 > D_2$

(C) can reduced but not oxidised by B_2 (A) reduced by D^-

So, oxidation potential $\rightarrow C_2 < B_2 < A_2 < D_2$

36. k = cell constant x $\frac{1}{R}$

$\Rightarrow$ cell constant = R x k = 0.012 x 55 = 0.66 cm^{-1}

38. Cetyltrimethyl ammonium bromide is cationic detergent.

39. The principal emulsifying agents for O/W emulsions are proteins, gums, natural and synthetic soaps.