Aakash + BYJU'S

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Aakash National Talent Hunt Exam 2021

(*Class XII Studying Moving to XII Passed*)

ANSWERS

1. (4)
2. (3)
3. (3)
4. (2)
5. (2)
6. (1, 2, 3)
7. (2, 3)
8. (4)
9. (1)
10. (1)
11. A – P, R, S
    B – Q, S
    C – P, R
    D – Q, R, S
12. (2)

13. (4)
14. (4)
15. (4)
16. (2)
17. (2, 3, 4)
18. (1, 2, 3, 4)
19. (1)
20. (4)
21. (3)
22. A – Q, S
    B – R, S
    C – P, S
    D – P, S
23. (3)
24. (3)

25. (3)
26. (3)
27. (2)
28. (3)
29. (1, 2)
30. (1, 3)
31. (2, 4)
32. (3)
33. (2)
34. (2)
35. A – P, Q, R
    B – R, S
    C – P, Q, R
    D – R, S

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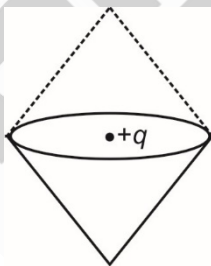
ANSWERS & SOLUTIONS

PHYSICS

1. Answer (4)

$$U_i = \frac{3kq^2}{a}$$

$$U_f = \frac{kq^2}{a} + \frac{2\sqrt{3}\,kq^2}{a}$$

$$W = U_f - U_i = \frac{2\sqrt{3}\,kq^2}{a} - \frac{2kq^2}{a}$$

$$= \frac{2kq^2}{a}(\sqrt{3}-1)$$

2. Answer (3)

Put a similar cone above it then total flux linked with closed surface.

$$2\phi = \frac{q}{\varepsilon_0}$$

$$\phi = \frac{q}{2\varepsilon_0}$$

3. Answer (3)

$$H = I^2Rt$$

$$800 = (5)^2 \times 8 \times R$$

$$R = 4\,\Omega$$

4. Answer (2)

$$B'_H = B_H \cos 37°$$

$$\tan \delta' = \frac{B_v}{B'_H} \Rightarrow \tan 45° = \frac{5}{4} \frac{B_v}{B_H}$$

$$\tan \delta = \frac{4}{5} \Rightarrow \delta = \tan^{-1}\left(\frac{4}{5}\right)$$

5. Answer (2)

$$i_{r.m.s.} = \sqrt{a^2 + \frac{b^2 + c^2}{2}}$$
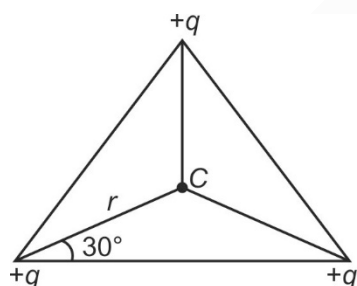
$$= \sqrt{(3)^2 + \frac{(4)^2 + (4)^2}{2}}$$

= 5 A

6. Answer (1, 2, 3)

$$\phi = BA \cos(90° - \theta)$$

$$e = -\frac{d\phi}{dt}$$

$$e = A \sin\theta \frac{dB}{dt} + B \sin\theta \frac{dA}{dt} + BA \cos\theta \frac{d\theta}{dt}$$
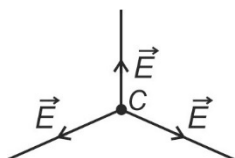
7. Answer (2, 3)

Electric potential at centroid C

$$V = \frac{3q}{4\pi\varepsilon_0 r}$$
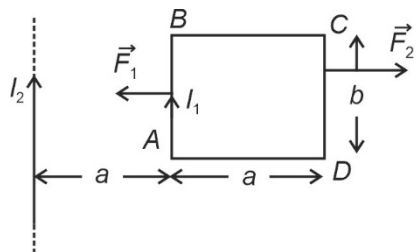
$$r = \frac{a}{\sqrt{3}}$$

$$\Rightarrow \quad V = \frac{3\sqrt{3}q}{4\pi\varepsilon_0 a}$$

Electric field at centroid

Vector sum of three concurrent electric fields of equal magnitudes at equal angles in a plane will be zero.

8. Answer (4)

Force on AB, $F_1 = \dfrac{\mu_0}{2\pi}\dfrac{I_1 I_2 b}{a}$

Force on CD, $F_2 = \dfrac{\mu_0}{2\pi}\dfrac{I_1 I_2 b}{2a}$

$F_{net} = F_1 - F_2$

$\qquad = \dfrac{\mu_0 I_1 I_2 b}{4\pi a}$

9. Answer (1)

$|dU| = I_1 (b dx)\dfrac{\mu_0}{2\pi}\dfrac{I_2}{x}$

$\int |dU| = \dfrac{\mu_0 I_1 I_2 b}{2\pi}\displaystyle\int\limits_{a}^{2a}\dfrac{dx}{x}$

$U = \dfrac{\mu_0 I_1 I_2 b}{2\pi}\ln 2$

10. Answer (1)

The capacitive reactance of capacitor is

$x_c = \dfrac{1}{2\pi f c}$

for dc, $f = 0 \Rightarrow x_c = \infty$

So it block dc and allow ac

11. Answer A(P,R,S); B(Q,S); C(P,R); D(Q,R,S)

In case (A)

$\vec{F}_{AB} = -IB_0 a\hat{j},\ \vec{F}_{BC} = IB_0 a(-\hat{k}),\ \vec{F}_{CD} = 0$

$|\vec{F}| = |\vec{F}_{AB} + \vec{F}_{BC} + \vec{F}_{CD}| = IB_0 a\sqrt{2}$

In case (B)

$\vec{F}_{AB} = 0,\ \vec{F}_{BC} = IB_0 a\hat{k},\ \vec{F}_{CD} = 0$

$\Rightarrow |\vec{F}| = IB_0 a$

In case (C)

$\vec{F}_{AB} = -IB_0 a\hat{i},\ \vec{F}_{BC} = 0,\ \vec{F}_{CD} = -IB_0 a\hat{j},\ \vec{F}_{DE} = 0$

$|\vec{F}| = IB_0 a\sqrt{2}$

In case (D)

$\vec{F}_{AB} = -IB_0 a\hat{j},\ \vec{F}_{BC} = IB_0 a\hat{k},\ \vec{F}_{CD} = 0,\ \vec{F}_{DE} = IB_0 a\hat{j},\ \vec{F}_{EF} = 0$

$|\vec{F}| = IB_0 a$

CHEMISTRY
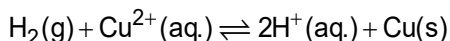
12. Answer (2)

For FCC unit cell,

$4r = \sqrt{2}a$

$a = \dfrac{4r}{\sqrt{2}} = 2\sqrt{2}r$

Edge occupied by atoms = 2r

Fraction of edge occupied by atoms $= \dfrac{2r}{2\sqrt{2}r} = \dfrac{1}{\sqrt{2}} = 0.7$

13. Answer (4)

Cell reaction is given as

$H_2(g) + Cu^{2+}(aq.) \rightleftharpoons 2H^+(aq.) + Cu(s)$

$Q = \dfrac{[H^+]^2}{p_{H_2(g)}} \times [Cu^{2+}]$

$E_{cell} = E^o_{cell} - \dfrac{0.059}{2} \log \dfrac{[H^+]^2}{p_{H_2} \times [Cu^{+2}]}$

For maximum E_{cell}, $[H^+]$ should be low and $p_{H_2(g)}$ and $[Cu^{2+}]$ should be high.

14. Answer (4)

Greater the charge on the flocculating ion added, greater is its power to cause coagulation.
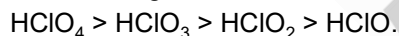
15. Answer (4)

Zn, Cd and Hg have completely filled *d*-subshell in the ground state as well as in their common oxidation state. Therefore, they are not regarded as transition element.

16. Answer (2)

Oxidising power of HClO is maximum among oxoacids of chlorine.

Acidic strength order

$HClO_4 > HClO_3 > HClO_2 > HClO.$

17. Answer (2, 3, 4)

- At azeotropic composition, the composition of liquid and vapour are same, therefore not possible to separate them by fractional distillation.
- Solution showing large positive deviation from Raoult's law form minimum boiling azeotrope.

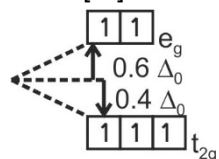18. Answer (1, 2, 3, 4)

For zero order reaction

$R = k \,[conc]^0$

$t_{1/2} \propto$ initial concentration of reactant

$[A]_t = [A]_0 - kt$, where $[A]_t$ is concentration at time t, $[A]_0$ is the initial concentration of the reactant.

19. Answer (1)

$Fe^{3+} : [Ar]3d^5$

CFSE = 0

$\because$ F$^-$ is a weak field ligand.

20. **Answer (4)**

Colour of aqueous solution of complexes of Ni^{2+} become violet with increase in number of en (ethylenediammine) ligands.

21. **Answer (3)**

At infinite dilution $\alpha = 1$ for every electrolyte.

22. **Answer A(Q,S); B(R,S); C(P,S); D(P,S)**

- $3Cu + 8HNO_3 \text{ (dilute)} \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

- $Cu + 4HNO_3 \text{ (conc.)} \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

- $4Zn + 10HNO_3 \text{ (dilute)} \rightarrow 4Zn(NO_3)_2 + 5H_2O + N_2O$

- $Zn + 4HNO_3 \text{ (conc.)} \rightarrow Zn(NO_3)_2 + 2H_2O + 2NO_2$

- $I_2 + 10HNO_3 \rightarrow 2HIO_3 + 10NO_2 + 4H_2O$

- $P_4 + 20HNO_3 \rightarrow 4H_3PO_4 + 20NO_2 + 4H_2O$

BIOLOGY

23. **Answer (3)**

Apomictic seeds are produced without fertilisation. They are formed from cells of integument or nucellus.

24. **Answer (3)**

25. **Answer (3)**

Cyclosporin A is an immunosuppressive agent.

26. **Answer (3)**

The three letter codons i.e. genetic code will direct the assembly of same amino acids in all organisms. Hence, transfer of DNA coding for a particular protein will direct the same effect, in terms of production, in all organisms.

27. **Answer (2)**

RT-PCR uses the enzyme reverse transcriptase [RT] in combination with PCR and gel electrophoresis. Reverse transcriptase makes the first DNA strand using the mRNA as a template.

28. **Answer (3)**

The given subject has undergone menopause due to which FSH levels rise in the absence of negative feedback mechanism.

29. **Answer (1, 2)**

Leading strand requires many primers and the replication is discontinuous on this strand.

30. **Answer (1, 3)**

In vitro fertilisation followed by transfer of embryo into the female genital tract is commonly known as test tube baby programme.

31. **Answer (2, 4)**

Biopsy is an invasive procedure wherein a cut or sectioned tissue is analysed. MRI uses non-ionising radiations and strong magnetic fields. Radiography and CT-scan uses X-rays (ionising in nature).

32. **Answer (3)**

RNA polymerase III synthesizes tRNA and 5 S rRNA

33. **Answer (2)**

Prokaryotes have only a single RNA polymerase whereas eukaryotes have different RNA polymerases. *Aspergillus* is a eukaryote.

34. Answer (2)

    Anti-tetanus immunoglobulin is used to prevent tetanus in those who have a wound that is a high risk and in patients who were not vaccinated using tetanus toxoid (TT).

35. Answer A(P,Q,R); B(R,S); C(P,Q,R); D(R,S)

    Haemophilia and colourblindness are sex linked recessive disorders. Cystic fibrosis and phenylketonuria are autosomal recessive disorders.

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