CBSE PMT – 2007 MAINS

PHYSICS

1. (a) How many photons of wavelength 439 nm should strike on a perfectly reflecting surface in 1 second so that it may exert a force of 10N?

(b) Can water be boiled without heating?

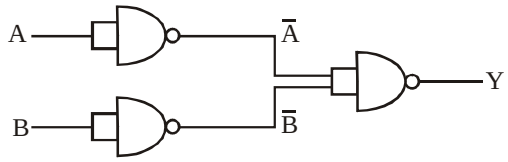
2. (a) Equation for two waves is given as $y_1 = a\sin(\omega t + \phi_1)$, $y_2 = a\sin(\omega t + \phi_2)$. If amplitude and time period of resultant wave does not change then calculate $(\phi_1 - \phi_2)$.

(b) A solid sphere of radius *a* having charge *q* is placed inside spherical shell of inner radius *r*, outer radius *R*.

Find potential at distance *x*, where $r < x < R$.

3. (a) Prove that for a monoatomic gas ratio of specific heat $\gamma = 5/3$

(b) Give the truth table of the following

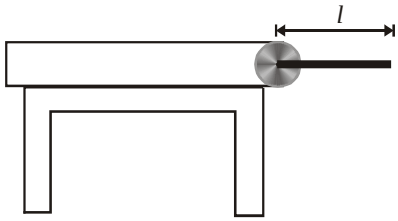


4. (a) Write the difference between nuclear force and coulombic force.

(b) An airplane is moving horizontally with speed of 100 m/sec at height of 2000 m from ground. A small object is detached from it and strikes the ground. Calculate the angle from vertical with which it strikes the ground.

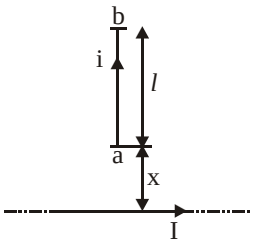
(c) Which of the following quantities have same dimensional formula?
Angular momentum, impulse, energy, torque, force and moment of inertia.

5. (a) From a table, a rod is hinged as shown in the figure. When the support is withdrawn calculate the acceleration of center of mass.



(b) There are two wires each produces frequency of 500Hz. By what percentage tension in one wire is increased so that 5 beats per second can be heard?

6. (a) Find the force on conductor carrying current *i* as shown the figure.



(b) A conducting cone is given charge *q*. How will the charge density and electric potential varies at different points of cone?

7. (a) When 4 amp current flows through battery from positive to negative terminal potential difference is 12V obtained, when 2 amp current passes from negative to positive terminal of the battery potential difference 9V is obtained, calculate emf and internal resistance of the battery.

(b) A small pulley of radius 20 cm and moment of inertia 0.32 kg m^2 is used to hang a 2kg mass with the help of a massless string. If this load is released then calculate acceleration of the block.

8. (a) Capacitance of 6μF is charged by 6V battery. Now it is connected with inductor of 5mH. Find current in inductor when 1/3rd of total energy is magnetic.

(b) An object is thrown vertically upward with some speed. It crosses two points *p, q* which are separated by *h* metre. If t_p is the time between *p* and highest point and coming back and t_q is the time between *q* and highest point and coming back, relate acceleration due to gravity t_p, t_q and *h*.

9. (a) Two coils *m* & *n* having 10 turns and 15 turns respectively are placed close to each other. When 2A current is passing through coil *m*, then flux linked in coil *n* is 1.8×10^{-4} Weber per turn. If 3A current is passed through coil *n* then, calculate the flux linked per turn of coil *m*.

(b) A string having tension 360N and mass /length $= 4\times10^{-3}\,\text{kg/m}$. It produces two consecutive resonant frequencies with a tuning fork, which are 375 Hz and 450 Hz. Find mass of string.

10. (a) In photoelectric effect a photon of wavelength 3300Å is incident on metal surface of work function 2.5eV. Now emitted electrons enter in a transverse magnetic field $6.7\times10^{-6}\,\text{T}$ and turn in a circular path of radius 50 cm. Calculate charge of electron from the given data?

(b) If temperature and magnetic field applied across paramagnetic substance are tripled, how many times intensity of magnetization of substance will change?

CHEMISTRY

11. (i) Two silver rods are dipped in 1M HCl and 1M HNO_3. In which of the two acids will the silver rods dissolve under standard conditions? Given: $E^0_{Ag/Ag^+} = -0.79$ volt, $E^0_{NO_3^-/NO} = +0.96$ volt.

(ii) A 0.1M acetic acid solution ionizes to 1.2%. What is its K_a ?

12. (i) Why NH_3 is more soluble in water than PH_3 ?

(ii) Why BH_3 dimerizes but BF_3 does not?

(iii) The complex $K[PtCl_3C_2H_4]$ has 3 chlorine atoms bonded to platinum. Why is the chlorine atom lying opposite to ethene have higher bond length?

13. (i) An electron in which orbit of lithium will have same energy as an electron in the second orbit of hydrogen?

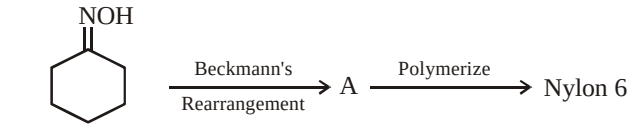
(ii) $I_2 + CH_3COCH_3 \xrightarrow{H^+} CH_3COCH_2I + HI$. For the reaction, Rate = $K[CH_3COCH_3]^1[H^+]^1$. What is the order of the reaction with respect to I_2? Also give the total order.

$[I_2]$ Mol/ltr	$[CH_3COCH_3]$ Mol/ltr	$[H^+]$ Mol/ltr	Rate Mol/ltr sec
3×10^{-3}	2.5×10^{-2}	1.5×10^{-3}	2×10^{-2}

Also find the value and unit of the rate constant from the data given above.

(iii) For a photoelectron, the frequency is given by the expression $\nu = 3.3\times10^{15}\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$. If the wavelength of the photoelectron is 6600Å, what will be the value of 'n'?

14. (i) Complete the reaction given below



Cyclohexanonoxime

(ii) Identify which of the following given compounds is optically active?

(a) 2-chloro 3-methyl pent -1, 4-diene (b) 3-methyl 3-hydroxy pentanol

(c) 2-chloro 2-methyl butane

(iii) Convert:

(a) $Ph - C \equiv CH \longrightarrow Ph - \underset{\underset{O}{\|}}{C} - CH_3$ (b) $Ar - NH_2 \longrightarrow ArNC$

(iv) An alkene C_4H_8 reacts with HBr both in the presence and absence of peroxides to give the same product. Identify the alkene.

15. (i) $C_4H_{10}O$ is produced on reaction of an alkane with H_2O/H_2SO_4, which is not resolvable into optical isomers. Identify the compound?

(ii) Make two possible dipeptides from the amino acids given below:

$$NH_2 - (CH_2)_5 - \underset{\underset{NH_2}{|}}{CH} - COOH \text{ and } NH_2 - \underset{\underset{COOH}{|}}{CH} - (CH_2)_3 - COOH$$

(iii) The amino acid alanine when kept in a solution with pH less than its isoelectric point it coagulates at the cathode and if pH is greater than isoelectric point it coagulates at anode. Explain this phenomenon.

(iv) Which out of 1-Butene and 2-Butene react easily with Br_2 in CS_2 and why?

16. (i) Why 1-Butyne gives sodium salt with $NaNH_2$ but 2-butyne does not?

(ii) Draw the structures for DNA purines?

17. (i) For 0.5 M H_2SO_3 solution $K_{a_1} = 1.8\times10^{-2}$ and $K_{a_2} = 8.3\times10^{-5}$. Find the concentrations of H^+, HSO_3^- and SO_3^{2-}?

(ii) N_2O_4 dissociates with a degree of dissociation as 0.4. Establish $K\chi$. Relation between $K\chi$ and Kp and the value of K_p. Given total pressure = 1 atm and T = 315 K.

(iii) 1 Mole of nitrogen and 4 mole of hydrogen react to form ammonia in a 20 litre vessel. 10 litres of water are added and the vessel properly shaken. What will be the pressure of the residual gases?

18. (i) Why is F_2 more reactive than Cl_2?

(ii) Why is CrO_4^{2-} more oxidizing than MoO_4^{2-} ?

(iii) Out of $(SiH_3)_2O$ and $(CH_3)_2O$ which is more basic and why?

19. (i) The empirical formula of an insoluble compound is $PtCl_2.(NH_3)_2$. On churning this compound with $AgNO_3$ we get $[Pt(NH_3)_4]Cl_2$ and $Ag_2[PtCl_4]$. What will be the molecular formula of the compound will be?

(ii) Out of trimethyl amine and triethyl phosphine, which one has higher dipole moment?

20. (i) Why PO_4^{3-} ions exist but NO_4^{3-} ions don't?

(ii) Why B_2 is paramagnetic but C_2 is not?

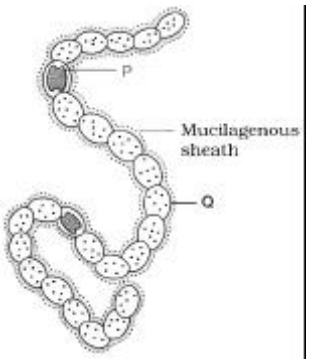
(iii) For a octahedral fields splitting $\Delta_0 > P$ when the pairing energy is less and $\Delta_0 < P$ when pairing energy is higher. Explain the spin magnetic moments acquired by d^5 and d^6 configurations of metal ions in this field.

BIOLOGY

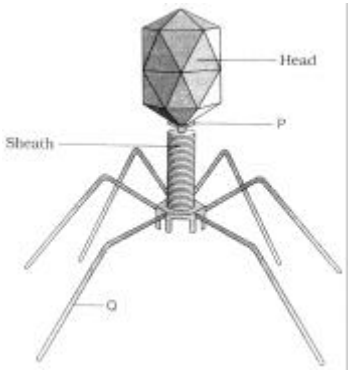
21. Write the location and function of the following

(a) Cytoskeleton
(b) Phytol chain
(c) Synergid
(d) Sieve tube element
(e) Centromere

22. Refer the following diagrms (a) to (e) :



(a)



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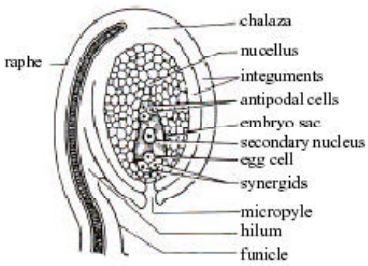

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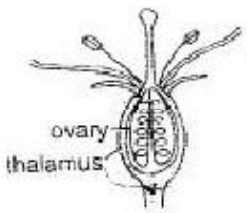


(d)

(e)

(a) What is shown in diagram (a)? What are (P) and (Q)?
(b) Tell whether the diagram (b) is T_1-phage or T_2-phage? What are (P) and (Q)?
(c) Which type of ovule is shown in diagram (c)? Give one reason.
(d) What is the type of flower called given in diagram (d)? Give examples of such flower.
(e) Which type of aestivation is shown in (e)? Give examples?

23. Write down the types of placentation, inflorescence and fruit of the following
(a) Pea (b) Coriander
(c) Wheat (d) Sunflower (e) Mustard

24. Differentiate between the following [Give one important difference]
(a) Culm and Caudex (b) Slime moulds and Fungi
(c) Cyathium and Hypanthodium (d) Biological magnification and eutrophication
(e) White rust and Brown rust.

25. Match the column-I and Column-II :

Column-I	**Column-II**
(a) Jacob and Monod	(i) Neurospora
(b) One gene one enzyme hypothesis	(ii) Operon
(c) Griffith	(iii) Reverse Transcriptase
(d) Temin and Baltimore	(iv) Okazaki fragments
(e) DNA polymerase	(v) Transformation
	(vi) Transduction
	(vii) Conjugation

26. Fill in the blanks with suitable words given in boxes:

Marsilea	Coralloid root	Usnea		Eichhomia
Monoecious		Pneumatophores	Geitonogamy	Cycas
Pinus	Dioecious	Vivipary	Xenogamy	Oscillatoria

(a) Rhizophora has both _____and _____
(b) Aquatic plants are _____(Pteridophyte) and _____ (Angiosperm)
(c) Plant bearing both male and female flowers is called_____and the pollination between different flowers of the same plant is called_____.
(d) _____has _____.

27. (a) Give any two conditions for seed habit.
(b) Among the pairs which one shows the tendency of seed habit?
(i) Lycopodium and Equisetum
(ii) Selaginella and Pteris.
(iii) Dryopteris and Pteridium.
(c) Suggest three ways to break seed dormancy.

28. Fill in the blanks
(a) Mutation can be defined as _____variation.
(b) Mutation leads to evolution of _____ of a gene.
(c) Genes expressed only in homozygous state are_____.
(d) When both alleles of a gene are expressed it is _____.
(e) Gene, which is most frequent is _____type.

29. (a) Who discovered photoperiodism?
(b) Select one SDP and one LDP from following plants
Chrysanthemum , Rice, Spinach, Barley, Radish
(c) Who gave the term 'Phytochrome'? Give one specific feature of phytochrome.

30. Match the Column-I and Column-II

Column-I	**Column-II**
(a) Indian Rhinoceros	(i) Extinct
(b) Acid rain	(ii) Endangered
(c) Somaclonal variations	(iii) Gir forest
(d) Protoplasm fusion	(iv) Corbett National Park
(e) Biopiracy	(v) CFC
	(vi) Nitrogen oxide
	(vii) Sulphur oxide
	(viii) PEG
	(ix) Mutation
	(x) Tumeric

31. Differentiate between

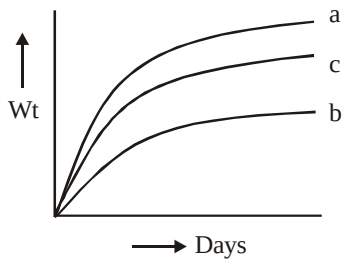
(a) Habitat and Niche (b) Flora and Vegetation

32. Answer the following question:

(a) Apart from CO_2, name other green house gases

(b) What is the type of movement of twiner and opening of flower?

33. Three groups of baby mice



(a) kept on complete diet (b) fed basal diet without nutrient to be tested

(c) basal diet + carotene by feeding carrots

34. Out of following animals – answer the questions.

Whale, Earthworm, Bat, Starfish, Scorpion, Honey bee, Peafowl.

(a) Which animal is different from rest of animals?

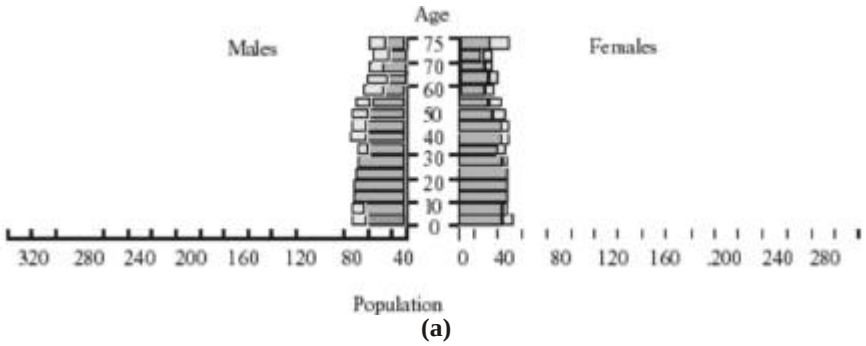
(b) How many of these are poisonous, which class they belong to?

(c) Which animals belong to same class?

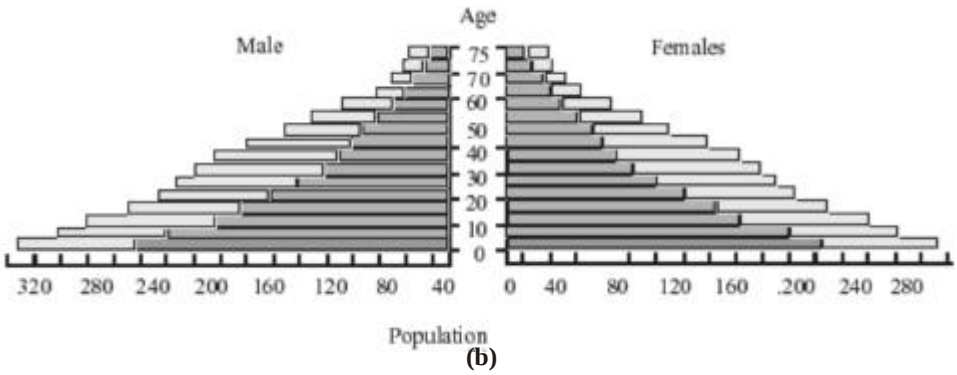
(d) Which animals are only representatives of their phylum?

(e) Which of the following have 3 ear ossicles. Name the ossicles in the order of sound transmission.

35. The following diagrams represent Age-Sex pyramid of (a) developed (b) developing nation.

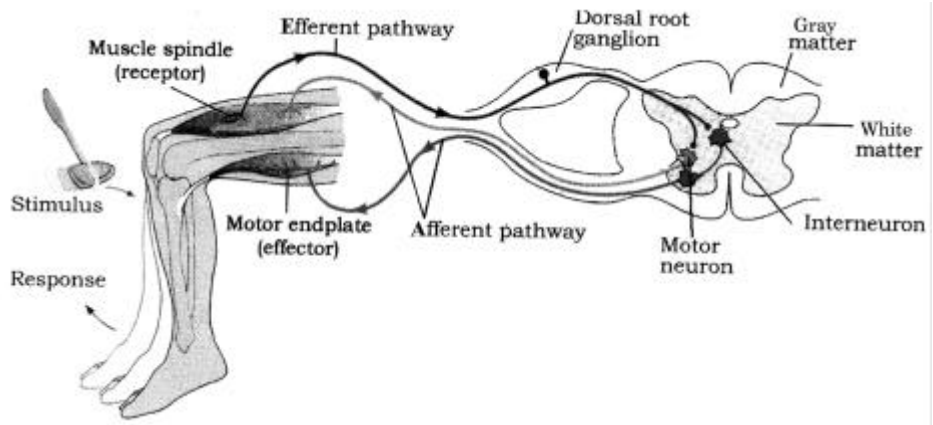


(a)



(b)

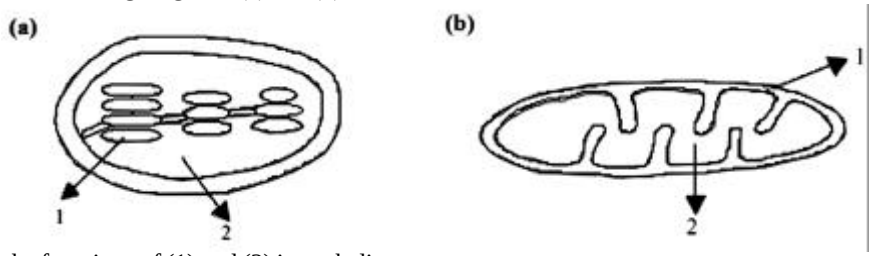
36. Refer the following diagram :



(a) What kind of reflex is it?
(b) Where is it striking?
(c) List the errors in the above diagram?

37. (a) Nictitating membrane and Vermiform appendix are examples of which type of organs.
(b) Define vestigial organs
(c) Which of the following four can be categorised in the same category?
Out of coccyx, mammary glands muscles of external ear and opacity of eye due to cataract are these 4 in same categories.

38. Refer the following diagrams (a) and (b)



Write the functions of (1) and (2) in each diagram.

39. In photorespiration, RuBP is oxidized to form glycolate and glycerate. Glycolate enters the PCO cycle to regenerate glycerate. Draw a flow diagram of photorespiration to show different intermediates and the cell organelles involved.