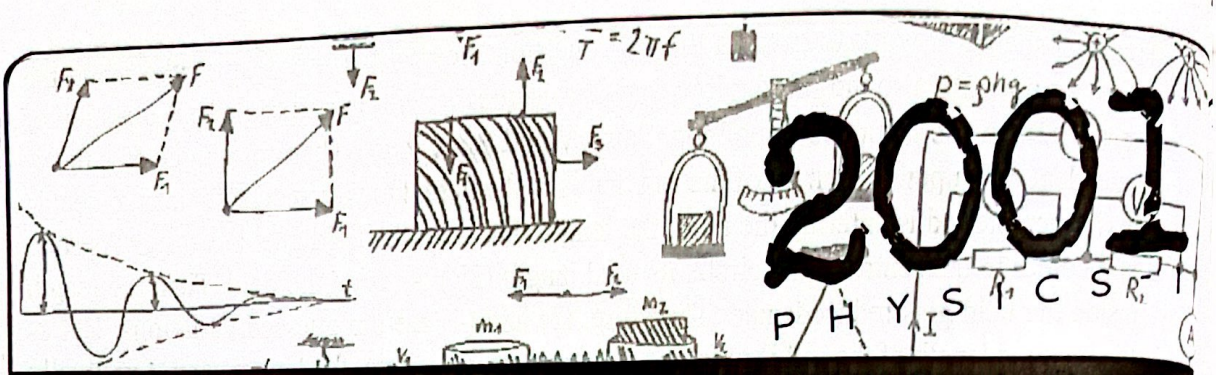


General Certificate of Education (Adv. Level) Examination

($g = 10N\ kg^{-1}$)

01 Unit and Dimensions

1. eV (electron-volt) is a unit of

06 Electrostatic Potential

(1) power. (2) energy. (3) charge. (4) voltage. (5) potential difference.

As soon as you saw the question, you can recognize that eV is a unit of energy.

03 Intensity of Sound

2. A sound with intensity 10^{-12} W m^{-2} is defined to have an intensity level of 0 decibels. Th intensity level of a sound of intensity 10^{-8} W m^{-2} is

(1) -40 dB. (2) 20 dB. (3) 40 dB. (4) 60 dB. (5) 80 dB.

02 Work Power and Energy

You should be able to calculate it form your memory if you are a follower of 'Rosa Method' 10^{-12} Wm^{-2} is the threshold of hearing. Therefore, once you divide 10^{-8} by 10^{-12}, you will ge 10^4 where 40 dB is the corresponding value. (10 log 10^4)

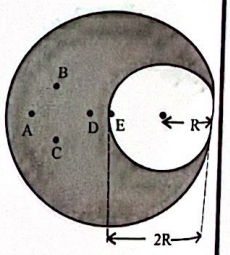
3. Two particles A and B have equal momenta, but the velocity of the particle B is four times tha of A. The ratio $\frac{\text{kinetic energy of A}}{\text{kinetic energy of B}}$ is

(1) 1/4 (2) 1/2 (3) 1 (4) 2 (5) 4

03 Electromagnetic Waves

This is the reciprocal of the question found in 2000 exam paper. You could calculate it from your memory if you have done that question correctly. Kinetic energy is ½ pv if expressed in momentum (p) and velocity (v). As particles have the same momentum, their ratio of kinetic energy is equal to their ratio of velocity. That is V_A/V_B. The answer is ¼ as $V_B = 4$ VA.

4. A uniform circular plate of radius 2R has a circular hole of radius R cut out of it as shown in the figure. The centre of gravity of the plate with the hole is most likely to be found at



(1) A (2) B (3) C (4) D (5) E

02 Centre of Gravity

As mentioned always, for this question you can get the answer by simple guessing. The centre of gravity of the sheet without the hole situates at its centre E. As the hole is cut from right side, the centre of gravity should lie on the left side of E after cutting. You can get answer 4 if you think this much. You can omit point B and C as they lie out of the symmetrical axis. From the initial mass of the sheet, the mass of the sheet extracted from the hole is ¼. In fact, the new centre of gravity cannotliemore to the left sideas point A.

5. Consider the following statements made about infrared, ultraviolet, X-rays, radio waves and gamma rays.

(A) All of them are electromagnetic waves.

(B) All of them travel with the same speed in free space.

(C) Radio waves have the longest wavelength.

Of the above statements.

(1) only (A) is true. (2) only (A) and (B) are true.

(3) only (A) and (C) are true. (4) only (B) and (C) are true.

(5) all (A), (B) and (C) are true.

Electromagentic Waves 03

You should get the answer as soon as you read the question. If you cannot understand that all statements are correct, you are an ignorant child of basic Physics who has not answered past papers.

6. The mercury column rises in a mercury-in-glass thermometer when the temperature is raised. The most appropriate reason for this is

(1) mercury is a good conductor of heat. (2) glass is a poor conductor of heat.

(3) glass expands when heated. (4) glass expands less than mercury when heated.

(5) mercury expands uniformly with rise in temperature.

Thermometry 04

The height of mercury column of increases as the expansion of glass is less than mercury's expansion. If it happened vice versa, height of mercury column should decrease with the increase of temperature. Therefore, 4th choice is the reason for the observation mentioned in the question.

7. The electrical energy stored in a 1 μFcapacitor connected across a 2 V cell is

(1) 5×10^{-7} J (2) 1×10^{-6} J (3) 2×10^{-6} J (4) 4×10^{-6} J (5) 6×10^{-6} J

Electrostatic Potential 06

It is a very simple calculation. It is not problem that cannot be done from memory.

Stored energy = ½ X 10^{-6} X 4 = 2X 10^{-6} J

8. The mass and radius of the earth is M and R respectively. The escape velocity of a rocket of mass *m* on the earth surface is

(1) $\sqrt{\frac{2GM}{R}}$ (2) $\sqrt{\frac{GM}{R}}$ (3) $\frac{\sqrt{2GM}}{R}$ (4) $\frac{\sqrt{GM}}{R}$ (5) $\sqrt{\frac{2GmM}{R}}$

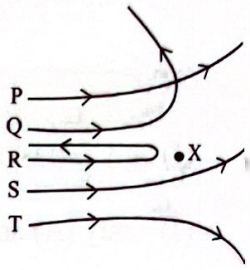
Gravitational Force Fields 05

This will be a hard problem if you do not know what is escape velocity. The escape velocity of an object at Earth's surface is the minimum velocity that requires to overcome from Earth's gravitational field completely. For this purpose, kinetic energy of the moving object should be nearly equal to the gravitational potential energy at Earth's surface.

$$\frac{1}{2}mv^2 = \sqrt{\frac{GMm}{R}}\ v = \sqrt{\frac{2Gm}{R}}$$

In the expression, m is not included. At a glance you will think that it cannot occur like thi Even though escape velocity is not dependent upon m, large kinetic energy must be supplie to a large m. Therefore, there is no contradiction in this result.

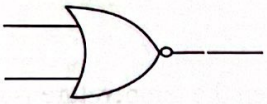
9. A proton is fired at an atomic nucleus (X). Which one of the paths shown in the diagram is not possible for the proton?

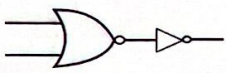


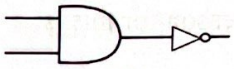
(1) P (2) Q (3) R (4) S (5) T

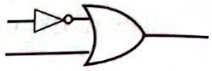
11 **Particles and Waves**

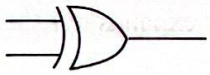
A proton as well as a nucleus is positively charged. Therefore, a repulsive force is experienced by the proton from the nucleus. Path of S represents an attractive force from the nucleus. P, Q and T clearly show the paths due to repulsive forces. R shows the path of the proton when it heading directly towards nucleus where the speed can gradually reduce, attain instant stillne and deflect away. The unrealistic path is S.

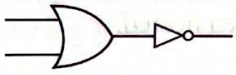
10.  The gate shown in the figure is equivalent to


(1)


(2)


(3)


(4)


(5)

09 **Logic Gates**

This is a very easy question. Figure shows a NOR (NOT OR) gate. The correct answer is 5.

11. In the equation $v^i = ka^j s$,v represents the velocity, a represents the acceleration and s represent the displacement. k is a constant and i and j are integers. What should be the values of i and in order to make the equation dimensionally correct?

(1) 1, 1 (2) 1, 2 (3) 2, 1 (4) 2, 2 (5) 2, 3

03 **Doppler Effect**

Dimensional analysis is not necessary when finding an answer to this question. When it i given that v represents velocity, a is acceleration and s is displacement, instantly you shoul remember $v^2=2as$ equation. From that you can directly get the answer as i=2 and j=1. It wi be time consuming if you go to do dimensional analysis. As v, a and s are clearly define constant k could not have dimensions. Yet, it is better if k was mentioned as a dimensionles constant. One can argue that it is a weak point in the question. There is truth in it but it doe not affect to get the answer just because it was not mentioned in the first place.

12 A train travels along a straight track. Another train travels in the same direction behind th first train at the same speed. The first train blows a whistle of frequency f_0.If the apparen frequency of the whistle heard by a stationary passenger sitting in the second train is f, then

(1) $f > f_0$ (2) $f < f_0$ (3) $f = f_0$ (4) $f = 2f_0$ (5) $f = \frac{1}{2}f_0$

03 **Doppler Effect**

No calculation is needed. As two trains go directly on the same speed, there is no relative motion. Man is also staying still. Therefore, there cannot be a change in the frequency heard. $f=f_0$. There is no need of substitution to any equation.

13. A 50 cm long hollow cylindrical tube open at both ends is placed in air. A sound source that produces pure tones is placed adjacent to one end of the tube. The frequency of the emitted sound is increased gradually starting from a very low value. At a frequency of 320 Hz, the tube resonates. The speed of sound in air is

(1) 160 m s^{-1} (2) 320 m s^{-1} (3) 340 m s^{-1} (4) 360 m s^{-1} (5) 640 m s^{-1}

Longitudinal Waves **03**

You can get the answer from your memory or simple calculation. Both ends are open in the tube. As the frequency of the sound source is increased from a small value, it initially resonates to the fundamental frequency of the tube. At that instance, the wavelength of the standing wave is double the length of the tube. There is no need to draw diagram as mentioned many times. Such questions can be found in many past papers. If wavelength is λ, $\lambda = (2 \times 50)$ cm = 1 m. According to $v = f\lambda$, $v = 320$ ms^{-1}.

You can clearly solve such problems from memory. Length of the tube is given as 50 cm, so that 1 m will be obtained when multiplied by 2. Then the speed of the sound is equal to the magnitude of the frequency. If you cannot solve it from memory, then do not try even though I asked to do using memory.

14. The velocity of sound in a gas at 27 ^{0}C is V. The temperature at which the velocity of sound in the gas becomes 2V is

(1) 54 ^{0}C (2) 108 ^{0}C (3) 600 ^{0}C (4) 927 ^{0}C (5) 1200 ^{0}C

Velovity of Sound **03**

It needs a simple calculation for this question. I cannot do it from memory. Speed of sound v inside a gas is proportional to root of its absolute temperature T. $v \propto \sqrt{T}$

$\frac{2v}{v} = \sqrt{\frac{T}{300}}$ T= 1200 K = 927^{0}C

27 ^{0}C is given to get a round digit (300) when 273 is added. Then the rest of calculation gets easy. As you can understand, the temperature needs to be increased to a higher value in order to double the speed of sound of the gas.

15. A convex lens of focal length 25 cm is kept contact with a concave lens of focal length 10 cm. The power of the lens combination in diopters is

(1) 4 (2) 6 (3) 10 (4) 14 (5) 15

Refraction through Lenses **03**

This is not a problem that cannot be solved from memory according to the given focal lengths. When the focal length of the convex lens turned into m, 1/f value is -4. The respective 1/f value of concave lens is 10. Therefore, the power of the combined lens is 6 diopters.

According to the convention we choose, the power of a convex lens is positive. Hence the combined lens behaves as a convergent, the correct answer is -6. There is no mistake as there are no minus answers. It could have been better if the question was asked as the magnitude of combined lens in diopters.

16. The viscous force acting on a sphere moving in a fluid is

(A) directly proportional to the velocity of the sphere.

(B) directly proportional to the mass of the sphere.

(C) inversely proportional to the radius of the sphere.

Of the above statements

(1) only (A) is true. (2) only (B) are true. (3) only (A) and (B) are tr

(4) only (B) and (C) are true. (5) all (A), (B) and (C) are true.

10 **Viscosity**

They are very simple statements. You need to identify whether they are true or false while are reading. Viscous force is given by $6\pi\eta av$. Therefore, only (A) the correct statement.

17. A monochromatic ray of light undergoes minimum deviation after passing through a pri If the angle of deviation produced by one of the prism surface is 20^0, the angle of minim deviation of the say is,

(1) 10° (2) 20° (3) 30° (4) 40° (5) 60°

Calculation is not needed for this question. At minimum deviation, the ray travels symmetric inside the prism. Therefore, if the deviation is 20^0 from one face, it is the same for the ot face. So, the minimum deviation angle of the ray is 40^0.

18. A person who is long sighted has near point at 50 cm. What spectacles are required for him view objects comfortably at 25 cm?

(1) Converging lens of focal length 100 cm

(2) Diverging lens of focal length 100 cm

(3) Converging lens of focal length 50 cm

(4) Diverging lens of focal length 50 cm

(5) Converging lens of focal length 25 cm

03 **Defect of Vision**

Similar problems are given many times in previous papers. The object that is in 25 cm distan should be seen as it is from 50 cm distance.

$$\frac{1}{50} - \frac{1}{25} = \frac{1}{f}$$

f = -50 cm is the answer. It can be directly solved if you write the above equation to save t time. The values are given to get a very easy answer.

19. An electric heater is used to raise the temperature of water from 20 °C to 30 °C and supp hot water at a rate of 1 kg per minute. The minimum power of the heating element is (specif heat capacity of water = 4200 J kg^{-1} $^0C^{-1}$)

(1) 7 W (2) 70 W (3) 700 W (4) 4200 W (5) 8400 W

04 **Calorimetry**

Even such problems are also found in previous papers. Needed only a simple calculation. needed. $\frac{1}{60} \times 4200 \times 10 = 700\ W$ Simplifies easily.

20. Relative humidity inside a closed chamber can be increased by

(A) adding water vapour to the chamber.

(B) by decreasing the temperature inside the chamber.

(C) by decreasing the volume of the chamber.

Of the above statements

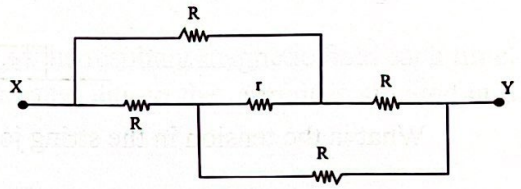
(1) only (A) is true. (2) only (B) are true. (3)only (A) and (B) are true.

(4) only (B) and (C) are true. (5) all (A), (B) and (C) are true.

Hygrometry **04**

Eventhough it is seenas a tough question, you do not need to think far. If water vapour is added to the chamber, clearly there should be an increase its relative humidity. Relative humidity increases even if the temperature is decreased. Relative humidity is the ratio of mass of water vapour present in a certain volume to mass of water vapour needed to saturate the same volume. When water vapour is added to the chamber, the amount of water vapor increases in the chamber. Likewise, the amount of water vapour needed to saturate can beachieved from the existing amount of water vapourby reducing temperature. Even when the volume of the chamber is reduced, at some instance it could be saturated from the existing amount of water vapour. In another way, if the volume of the chamber is reduced, mass of water vapour in a unit massincreases. Therefore, all three statements are correct.

21. The equivalent resistance between X and Y in the network of resistances shown is

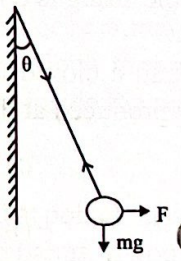


(1) r (2) R (3) 2R
(4) 2R + r (5) 4R+r

Ohm's Law Combination of Resistances **04**

Giving this question is a shameful act. There are many standardized questions in previous papers than this question. If you cannot see that r is unnecessary for calculation, then you are a child who has not looked at the past papers. The equivalent resistance of 2R, 2R parallel structure is R.

22. An object of mass m is hung by a string and is kept in equilibrium as shown in the diagram by a horizontal force F. The magnitude of F is



(1) mg tan θ (2) mg sinθ (3) mg

(4) mg cosθ (5) $\frac{mg}{\tan\theta}$

Equilibrium of Forces **02**

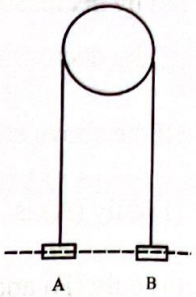
This question doubles the shame as in the previous question. Even tension of the string is marked.

$F=T\sin\theta$

$mg=T\cos\theta$

$F=mg\tan\theta$

23. Two equal masses A and B are attached to a light inextensible string passing over a smoot light pulley as shown in the diagram. The mass B is moved down, held it stationary and the released it. Which of the following statements is correct for the subsequent motion of B?



(1) B will move back to the original position.

(2) B will start to oscillate up and down and come to rest.

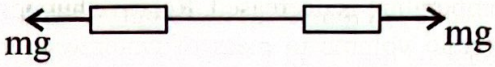
(3) B will stay stationary.

(4) B will start to move downwards.

(5) B will start to move upwards.

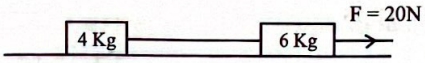
02 **Equilibrium of Forces**

If you do not think properly, you can get this question wrong. No calculation is needed. Ma B is at rest when it is released after pulling down. A resultant force is not acting as the mass are equal in the system (A and B).



Therefore, the system should be at rest. The correct answer is (3). The logic of, B should g downwards if B stays lower than A when B is being pulled down, is not correct. Even thoug it is felt at a glance that it should happen like that,it is against the first law of Newton. A object tends to be at rest, if there is no resultant force acting upon it.

24. Two masses joined by a light string are pulled along a smooth hotizontal table as shown in th diagram.



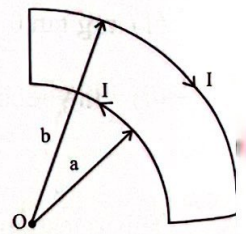
What is the tension in the string joining the masses?

(1) 4 N (2) 8 N (3) 12 N (4) 20 N (5) 30 N

02 **Newton's Law and Momentum**

There are similar questions that can be found in many previous papers. This question can b done using the memory. The easiest method to find tension is to find a by applying F = ma the system and applying F= ma again to 4 kg. Once F= ma is applied to the system, the tensio of strings cancels with each other. 6 plus 4 is 10. 20 divided by 10 is 2. 2 multiplied by 4 is Therefore, tension of the string is 8 N.

25. A current I flows around a closed loop as shown in the figure. The magnetic flux density produced at the centre O is given by



(1) $\frac{\mu_o I}{2}\left(\frac{1}{a}+\frac{1}{b}\right)$ (2) $\frac{\mu_o I}{4}\left(\frac{1}{a}+\frac{1}{b}\right)$

(3) $\frac{\mu_o I}{8}\left(\frac{1}{a}+\frac{1}{b}\right)$ (4) $\frac{\mu_o I}{8}\left(\frac{1}{a}-\frac{1}{b}\right)$

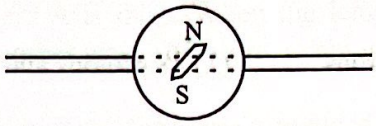
(5) $\frac{\mu_o I}{16}\left(\frac{1}{a}-\frac{1}{b}\right)$

07 **Magnetic Effect of Electric Currents**

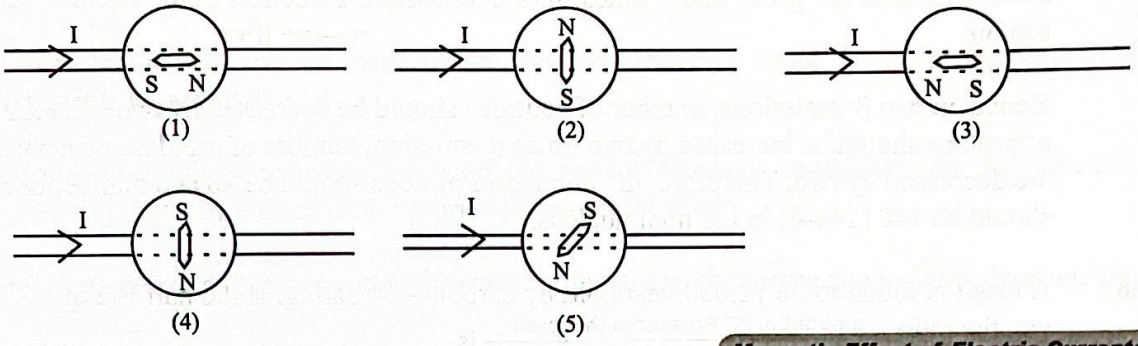
This is a very easy question if you have gone through past papers. The current flow in th opposite direction of the two loops. Hence, the direction of the magnetic flux density of on loop should be opposite to the direction of the magnetic flux of the other loop due to it flowing current. Both loops are ¼ of a complete circle. Therefore, magnetic flux density o point O is,

$$\frac{1}{4}\frac{\mu_o I}{2}\left(\frac{1}{a}-\frac{1}{b}\right)=\frac{\mu_o I}{8}\left(\frac{1}{a}-\frac{1}{b}\right)$$

26. A compass is placed on top of a wire as shown in the diagram.

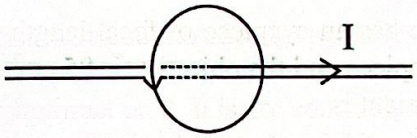


When a large current is passed through the wire.which one of the following diagrams best represents the direction of the compass needle? Neglect the effects due to the earth's magnetic field.



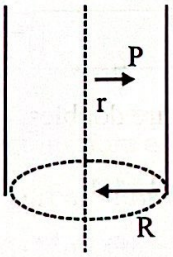
This has been a confusing problem to some students. In the syllabus, it is true that problems consisting bar magnets are not included. But you should know about the compass which was mentioned in year 7-8. On the other hand, it is a common activity to use a compass in the study of magnetic field of a current carrying wire (are you doing such things in the classroom?)

The north pole of a compass directs to the direction of the resultant magnetic field each time. When current flows in a wire, the magnetic field created due to the current is situated at a perpendicular plane to the wire.



Therefore, the compass should be located perpendicular to the wire where its north pole to downwards. Therefore, the correct answer is (4).

There can be a conflict between will there or will not be a magnetic field on the wire if the compass is placed on top of the wire. When current flows through a wire, a magnetic field is created onthe wire, around the wire and as well as inside the wire. The magnetic field is not zero inside the wire.



Magnetic field intensity is not zero at point P inside a wire. It can be calculated but such problems are out of the syllabus. If you want to find B in point B, the current that should be taken for calculation is $\left(\frac{I}{\pi R^2} . \pi r^2\right)$.

When current flows through the wire, it flows across the full cross section. It is wrong to think as the current flows only on its surface. If the radius of the wire is R, the current flows across a unit area is $\left(\frac{I}{\pi R^2}\right)$. Flow of a current should not be mistaken with a net charge on a conductor at a static situation. Such a charge stays only on the surface of the conductor.

27. Radioactive $^{234}_{90}Th$ nucleus emits β^- emissions followed by an α emission. The resulting nucleus will have

(1) 86 protons and 140 neutrons. (2) 88 protons and 140 neutrons.

(3) 90 protons and 140 neutrons. (4) 90 protons and 142 neutrons.

(5) 96 protons and 142 neutrons.

11 **Radioactivity**

Such questions are given many times. In a β^- emission, a neutron in the nucleus becomes a proton. $n \rightarrow p + \beta^- + \bar{\nu}_e$

Hence, in two β^- emissions, number of neutrons should be decreased by two whereas number of protons should be increased by two. In an α emission, number of protons and neutrons both are decreased by two. Therefore, the number of protons should be 90 and number of neutrons should be 140 (144-4) in the final nucleus.

31

28. A fossil is found to be 72,000 years old by carbon – 14 dating. If the half life of ^{14}C is 6,000 yrs, the ratio $\frac{\text{amount of } ^{14}C \text{ Present in the fossil}}{\text{amount of } ^{14}C \text{ Present in living tissue}}$ is

(1) $\frac{1}{2}$ (2) $\frac{1}{2^3}$ (3) $\frac{1}{2^5}$ (4) $\frac{1}{2^{12}}$ (5) $\frac{1}{2^{16}}$

03 **Optical Instrument**

You do not need calculation for this question. As the half-life of ^{14}C is 6000 years, during 72000 years, ^{14}C has passed 12 half-lives. After every half-life, the number of radioactive nuclei gets reduced to half from the initial amount. If that is so, after 12 half-lives should not the ratio be $1/2^{12}$? Do you need rough calculations? Avoid using such expressions as $N = N_{oe}^{-\lambda t}$. It is just enough to know what is meant by half-life.

29. An astronomical telescope has an eyepiece of focal length 5 cm. At normal adjustment the separation between the eyepiece and the objective is 85 cm. The angular magnification of the telescope at normal adjustment is

(1) 90 (2) 85 (3)80 (4) 17 (5) 16

10 **Elasticity**

This question has been given many times. The focal length of objective lens is 80 cm. Answer is 16 when 80 is divided by 5.

30. A uniform elastic wire is suspended vertically from the ceiling and a mass is hung from the bottom end. Consider the following statements assuming that the proportional limit of the wire is not exceeded.

(A) If the length of the wire is doubled, the strain in the wire doubles.

(B) If the area of cross section of the wire is doubled, the strain in the wire doubles.

(C) If the hung mass is doubled, the strain in the wire doubles.

Of the above statements

(1) only (A) is true. (2) only (B) are true. (3) only (C) is true.

(4) only (A) and (C) are true. (5) only (B) and (C) are true.

The true or false nature of these statements can be easily determined by using the relationship of Young modulus = stress/strain. If stress is not changed, there is no chance that strain gets changed. Therefore, statement A is false. When the length is doubled, the extension gets doubled if you think from another way. Therefore, strain is unchanged.

If the cross- sectional area is doubled, the stress is reduced by half. Then strain also needed to reduce by half. Therefore, statement B is false.

Once the hung mass is doubled, the stress gets doubled. Accordingly, strain shouldalsobe doubled. Therefore, statement C is true.

31. A steel razor blade can be made to stay on the surface of water. Consider the following statements regarding this

(A) Staying of the steel razor blade on the surface of water contradicts the Archimede's Principle because there is no upthrust acting on the blade.

(B) The steel razor blade is kept on the surface of water by the forces due to the surface tension of water.

(C) Adding soap to water would cause the steel razor blade to sink because soap reduces the surface tension of water.

Of the above statements

(1) only (A) is true. (2) only (B) are true. (3) only (C) is true.

(4) only (A) and (C) are true. (5) only(B) and (C) are true.

Surface Tension **10**

This is also an easy question. It is a common fact that a blade can be kept on water due to surface tensional forces of water. When the blade is on the surface of water, it does not displace water from it. Hence, there is no upthrust on it. It is not contradictory to Archimedes' law as there is no upthrust acting upon it because the blade is not sinking in water. Therefore, statement A is wrong. However, it should be deduced as a wrong statement from the phrase 'contradictory to Archimedes' principle'. As we know, such phenomenon cannot falsifyArchimedes' principle. One can argue that it should be mentioned as buoyancy law not Archimedes' law. There is a truth in that argument. It is mentioned as Archimedes' principle by fairly considering thefact that there is no upthrust as the blade is not sinking. It can be directly identified that statements B and C are true.

32

Air flows through the tube PQ at a constant rate. Two ping-pong balls are levitated in equilibrium above the tiny vertical tubes X and Y through which the air escapes. The heights of the two balls from the tube at equilibrium are h_x and h_y respectively. Which one of the following statements is true?

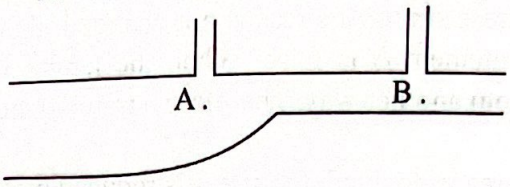
(1) If air flows from P to Q, $h_x > h_y$ (2) If air flows from P to Q, $h_x = h_y$

(3) If air flows from P to Q, $h_x < h_y$ (4) If air flows from Q to P, $h_x = h_y$

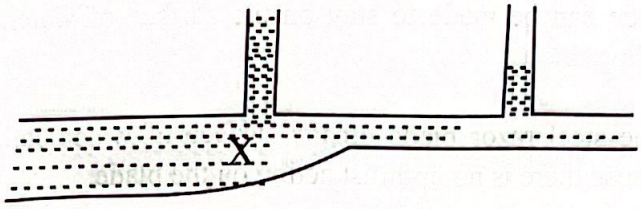
(5) If air flows from Q to P, $h_x < h_y$

Hydrodynamics **02**

The logic that Shoud be applied is Simple even though it is seen as an abnormal equation.

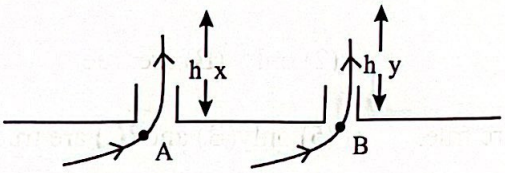


It is a known fact that the pressure of point A is bigger than the pressure of point B. Therefo when balanced,simply the ping pong ball above X should be at a larger height. We get familiar image if a liquid flow rather than air in the two vertical tubes. That means the liq level of X is at a higher level than the liquid level of Y.



If it is true for a liquid why it is not true for a gas? The only difference is that this phenomen is not visible to our eye if there is a gas flow (If the requirements are being satisfied).

If you write equations for this question, it should be done carefully. As it is mentioned t little amount of air flow out of the vertical tubes, all streamlines cannot be parallel to PQ ax On the other hand, balls cannot be balanced if some air did not flow out of vertical tub Consider two streamlines coming out from thinner tubes.

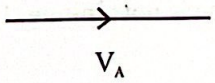


Applying Bernoulli's equation on these streamlines separately,

$$P_A + \frac{1}{2}\rho V_A'^2 = P' + \frac{1}{2}\rho v^2 + h_x \rho g$$

$$P_B + \frac{1}{2}\rho V_B'^2 = P' + \frac{1}{2}\rho v^2 + h_y \rho g$$

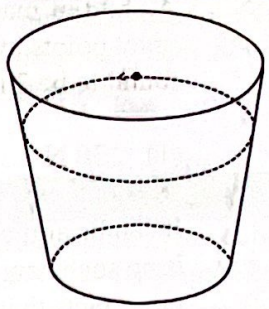
P_A and P_B are pressure at points A and B respectively. V'_A and V'_B are gas velocity at point and B. This is not the gas velocity of a horizontal streamline.



Pressure of the gas at the height where the ball balancesis mentioned as P'. v is the gas veloci in that situation. If we treat the ping pong balls as identical balls (that is a logical consideration it is not wrong to consider the two instances of gas pressure and velocity as equal at the heig that they should be balanced.

Therefore, once we look at the above equations, $h_x > h_y$ as $P_A > P_B$. Truly it is also V'_A V'_B. This should not be confused with the velocity of horizontal streamline (V_A and V_B Bernoulli's equation can be applied to a horizontal streamline separately as well. Also, all these arguments are independent from the direction of the gas in the tube.

33. An object moves along a horizontal circular path on the inner surface of a smooth conical shaped vessel, as shown in the figure. The force/ forces acting on the object as observed by a stationary observer is/are



(1) weight of the object only.

(2) weight of the object and reaction force normal to the surface only.

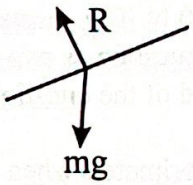
(3) weight of the object and centripetal force only.

(4) reaction force normal to the surface and centripetal force only.

(5) centripetal force only.

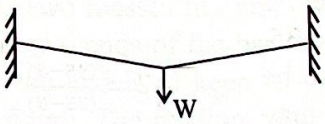
Circular Motion **02**

Some children got the answer wrong due to unnecessary thinking. As the pot is smooth, only the mass of the object and the reaction acting perpendicularly on the surface is acted upon the object.



The horizontal component of R gives the centripetal force to move on a horizontal circle. The weight of the object is balanced by the vertical component of R. The force that is acted upon the object or observed by a stationary observer is not only the centripetal force. Actually, the centripetal force is obtained by the component of R. Centripetal force is always obtained by forces such as friction, tension, perpendicular reaction, magnetic forces. Therefore, centripetal force is not a force that is appearing automatically from the sky. We call it a centripetal force as it is towards the centre. But the root of it lies upon the above-mentioned forces and other forces. On the other hand, the observer notices not only the object's motion of a horizontal circle. He observes that, there is no such motion to any other direction. If only the centripetal force is acting, how does the weight of the object is being balanced?

34 A weight W is hung on a tightly fixed rope as shown in the diagram.



The tension in the rope is

(1) approximately W (2) approximately $\frac{W}{2}$ (3) less than $\frac{W}{2}$

(4) in-between $\frac{W}{2}$ and W (5) much greater than W

Equilibrium of Forces **02**

Similar but a tougher question was given as question 53 in 1996. Look at its explanation. If you had investigated that, the answer of this question could be obtained easily. It should be understood that the answer is 5 once you read the question. There is no point in writing equations. The rope is almost horizontal is it is tied up tightly. Then the tension should be bigger than W. Have you experienced what would have happen when you put more clothes on a tightly bound rope? The correct answer missed a Sinhala letter 'ඔ'. Yet, the common belief was that, it did not have an impact on the answer of the question. Nearly saved the question from taking the answer as an'all'answer.

35. A child of mass 20 kg is sitting on a swing of negligible mass. The swing is attached to it pivot points by to ropes, each of 3 m length. The maximum speed of the child during a swing found to be 3 m s^{-1}. The maximum tension in each rope is

(1) 130 N (2) 160 N (3) 200 N (4) 260 N (5) 300 N

12 Circular Motion

It can be argued that this is a question of vertical circular motion. Even though it is true, there is no such new concept to be known or practised. However, do not attempt such questions with more facts than this question even they are related to questions of vertical circular motion.

It is known from the experience that the maximum tension of the string is occurring when the swing is at its lowest point. At that moment, if the tension of a string is T,

$$2T - (20 \times 10) = \frac{20 \times 3^2}{3}$$

$$2T = 260$$

Therefore, the correct answer is 130 N. The answer is wrong if two strings were neglected. It has been clearly mentioned in the question as two strings. Apart from that, it is mentioned as the tension of each string by the end of the question.

36. A given mass of water is in a calorimeter. when a 90 W heater is immersed in water, the temperature of water increases and come to a steady value at 35°C. If a 180 W heater is used the steady temperature is 45°C. What should be the room temperature?

(1) 10 °C (2) 15 °C (3)20 °C (4) 25 °C (5) 30 °C

04 Convection

Such questions have been asked before. If temperature is transforming to a continuous value, supplying heat rate should be equal to dissipative heat rate. Dissipative heat rate is proportional to the difference of temperatures between the heated body and the environment. If the room temperature is θ, taking proportional is the easiest way to solve the problem. I think the least number of steps to solve the problem has been written above. If a child could have written the two proportional statements, θ=25 can be obtained by logically. Because 180 is the double of 90. Therefore, extra temperature should be double. As 45 is obtained by adding 10 to 35, room temperature is needed to be reduced by 10 from 35. You may not remember such logic under the question paper mentality. Therefore, obtaining answer from the above simple calculation is good for your health.

$$90 \propto (35 - \theta)$$

$$180 \propto (45 - \theta)$$

$$2 = \frac{(45-\theta)}{(35-\theta)} \rightarrow 70 - 2\theta = (45 - \theta) \rightarrow \theta = 25$$

37. If an object is placed on the principal axis 31 cm from a concave mirror the image formed is slightly smaller than the object. If the object is placed 29 cm from the mirror the image formed is slightly larger than the object. The approximate focal length of the mirror is

(1) 7.5 cm (2) 15 cm (3) 28 cm (4) 30 cm (5) 32 cm

04 Optics

This question does not need a calculation.If an object is placed behind the radius of curvature of a concave mirror, its magnitude is reduced whereas if the object is kept in front of the radius of curvature, the magnitude is increased. No doubt that you have learnt this at your ordinary levels. According to the given data in the question, the radius of curvaturecan be guessed as 30 cm. Then the focal length of the mirror can be reasoned as nearly 15 cm. It has been described as an approximated focal length as a direct answer cannot be obtained.

38. A glass cube of side 24 cm and refractive index 1.5 contains a small air bubble. When viewed through the block from one side, the air bubble appears to be 12 cm from that side. When viewed from the opposite side, how far will the air bubble appear from that side?

(1) 16 cm (2) 12cm (3) 8 cm (4) 6 cm (5) 4 cm

Refraction 03

There is a very short method to solve this problem. If the apparent length is found in the cube, the answer comes automatically.The apparent length of the cube is $24 \times \frac{2}{3} = 16$. Now 12 is reduced from 16 is 4 as the answer. It can be solved from memory if it was done using this method. As the apparent length should be lesser than the real length, 24 should be multiplied by 2/3 not 3/2. It takes some time, if it is tried in the normal way. If the real length is x from the first side to the air bubble, $\frac{x}{12} = \frac{3}{2} \rightarrow x = 18$.Therefore, the distance to the air bubble from the other side is 24-18=6. Now if apparent length is y, $\frac{6}{y} = \frac{3}{2} \rightarrow y = 4$. Look how easy is the first method!

39. A rocket carries 1.8×10^4 kg of liquid oxygen in a vertical tank of cross section 3.0 m^2. At the lift-off the rocket accelerates vertically upward at 2.0 m s^{-2} relative to the earth. The pressure on the bottom of the tank at the lift-off is

(1) 1.2×10^3 N m^{-2} (2) 7.2×10^3 N m^{-2} (3) 1.2×10^4 N m^{-2}

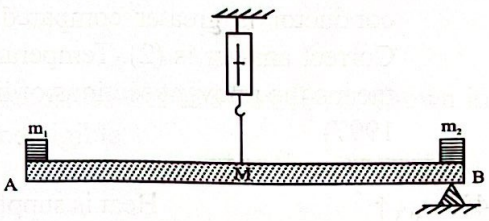
(4) 6.0×10^4 N m^{-2} (5) 7.2×10^4 N m^{-2}

Hydrostatics 02

This needs a simple calculation. If the rocket is at rest or moving at a constant velocity, the reaction of the bottom of the tank should be equal to the weight of the fuel. If the rocket is moving upwards with an acceleration, the reaction of the bottom is (mg+ ma). This is equal to the reaction of a person's feet standing on a lift. The force that is being acted upon the bottom should be divided by its area to find the pressure.

Pressure $= \frac{1.8 \times 10^4 (10+2)}{3} = 7.2 \times 10^4$ simplifies very easily.

40. A uniform bar of mass M suspended from its midpoint by a spring balance. Two masses m_1, and m_2 ($m_2 > m_1$) are placed at the two ends of the bar. A wedge supports the bar at the end B to keep it horizontally as shown in the figure. The reading of the spring balance is



(1) 0 (2) $m_1 g$ (3) $(M+m_1) g$ (4) $(M+2m_1) g$ (5) $(M+m_1+m_2) g$

Equilibrium of Forces 02

You will be amazed as this can be done using memory! It is true. Look at this logic. It is a uniform rod. It is hung from the middle. Therefore, there is no moment of forces acting upon the axis it has been hung due to the weight of the rod. The force acting on left-hand corner is $m_1 g$ downwards. If the rod is balanced, should not be the net force acting on the right-hand corner is $m_1 g$? The rod is not in equilibrium if it is not like that. Hence, is not the total downwards force acting on the rod or the reading of the spring balance should be $(M+ 2m_1)g$? If you move to calculation without seeing this logic, the easiest method is to take moments around B. If the tension of the spring is T and the length of the rod is 2a,

$$Ta = Mga + m_1 g 2a \rightarrow T = (M + 2m_1)g$$

Resolution of forces by taking the reaction from the pivotis a stupid action.

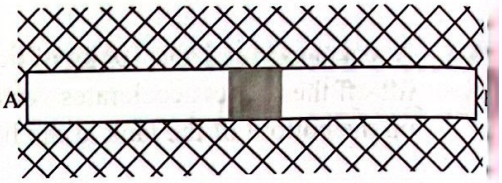
41. The frequency of a tuning fork is 256 Hz. When it sounded with a sonometer wire, 3 beats pe second were heard. When the tension of the wire was reduced, again 3 beats per second were heard. The frequency of the sonometer wire after reducing the tension is

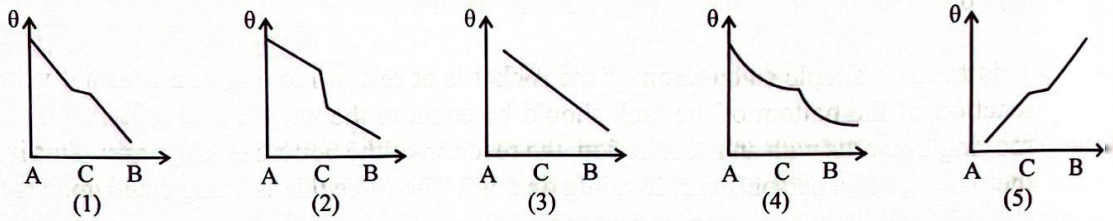
(1) 250 Hz (2) 253 Hz (3)256 Hz (4) 259 Hz (5) 262 Hz

03 Transverse Waves

There is no doubt that you may have solved many problems like this. The initial frequency according to 3 beats can be 259 Hz or 253 Hz. But as the tension of the wire is reduced, the initial frequency of the wire should be 259 Hz to get 3 beats again. If the initial frequency is 253 Hz, its frequency gets lesser than 253 Hz once its tension is reduced more. If that happens there will not be 3 beats again with the tuning fork's frequency of 256 Hz. Therefore, 253 Hz is the frequency of the wire when the tension isreduced. Although it is written like this for the explanation, this can be solved in the mind of an intelligent child.

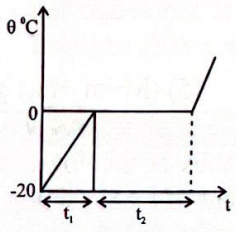
42. The rod AB is made by connecting two identical metal rods with a thin piece of a poorly conducting material C as shown in the figure. The rod is well lagged except at the two ends. If a steady heat flow in maintained from A to B, the variation of the temperature (θ) along the rod is best represented by





04 Conductivity

This is a comical question. This might have given as another question could not be found. Or else the inspectors were seen to be bankrupt. Temperature gradient across a weak heat conductor is greater compared to a temperature gradient across a strong heat conductor. Correct answer is (2). Temperature gradient of the two metal rods should be the same. That means the relevant sections of lines must be parallel. (Look at the 53rd question of past paper 1997)

43. 

Heat is supplied at a constant rate to a certain amount of ice. The variation of temperature θ with time t is shown in the figure. If the specific heat capacity of ice is C and specific latent heat of fusion of ice is L, $\frac{t_2}{t_1}$ ratio is

(1) $\frac{L}{C}$ (2) $\frac{C}{L}$ (3) $\frac{20\,L}{C}$

(4) $\frac{L}{20\,C}$ (5) $\frac{LC}{20}$

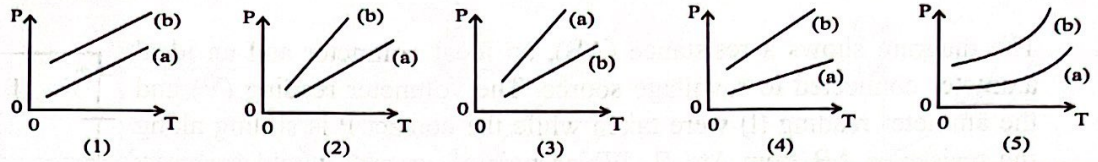
04 Calorimetry

This can be seen in past papers. (Question number 54 and 55 of past paper 1995) If the supplying heat rate is Q, $Qt_1 = mc20$

$$Qt_2 = mL$$

Therefore, $\frac{t_2}{t_1} = \frac{L}{20c}$ $(t_1 \propto 20c, t_2 \propto L)$

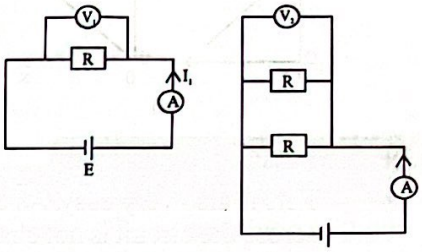
44. An ideal gas is kept inside a rigid container. Then another ideal gas added into the container. The variation of pressure (P) inside container with the absolute temperature (T) before adding second gas (a) and after adding the second gas (b) are best represented by



Expansion of Gases **04**

For this, look at the 58th question of past paper 1996. This is simpler than that question. Only the following two facts are needed.
(i) Once another gas is added line (b) should be above the line (a)
(ii) Once the two lines are stretched, they should meet at absolute zero value.
The straight line of (2) satisfies these two facts. The question of 1996 has a Celsius scale as its horizontal axis. Therefore, the lines meet at the minus section of θ axis.

45. Consider the following two circuit diagrams. V_1 and V_2 are voltmeter reading and I_1 and I_2 are ammeter readings. If the voltmeters and ammeters are ideal and the internal resistance of the cells are negligible which of the following is true?



(1) $V_2 = V_1$ and $I_2 > I_1$ (2) $V_2 = V_1$ and $I_2 < I_1$

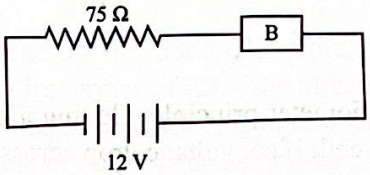
(3) $V_2 > V_1$ and $I_2 > I_1$ (3) $V_2 > V_1$ and $I_2 < I_1$

(5) $V_2 = V_1$ and $I_2 = I_1$

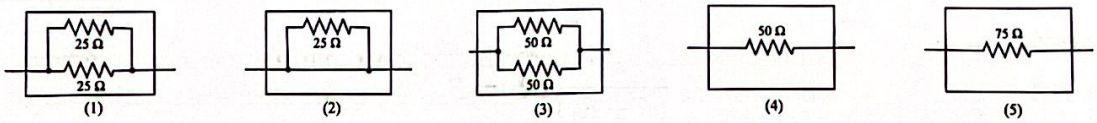
Ohm's Law Combination of Resistances **08**

It is a very easy ordinary level question. As the ammeters are ideal, their internal resistances are negligible. Internal resistances of the cells are also negligible. Therefore, the reading of the voltmeters is the same on both circuits. The electromotive force of the cells, E is shown here. As the resultant resistance of the second circuit (R/2) is lesser than the first circuit (R), $I_2 > I_1$.

46. A circuit contains 75 Ω resistor and an unknown resistor/ resistors in a box (B) as shown in the diagram. The internal resistance of the battery is negligible.



If the voltage across 75 Ω is 9 V, which of the following represents the unknown resistor/ resistors?

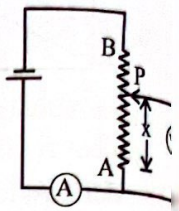


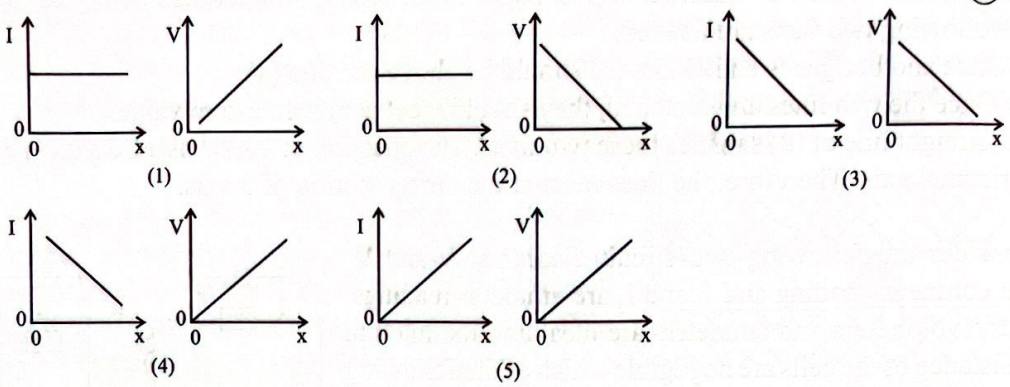
Ohm's Law Combination of Resistances **08**

This can be done from memory. As we can neglect the internal resistance of the battery, voltage drop across B should be 3V. That means the ratio of voltage drop is 3:1. Hence, the ratio of corresponding resistors is also 3:1. Therefore resistor in B should be 25 Ω. The

only arrangement that gives 25 Ω is (3). It is not correct to take (2) as seen. Even thou arrangement (2) has 25 Ω, its ends are short circuited. Therefore, the effective resistance that arrangement is zero. If that occurs, 12 V is dropped across 75 Ω.

47. The diagram shows a resistance (AB), an ideal voltmeter and an ideal ammeter connected to a voltage source. The voltmeter reading (V) and the ammeter reading (I) were taken while the contact P is sliding along the resistance AB from Ato B. Which pair of graphs would correctly represents the variation of I and V with x?

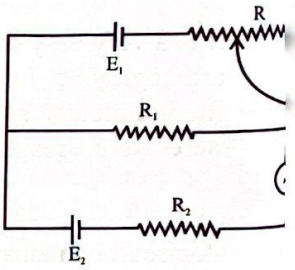




08 Potentiometer

This is also very easy. As the voltmeter is ideal, its resistance is infinite. Therefore, the curre across the circuit is not changed depending on the location of the touch key P. But the voltmet reading is increased linearly with x. Even though the current across the resistor is the sam the multiplication value of iR increases gradually (as respective R increases). The corre answer is (1).

48. The two cells of e.m.f.'s E_1 and E_2 ($E_1 > E_2$) shown in the circuit have negligible internal resistance. For what value of R will the ammeter A reads zero current?



(1) $\frac{E_1}{E_2}\ R_2$ (2) $\left(\frac{E_1 + E_2}{E_1}\right) R_1$

(3) $\left(\frac{E_1 - E_2}{E_1}\right) R_1$ (4) $\left(\frac{E_1 + E_2}{E_2}\right) R_1$

(5) $\left(\frac{E_1 - E_2}{E_2}\right) R_1$

08 Potentiometer

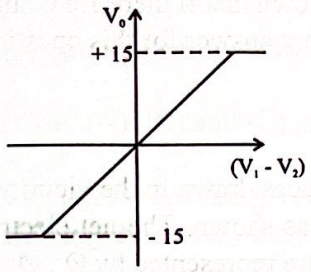
This is a modification of potentiometer principle. Getting a zero reading in ammeter mean there is no current flow from E_2 cell. If so, voltage drop across R_1 should be equal to E_2. Trul this circuit is the potentiometer circuit that you are familiar with. The only difference is tha the mutual exchange of R_1 and R. If you like, R can be treated as the wire of potentiometer.

$$\frac{E_1}{(R + R_1)} . R_1 = E_2$$

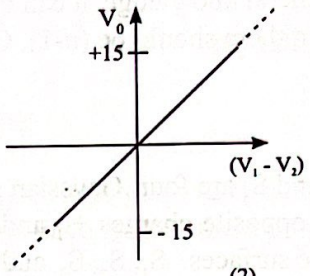
$$E_1 R_1 = E_2 R + E_2 R_1$$

$$\frac{(E_1 - E_2)}{E_2} . R_1 = R$$

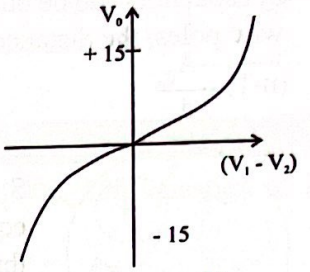
49. A 741 operational amplifier is powered with supply voltages of ±15 V. If V_1 and V_2 represent the input voltage and V_0 represents the output voltage, the variation of V_0 with $(V_1 - V_2)$ is best represented by



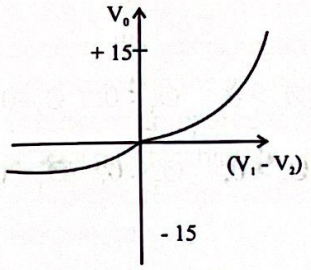
(1)



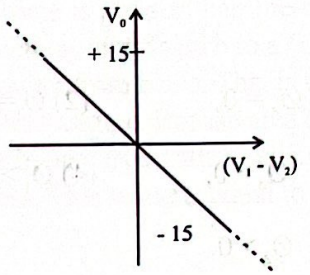
(2)



(3)



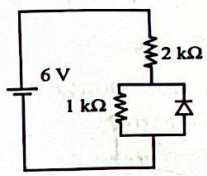
(4)



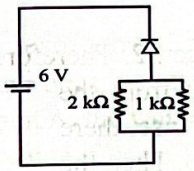
(5)

You can get the answer quickly as you soon as you see the question. There is nothing to think. The correct answer is (1).

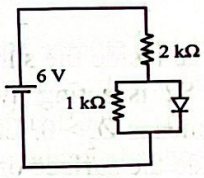
50. Which one of the following circuits draws the largest current from the 6 V cell?



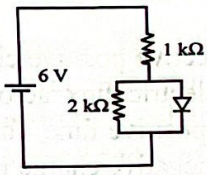
(1)



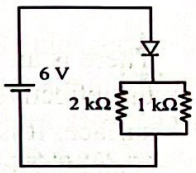
(2)



(3)



(4)

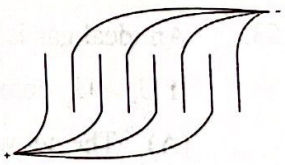


(5)

This is the 35th question of past paper 1998 with different values in resistors. The circuit that is giving the smallest resistance was asked in that question whereas in this question, the circuit that flows the highest current is asked. Both imply the same thing.

In (1), there is no current across the diode. Therefore, the resultant resistance is 3 kΩ. There is no current flow in the entire circuit of (2). The effective resistance of (3) is 2 kΩ (bit higher than 2 kΩ). The effective resistance of (4) is bit higher than 1 kΩ. In (5), the resistance value of the parallel arrangement of resistors is lesser than 1 kΩ. Even though there is an addition of resistance (from the resistance of the diode), (5) has the least effective resistance. Therefore, the highest current flows in this.

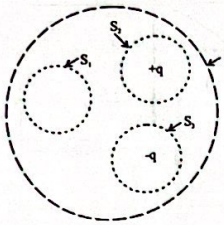
51. A capacitor consists of n number of equally spaced, parallel conducting sheets. Alternate sheets compose the negative plate as shown in the figure. If A is the area of each sheet and d is the spacing between two adjacent sheets, the capacitance of the arrangement is



(1) $\frac{\varepsilon_0 A}{(n-1)\,d}$ (2) $\frac{2\varepsilon_0 A}{nd}$ (3) $\frac{(n-1)\,\varepsilon_0 A}{d}$ (4) $\frac{n\varepsilon_0 A}{d}$ (5) $\frac{\varepsilon_0 A}{nd}$

Question 25 of past paper 2000 is similar to this question. There was a numerical question it whereas an expression is asked here. If you have answered the question of 2000, you shou get that there is a parallel arrangement here. When there are n number of sheets, (n-1) numb of capacitors can be built.By general knowledge, it can be known that if there are n number wire poles, the distance between them should be (n-1). Correct answer for this question is

$(n-1)\frac{A\epsilon_0}{d}$

52. 

S_1, S_2, S_3 and S_4 are four Gaussian surfaces drawn in the vicinity of th equal and opposite charges +q and –q as shown. The net electric fl through the surfaces. S_1, S_2, S_3 and S_4 are represented by $\emptyset_1$, $\emptyset_2$, $\emptyset_3$ a $\emptyset_4$ respectively. Which of the following is correct?

(1) $\emptyset_1=0$, $\emptyset_2=0$, $\emptyset_3=0$, $\emptyset_4=0$,

(2) $\emptyset_1=0$, $\emptyset_2>0$, $\emptyset_3<0$, $\emptyset_4=0$,

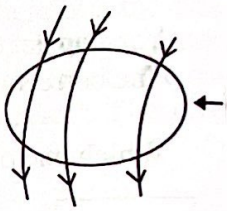
(3) $\emptyset_1>0$, $\emptyset_2>0$, $\emptyset_3<0$, $\emptyset_4>0$,

(4) $\emptyset_1>0$, $\emptyset_2>0$, $\emptyset_3<0$, $\emptyset_4=0$,

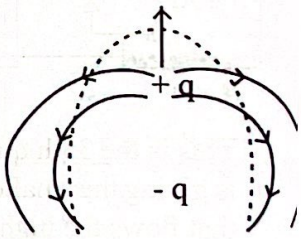
(5) $\emptyset_1<0$, $\emptyset_2>0$, $\emptyset_3<0$, $\emptyset_4>0$,

06 **Gauss Theorem**

Answer can be found using the simple knowledge of Gauss theorem. There is no need to know the magnitude value of the electric flux. When you consider surface S_1, there is no effective charge inside the boundary of the surface marked by S_1. Therefore, the effective electric flux is zero across S_1. Electric force lines do not go across S_1. But the entering force lines are emitted again from the surface.



There is an effective positive charge inside the surface S2. Therefore, the effective electric flux across S2 is acting away from the surface. It is a positive flux. That means $\emptyset_2 > 0$. Likewise, there is an effective negative charge inside the surface of S3. Then the effective electric force lines flow into the surface. Therefore, it is a negative flux. That means $\emptyset_3 < 0$. Net charge is zero inside the surface of S4 (+q-q). That means $\emptyset_4 = 0$ again.



Question number 45 of 1998 is also a solved problem under the same logic.

Electric flux can be positive or negative but it is not a vector. Work from a force is a scalar. I magnitude can be positive or negative. The standard electric flux value is equal to the effecti charge inside the boundary marked by the surface. Therefore, the value of electric flux can 0, + or -.

53. An ideal gas is taken through a cycle process as shown in the P-V diagram.

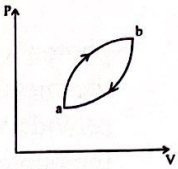
If $U_b > U_a$, consider the following statements.

(A) The net work done by the gas is positive for the whole process.

(B) Heat is absorbed along the path a→b whereas heat is liberated along the path b→a.

(C) The temperature of the gas at the beginning of the process is same as that at the end the process.

Of the above statements.

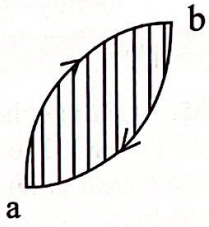


(1) only (A) is true. (2) only (A) and (B) are true.

(3) only (A) and (C) aretrue. (4) only (B) and (C) are true.

(5) all (A), (B) and (C) are true.

Such questions are given in previous years (29th question of 2000, 59th question of 1999). Solving this is very easy if you have studied them properly.



Statement A is correct. Work done by the gas is positive when moving from a to b ($\Delta W>0$) as the final volume is greater than the initial volume. Work done by the gas is negative when moving from b to a ($\Delta W<0$). Actually, the work done on the gas when moving from b to a. That is why the final volume is reduced compared to the initial volume. But the area of a→b curve with V axis is greater than the area of b→a curve with V axis. Therefore, the work is positive for the whole process. This value is equal to the area bounded by the two curves.

But this value cannot be numerically calculated without integration. If this is a shape like rectangle, effective work could have been calculated.

Directly it can be seen that statement B is also correct. The arrow points upwards when going from a→b whereas it points downwards when going from b→a. Even from this fact, you can get the answer here.

Statement C is also correct. Some people got this wrong. The gas should get its initial temperature again once it comes to the initial state no matter where it goes around. Once the gas comes to point A, the values of its P and V are equal to their initial values. How can T can take a different value if P and V remain unchanged? When P and V of an ideal gas is given, T has only one value (PV=nRT).

54. Electrons are emitted from a certain metal when a monochromatic light of wavelength λ is incident on it. his the Planck constant and c is the velocity of light. Consider the following statements.

(A) Kinetic energy of electrons emitted from the metal is less than hc/λ.

(B) Kinetic energy of electrons emitted from the metal does not depend on the material of the metal.

(C) Rate of emission of electrons depends on the wavelength λ.

Of the above statements

(1) only (A) is true. (2) only (A) and (B) are true.

(3) only (A) and (C) are true. (4) only (B) and (C) are true.

(5) all (A), (B) and (C) are true.

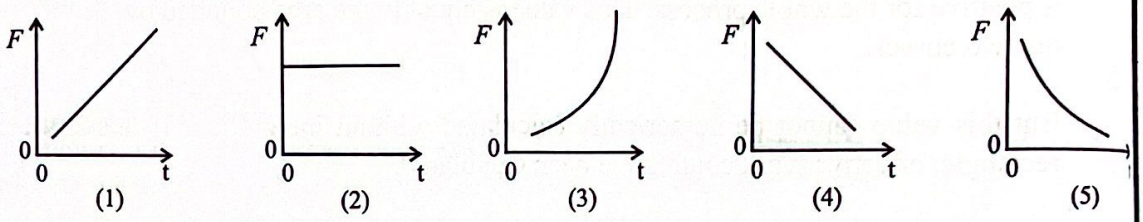
You can answer this question with the basic knowledge of photo electric effect. $\frac{hc}{\lambda}$ is the

photon's energy that falls on the metal. The kinetic energy of the emitting electrons fro the metal should be much lower than this value clearly. Some energy should be spent t provide work function. Therefore, kinetic energy of the emitting electrons is never equal t the photon's energy that falls on. Therefore, statement A is correct.

Statement B is false. As the value of the work function changes from metal to metal, th kinetic energy of the emitting electrons is dependent on the metal.

Statement C is also false. The rate of electron emission is dependent on the intensity of th falling rays not on its wavelength or frequency. More details are given in the explanation o 37th question of 2000 paper.

55. A mass is attached to the lower end of a vertical elastic string which is rigidly fixed at theothe end. The mass is then moved downward with a constant velocity by applying a force F. Th variation of F with time t is best represented by



10 Elasticity

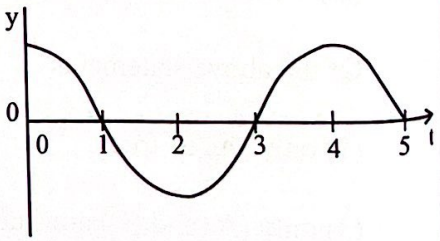
If the mass should be moved with a constant velocity, the resultant force acting on it shoul be zero. The force in the elastic string is proportional to its extension. So, the generate tension when it is stretched is gradually increased with the extension. Therefore, to kee on the resultant force as zero, the applying force F should also be increased gradually in a equivalent way. That means the variation of force F should be a straight line with a positiv gradient. Such variation is seen only in graph (1).

The weight of the mass is not connected to the applied force F. If x is the extension when th mass is hung from the string, $kx = mg$ (where k is the force constant of the string). From there if it was stretched more by a length x' with an applied force F,

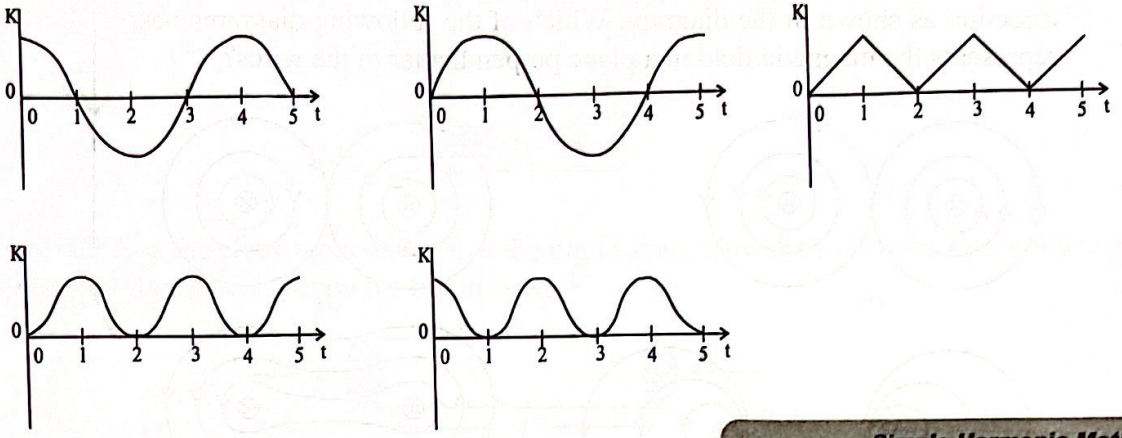
it should be $k(x + x') = F + mg$ when the resultant force is zero.

Then $F = k'x$ where F is directly proportional to x'. Such writing is unnecessary to find th answer to the question.

56. The graph shows the variation of displacement(y') of an object with time (t).



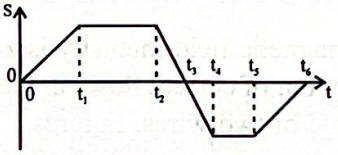
Which one of the following graphs best represents the variation of kinetic energy (K) of the object with time (t)?



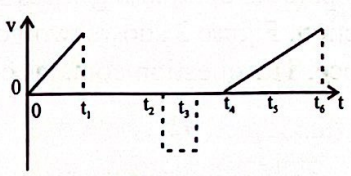
Simple Harmonic Motion 03

There is no need to write equation for this question. According to the graph of displacement versus time, it is clear that this graph shows simple harmonic motion. It is a known fact that in simple harmonic motion, kinetic energy is zero (object is at instant rest) when the displacement is at its maximum whereas when the displacement is zero kinetic energy goes to its maximum (as object is moving with maximum velocity). It is satisfied in cycles by the 3rd graph. Graph 1 and 2 can be omitted as kinetic energy cannot be in negative values. Graph 4 does not have the above-mentioned way of motion as its kinetic energy is maximum when the displacement is also maximum. Even though graph 5 has the specific motion, the displacement of simple harmonic motion is cyclic (like sine or cosine). There cannot be straight line graphs for K.

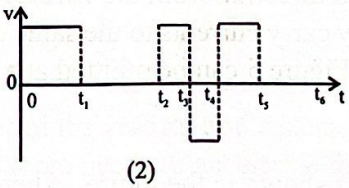
57. The displacement (s) – time (t) curve of an object is shown in the figure.



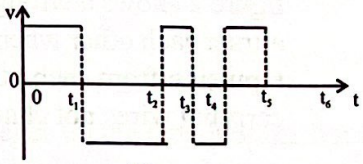
The corresponding velocity (v) – time (t) curve is best represented by



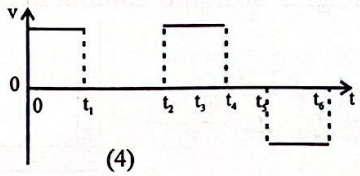
(1)



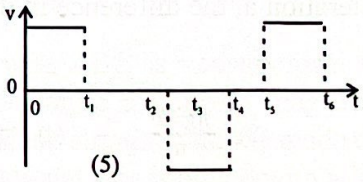
(2)



(3)



(4)

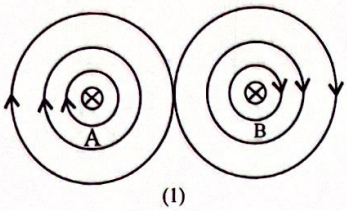


(5)

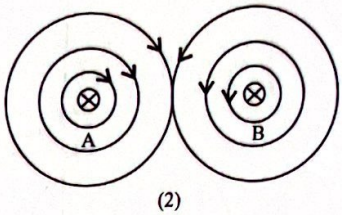
Simple Harmonic Motion 02

This is a s-t graph that was learnt in ordinary level. The magnitude and the direction of velocity can be obtained from the gradient of a line in s-t graph. The gradient of the straight line from 0-t_1 is a positive constant. From t_1 -t_2, the velocity of the object is zero. The gradient of the straight line from t_2-t_4 is a negative constant and from t_4-t_5 the gradient is zero. That means the object is in rest. From t_5 -t_6, there is a positive gradient. That value is equal to the value of 0-t_1. Therefore, the correct v-t graph is (5).

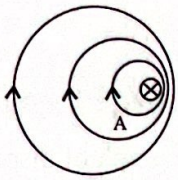
58. Two parallel long wires A and B carry identical currents in the same direction as shown in the diagram. Which of the following diagrams best represents the magnetic field in a plane perpendicular to the wires?

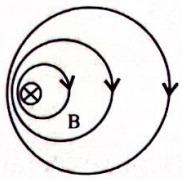


(1)

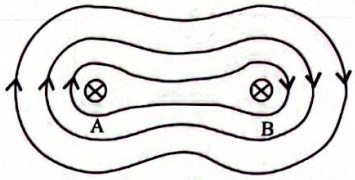


(2)

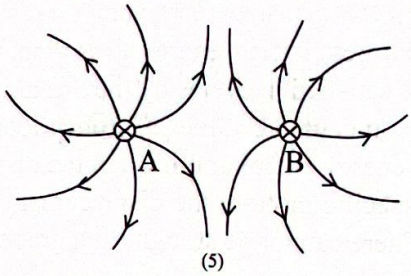




(3)



(4)



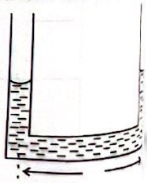
(5)

07 **Magnetic Effect of Electric Currents**

There is a point where the magnetic field intensity is zero (null point) in the middle of t parallel wires when equal amount of current flows in the same direction. The 4th figure sho such a null point in the middle of two wires. Figures 1 and 2 show the magnetic force lir when the wires are kept alone. Apart from that, the magnetic force lines are touched by o another. Two force lines can neither be touched nor intersected with each other. In additi figure 2 shows a wrong field direction from the wire B. Two parallel conducting wires sho attract each other when they carry currents to the same direction. Figure 3 shows two fields repulsion from each other. Figure 5 can be omitted at a glance. The question contains curre carrying wires not charges.

59 A U-tube contain a liquid as shown in the figure. When the tube is moved horizontally to t rightwith a constant acceleration a, the difference in the heights of liquid column in the tw limbs is

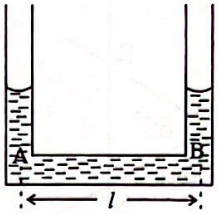
(1) $\frac{la}{g}$ (2) $\frac{lg}{a}$ (3) $\frac{l(g+a)}{a}$ (4) $\frac{lg}{(a+g)}$ (5) $\frac{l(g+a)}{g}$



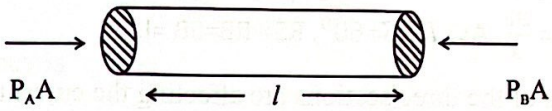
02 **Hydrostatics**

As soon the question is seen, a problem arises regarding what to do. We know from experienc that the liquid stem of left arm is rising compared to the liquid stem of right arm when the tub accelerates horizontally to the right. But how to find the difference of height in liquid stems

Consider the liquid stem length l in the connecting arm of U tube. If the U tube is at rest o moving horizontally with a constant velocity, the pressure is equal at the two corners of th liquid stem (A and B). If the liquid stem is moving at a constant acceleration a to the right pressure of A should be greater than of B.



Consider A as the cross-sectional area of the liquid stem. Now the following figure shows the horizontal forces acting upon the liquid stem.



As the liquid stem accelerate to the right, there should be a resultant force acting to the right. If that so, definitely the pressure of point A (PA) should be higher than point B (PB). Therefore, the height of the liquid stem on the left arm should be greater. Now let us apply F = ma to the horizontal liquid stem.

$$P_A A - P_B A = Al\rho a$$

$$P_A - P_B = l\rho a$$

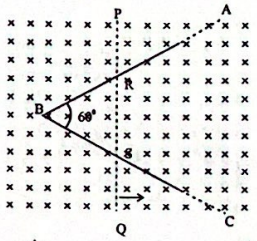
The density of the liquid is ρ. The thrust to the liquid stem from left arm is P_A A. P_B A is the thrust to the liquid stem from right arm. The difference of these two thrusts provides the resultant force to accelerate the liquid stem. There is no other horizontal force acting on the liquid stem.

Now what is P_A-P_B? Is not that the pressure difference of liquid stem of left and right arms? Therefore, if h is the height difference of the liquid stem,

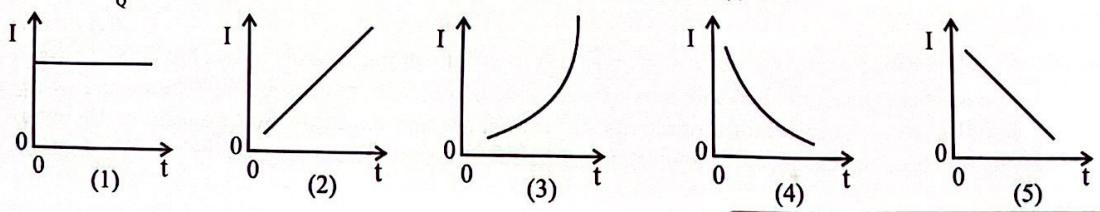
$$P_A - P_B = h\rho g = l\rho a$$

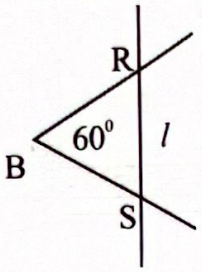
$$h = \frac{la}{g}$$

Therefore, the height difference of the vertical liquid stems depends on the length of the liquid stem of the bottom arm. The force needs to accelerate the liquid stem in the bottom arm is given by the pressure created due to the height difference of the vertical liquid stems.

60. 

A long wire ABC is bent to form a 60^0 angle and kept in a plane perpendicular to a uniform magnetic field, as shown in the figure. Another long straight wire PQ made of the same material with the same cross-sectional area is pulled with a constant velocity on the wire ABC, so that the triangle RBS is always equilateral. The induced current (I) in the triangle RBS varies with time (t) as





At a certain instant location of PQ wire, if l is the respective length of RS, the generate induced electro motive force is Blv. At that instance, the induced current in RBS triangle i proportional to $\frac{Blv}{3l} = \frac{Bv}{3}$. As $R\hat{B}S=60^0$, RS= RB=SB =l.

The wire resistances of the three sections are affecting the current flow across the triangle. A all the wires are made from same material and with same cross section, their resistances ar proportional to the lengths of the wires. Therefore, the current is taking a constant value wit time (as B and v are unchanged). The correct answer is (1).

Actually, answering to this MCQ paper should not be a difficult task. For an intelligent chil who has studied the relevant work load and studied past question papers in an investigativ mode, has the ability to mark at least 50 correct answers. If a child gets 25 questions or les than that, either he/she is a person who has missed his/her work load or he/she does no possess the simple intelligence that he/she should have to learn Physics.

Rough Worksheet of an Intelligent Child

3. PV_A/PV_B

8. $\frac{1}{2}mv^2 = \sqrt{\frac{GMm}{R}}$

14. $2 = \sqrt{\frac{T}{300}}$ 1200 1200-273=927

18. $\frac{1}{50} - \frac{1}{25} = \frac{1}{f}$

19. $\frac{1}{60} \times 4200 \times 10$

35. $2T - (200) = \frac{20\times9}{3}$

36. $2 = \frac{(45-\theta)}{(35-\theta)}$ $70 - 2\theta = (45 - \theta)$

39. $\frac{1.8\times10^4(12)}{3}$

43. $t_1 \propto 20c$ $t_2 \propto L$

48. $\frac{E_1}{(R+R_1)}.R_1 = E_2$ $E_1R_1 = E_2R + E_2R_1$

59. $P_A - P_B = h\rho g = l\rho a$

60. $\frac{Blv}{3l}$

I am requesting again to answer many past papers. While doing so, use knowledge intelligently to find answers without behaving like parrots. Try to do questions in other books. There is no wrong in it. But I have seen complex questions that cannot get answers easily. Some questions are out of our syllabus. Hence, get some advice regarding such questions from your teacher.