Kerala Board Class 10 Physics 2015

Instructions:

- First 15 minute duration is 'cool off time'.
- Cool off time is given to read and understand the questions well.
- The score of each question is given along with it.

Q1. Select the instrument that works on the principle of multiple reflections of sound. (1)

a. Watthour meter

b. Sonar

c. Stethoscope

d. Decibel meter

Solution:

c. Stethoscope.

Q2. Study the relationship between the first pair and then complete the second pair. (1)

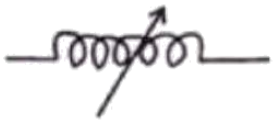
Capacitance : Farad :: Resistivity :

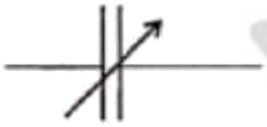
Solution :

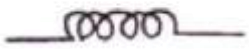
ohm - meter ($\Omega \cdot m$)

Q3. Given below are the symbols of a few electric components. Which of these components denote a variable inductor? (1)

a. 

b. 

c. 

d. 

Solution:

Variable inductor is as shown in figure b.

Q4. Which of the following describes ecliptic orbit? (1)

a. Orbit travelled by the moon around the sun

b. The path travelled by the earth around the sun

c. Orbit along which sun appears to move among the stars

d. Orbit along which moon appears to move among the stars

Solution:

b. Orbit along which sun appears to move among the stars

Q5. When can an equilateral satellite be called a geostationary satellite? (1)

Solution:

An equatorial satellite revolves around the Earth in an orbit along the equator. It can be called a geostationary satellite if its orbital period is the same as the Earth's rotational period, which is 24 hours. Additionally, the satellite must orbit in the same direction as Earth's rotation.

Q6. Match the items given in *A* suitably with the items given in B and C. (3)

A	B	C
Microphone	Sonar	Electrical Energy gets converted to sound
	Permanent Magnet	Energy
		The sound energy gets converted to electrical Energy
Ultrasonic sound	Butane	Conventional source of energy
		Non-conventional source of energy
CNG	Methane	The sound waves that are audible
		Sound waves that are not audible

Solution:

A	B	C
Microphone	Permanent Magnet	The sound energy gets converted to electrical energy
Ultrasonic Sound	Sonar	The sound waves that are audible
CNG	Butane	Conventional Source of Energy

Q7. In the AC circuits, what is the advantage of using inductors instead of resistors? (1)

Solution:

The advantage of inductors in AC circuits is that they oppose sudden changes in current due to Lenz's Law, providing protection against current transients. Unlike resistors, inductors store energy in their magnetic field instead of dissipating it as heat, making them more efficient. The voltage across an inductor is proportional to the rate of change of current, enabling them to regulate current flow effectively.

Q8. A motor rated 500W, 230 V utilises 3 units of electrical energy. Calculate the time for which the motor works. (1)

Solution:

Given that P(Power of the motor) $= 500$ W

E is the Energy utilised $= 3$ units $= 3$ kWh $= 3000$ Wh

Then Energy (E)= Pt

Therefore, $t = \frac{E}{P} = \frac{3000}{500} = 6$ hours

So, the motor works for 6 hours

Q9. Light energy is obtained in a fluorescent lamp and CFL as a result of electron emission. However, the process of electron emission is different in both cases. What is the difference? (2)

Solution:

In both fluorescent lamps and CFLs, light is produced through electron emission:

- When fast-moving electrons collide with the mercury atoms, ultraviolet (UV) rays are produced.
- In a fluorescent lamp, these UV rays strike the phosphor coating inside the tube, converting the UV light into visible light.
- In a CFL, the same process occurs, but in a smaller, compact design. The UV light produced by the mercury is absorbed by the fluorescent material, which then converts it into visible light, making CFLs more energy-efficient.

Q10. It is not safe to operate several electrical appliances simultaneously by using an adapter operating from a single point. Why? (2)

Solution:

When multiple electrical appliances are connected through an adapter, the total current drawn from the single socket may exceed the socket's rating, causing **overload**. This can lead to overheating and potential fire hazards. Therefore, it is not safe to use an adapter for operating several appliances simultaneously.

Q11. In a household electric circuit,

a. Where is the MCB (Miniature Circuit Breaker) connected?

b. What is the function of ELCB (Earth Leakage Circuit Breaker)? (2)

Solution:

a. **MCB (Miniature Circuit Breaker)** is connected in series with the mainline in a household circuit. It automatically switches off the circuit in case of overloading or faults, similar to a fuse but with the advantage of being resettable.

b. **ELCB (Earth Leakage Circuit Breaker)** is a safety device that detects leakage of current to the earth, even in small amounts. When leakage is detected, it cuts off the power, preventing potential electric shocks and protecting humans and animals from harm.

Q12. A tuning fork is excited, and its stem is pressed on a wood table.

a. The table starts to vibrate. What is this type of vibration called?

b. Under what condition, can resonance occur in this case? (2)

Solution:

a. The vibration that the table undergoes when a tuning fork is excited, and its stem is pressed on a wood table is known as forced vibration.

b. Resonance occurs when the natural frequency of the table matches the frequency of the tuning fork's vibrations.

Q13. What are the advantages of using armature as the stator in a power generator? (2)

Solution:

Using the armature as the stator in a power generator eliminates the need for brushes, which helps reduce mechanical wear, prevents sparking, and improves efficiency.

Q14. State what happens to the loudness of sound in the following cases:

a. The density of the medium increases

b. Distance between the source and the receiver increases (2)

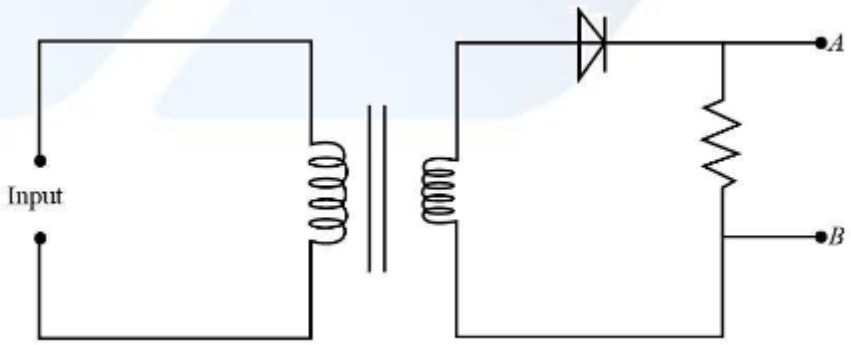
Solution:

a. When the density of the medium increases, the loudness of sound generally increases as well. This is because sound travels faster and more efficiently in denser media, allowing for a better transmission of sound energy.

b. When the distance between the source and the receiver increases, the loudness of the sound decreases. This happens because sound energy spreads out as it travels, and with increased distance, the intensity (and thus the loudness) diminishes.

Answer any one out of 15 A or B

Q15. A. A diode is connected to the output of a transformer, as shown in the figure given below. Analyse the figure. (2)

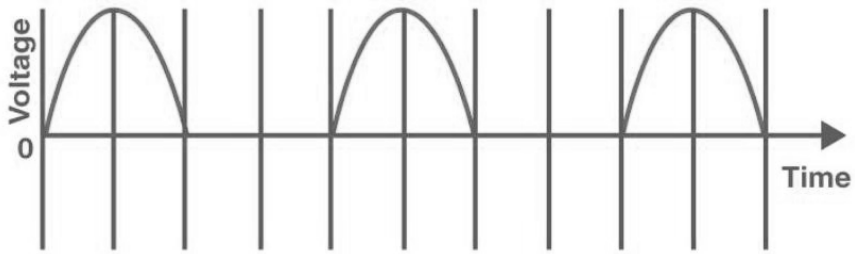


a. Draw a time voltage graph for the current obtained across AB

b. What is the function of diode in the circuit?

Solution:

a.



b. The diode functions as a rectifier in the circuit and allows only the positive voltage cycle to flow through the circuit, thus blocking the negative cycle. This results in a pulsating DC output, where only the positive half of the AC cycle is allowed through, and the negative half is blocked.

OR

B. When sound signals become amplified -

a. What change can you observe in the amplified signals?

b. What remains unchanged in the sound signal even after the amplification? (2)

Solution:

a. When the sound signals are amplified, the amplitude of the signals will also be larger, and so they will be louder than the original signal.

b. Meanwhile, even after the amplification of the sound signal, the frequency of the sound signal remains unchanged.

Q16. A blue flower appears blue in magenta light. In which other secondary light will the blue flower appear blue itself? (1)

Solution:

A blue flower appears blue under magenta light because magenta is a combination of red and blue wavelengths, and the flower reflects the blue component. Similarly, the flower will also appear blue under cyan light, as cyan is a combination of blue and green wavelengths. The flower reflects the blue component of cyan light, making it appear blue.

Q17. Describe an experimental set up to show that sunlight can be split up into consistent colours and then convert it back to white light. (2)

Solution:

To demonstrate that sunlight can be split into its constituent colors and recombined into white light, we can perform the following experiment:

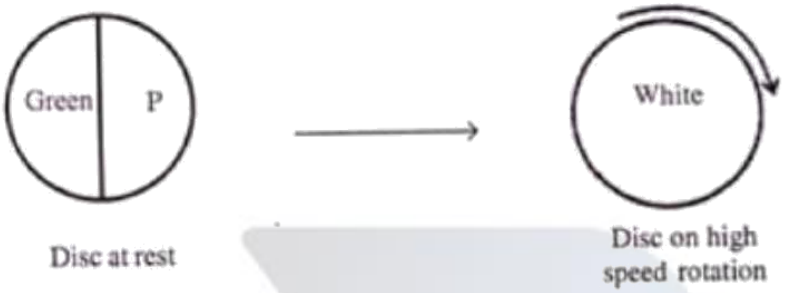
1. Place a prism close to a window on a table, with its base facing down. We should ensure that sunlight passes through a small slit to direct it onto the prism.
2. As sunlight passes through the prism, it gets split into a spectrum of colors (red, orange, yellow, green, blue, indigo, violet), known as the visible spectrum. This is due to the dispersion of light, as different colors bend by different amounts when passing through the prism.
3. To recombine the colors into white light, we place a second prism next to the first one, but inverted (with the base facing up, opposite to the first prism). The colored rays will pass through the second prism and merge, producing white light again.

Answer either 18 A or B

Q18. A. a. What do you mean by complementary colour?

b. Study the following figures and identify *P* and Q. (3)

a.



b.

Solution:

a. Complementary colours are pairs of colours that, when combined, produce white light. Each complementary colour consists of one primary colour and one secondary colour.

b. In figure a. P is magenta. Magenta and green are complementary colors, and when combined, they form white light.

Now, in figure b. Q is Blue, because when blue is mixed with green, it gives cyan colour.

OR

B. a. Is it correct to say that only red colour is given out from the water droplets situated on the outer edge of the rainbow? Justify your answer.

b. Write a situation in which a rainbow can be viewed as a full circle instead of an arc. (3)

Solution:

a. It is incorrect to say that only red color is given out by the water droplets. Each individual water droplet refracts and reflects all seven colors of the spectrum (red, orange, yellow, green, blue, indigo, violet). The red color in the rainbow appears on the outer edge due to its longer wavelength, which causes it to refract at a larger angle compared to the other colors. However, each droplet contributes all the colors, and the combined effect of many droplets forms the rainbow, with red on the outer edge.

b. A full-circle rainbow is observable from higher elevations or when the rainbow is formed at an angle where the observer can see all of it without obstruction.

Q19. "Chandra" is a telescope operating in space to unveil the secrets of the universe. (3)

A. Write the type of radiation that "Chandra" picks up to study the universe.

B. What are the advantages of setting up a telescope outside the Earth's atmosphere?

Solution:

A. Chandra is an X-ray telescope that operates in space. It picks up X-ray radiation from celestial objects, such as black holes, neutron stars, and supernova remnants, to help study the universe.

B. The advantages of setting up a telescope outside the Earth's atmosphere is that the effects of absorption and refraction of the Earth's atmosphere can be eliminated. This helps in providing a clear observation of the universe.

Q20. Instead of using biomass directly as fuel, it is always advantageous to use biogas produced from biomass.

A. What do you mean by biomass?

B. What are the advantages of using biogas as fuel? (3)

Solution:

A. Biomass refers to organic matter derived from plants and animals, such as dead plant parts, animal waste, and other organic materials. These materials can be used as fuel to produce energy. Examples of biomass include cow dung, dry leaves,

firewood, animal excreta, and vegetable waste. Biomass is considered a renewable energy source because it can be replenished through natural processes.

B. The advantages of using biogas as fuel include:

1. Biogas helps in the safe and healthy disposal of household and biowaste materials.
2. Biogas reduces the need for **wood** and helps **prevent deforestation**.
3. The **slurry** from biogas production can be used as **manure**, enriching the soil.
4. Biogas burns **without smoke**, reducing **air pollution**.
5. Biogas produces a large amount of **heat per unit mass**.
6. Biogas is a **clean fuel** that burns completely without leaving any residue.
7. Biogas is a **cheaper** domestic fuel compared to many common fuels.

Q21. It is required to construct a transformer which gives 12 V from a 240V AC supply. The number of turns in the primary is 4800. (4)

A. Calculate the number of turns in the secondary

B. State whether the coil in the secondary has to be thick or thin. Justify your answer.

Solution:

A. The voltage generated by a transformer given as 12 V

And Number of turns in the primary coil = 4800

Now, V_s and N_s are the voltage and the number of turns of the secondary coil and V_P and N_p is the voltage and number of turns of the primary coil.

We know, $V_S/V_p = N_s/N_p$

Therefore, $N_s = (V_s/V_p) \times N_p$

Given $V_s = 12$ V and $V_p = 240$ V

Now, $N_p = 4800$, find $N_s = ?$

If we substitute the values we will get

$N_s = (V_s/V_p) \times N_p = (12/240) \times 4800 = 240$ turns

Thus, the number of turns in the secondary coil is 240 turns.

B. In a step-down transformer, the secondary coil is usually made with a thicker wire. In a step-down transformer, a thin wire is used in the primary coil, whereas thick wire in a secondary coil. The step-down transformer helps to change the high voltage AC (alternating current) to low-voltage AC. These transformers are also used to distribute electric power to homes.