Practice Questions - Term I

Date: 14/11/2021

Subject: Physics

Topic : The Human Eye and the Colourful World

Class: X

1. Which of the following statement is correct about the twinkling of the stars?

   ✗ **A.** Stars reflect sun's light in a non-uniform manner.

   ✗ **B.** Stars keep changing their positions with respect to the observer randomly.

   ✓ **C.** Light from the stars get refracted by the earth's atmosphere.

   ✗ **D.** Light from the stars get reflected by the water droplets in the clouds.

   Stars are celestial bodies that emit their own light similar to the sun. When this light enters the atmosphere, light from the stars get refracted by the earth's atmosphere. The atmosphere itself is not constant and its optical density keeps changing. This changes the extent of bending of the light constantly. Thus the stars seems to be twinkling for the observer.

2. Tyndall effect is the scattering of light by _____.

   ✗ **A.** air particles

   ✗ **B.** solid particles

   ✗ **C.** liquid particles

   ✓ **D.** colloidal particles

   Tyndall effect is scattering of light by particles in a colloidal mixture. When rays of light pass through a colloidal fluid, the tiny particles get illuminated due to scattering. Because of this, the path of light is made visible. The intensity of scattering depends on the size of particles in the colloids.

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3. If Ram is facing west and he sees a rainbow in front of him then, in which direction most probably the Sun is?

- ✗ **A.** North
- ✗ **B.** South
- ✗ **C.** West
- ✓ **D.** East

The Sun and the rainbow will always be in opposite directions. Rainbow is formed when a raindrop causes the light from the Sun to undergo partial internal reflection. This means that, the light is reflected back in the direction it came from (from the Sun). Hence, we can see a rainbow only if our back is facing the Sun. Hence in this case, the Sun will be in the east direction.

4. If the earth had no atmosphere, then at day time, the sky would appear as ___.

- ✗ **A.** red
- ✗ **B.** blue
- ✓ **C.** black
- ✗ **D.** white

If the earth had no atmosphere, there would not have been any scattering. Then, the sky would have appeared dark. The sky appears dark from the moon even during day as there is no atmosphere there.

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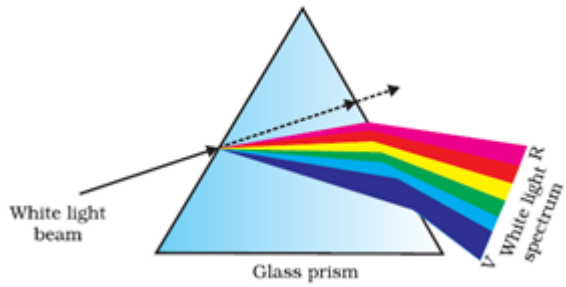
5. The danger signals installed at the top of tall buildings are red in colour. These can be easily seen from a distance because among all other colours, the red light:

- ✗ **A.** is scattered the most by smoke or fog.
- ✓ **B.** is scattered the least by smoke or fog.
- ✗ **C.** is absorbed the most by smoke or fog.
- ✗ **D.** Reflection of light from the earth.

The red light has relatively longer wavelength than the other colours of the spectrum. Hence, it suffers the least scattering.

6. Which colour will be refracted the most when white light is dispersed from a prism?

- ✗ **A.** Red
- ✗ **B.** Green
- ✗ **C.** Blue
- ✓ **D.** Violet



The refractive index of the medium is maximum for the violet light and minimum for the red light. Therefore, when white light enters a prism, it disperses into seven constituent colours and violet light shows the maximum deviation.

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7. Which combination of two identical prisms can cancel out the dispersion of white light?

- **A.** When placed inverted with respect to each other.
- **B.** When placed perpendicular with respect to each other.
- **C.** When placed at 60° with respect to each other.
- **D.** It's not possible to cancel out the effect of each other.

When two prisms are placed inverted to each other, the first prism causes dispersion of the white ray, whereas the second prism causes the reunification of all colours to again yield the white light.

8. One cannot see through fog because :

- **A.** fog absorbs the light.
- **B.** light suffers total reflection at droplets.
- **C.** refractive index of fog is infinity.
- **D.** light is scattered by droplets.

Fog is a visible aerosol consisting of tiny water droplets or ice crystals that remain near the surface of the earth.
When light travels through fog, it interacts with the water droplets of the fog and is scattered by them. The scattering of light by fog droplets is not uniform in all directions. The light from various objects get scattered by water droplets, so the eye cannot distinguish the objects, and thus one cannot see through fog.

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9. Answer the question by selecting the appropriate option given below:

Assertion (A): During rainbow formation, the light disperses into its seven constituent colours.

Reason (R): Air has lots of suspended dust particles.

A. Both A and R are true, and R is the correct explanation of A.

B. Both A and R are true, and R is not the correct explanation of A.

C. A is true, but R is false.

D. A is false, but R is true.

Rainbows are produced by a combination of refraction and reflection and involve the dispersion of sunlight into a continuous distribution of colours. Dispersion of the sunlight by a water droplet suspended in the atmosphere produces rainbows.

10. Assertion (A): The sky appears dark instead of blue to an astronaut.
Reason (R): Scattering of sunlight cannot happen due to the absence of atmosphere in outer space.
Choose the correct option.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true

The sky appears blue on Earth because the atmosphere of Earth scatters the most of the blue light from the white sunlight. However, there is no atmosphere present on the moon. Hence, no scattering takes place on the moon.
Thus, the sky appears dark to the astronauts on the moon.
Thus, statements A and R are both true and R is the correct explanation of A.

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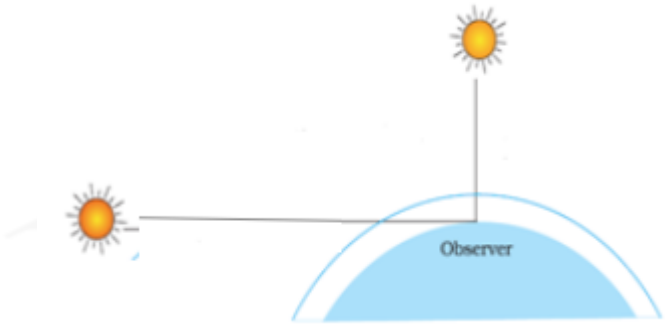
11. Why does sun appear yellowish-white at the noon?

- **A.** Because sunlight has to travel relatively shorter atmospheric distance.
- **B.** Because sun light has to travel longer atmospheric distance.
- **C.** Because only red and violet are scattered.
- **D.** Because all the colours are scattered by the cloud.

Light from the Sun overhead would travel relatively shorter distance. At noon, the Sun appears yellowish as only a little of the blue and violet colours are scattered and hence, **almost all the colours of visible spectrum reach our eyes. Hence,** we see almost the original colour of the Sun.



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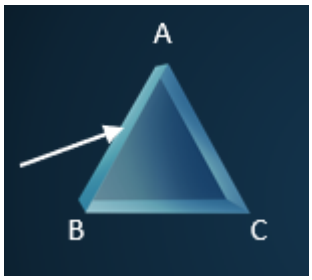
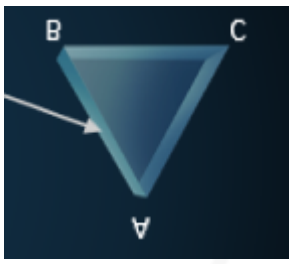
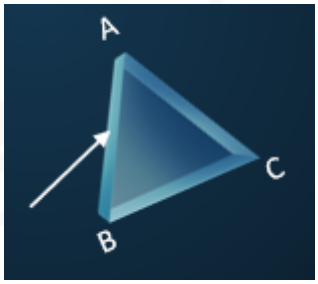
12. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in figure. In which of the following cases, after dispersion, the third color from the top corresponds to the color of the sky?

A. 

B. 

C. 

D. 

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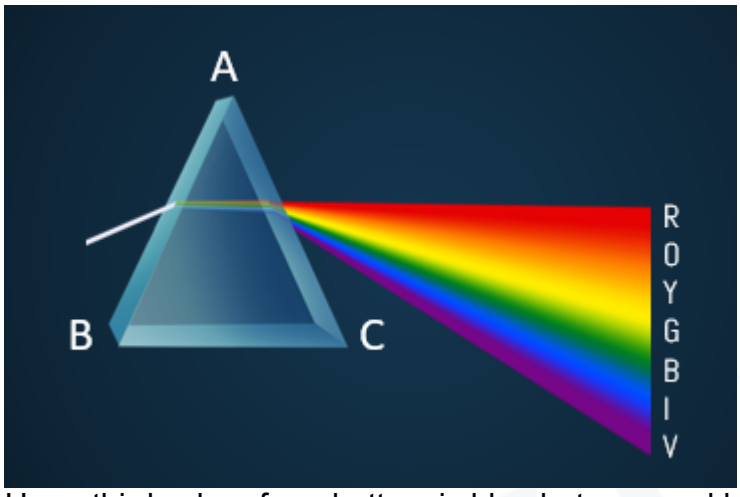
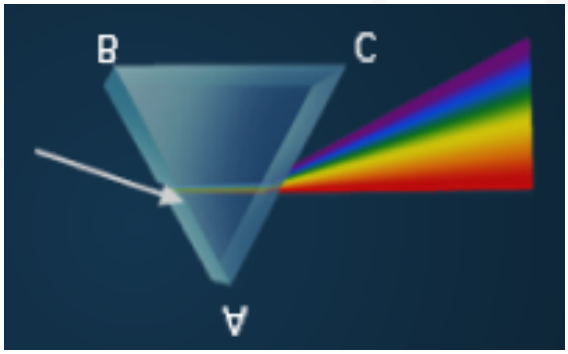
When the white light passes through some transparent material such as glass prism, it splits into its seven constituent colors(VIBGYOR). This phenomenon of splitting of white light is known as dispersion of light.
We know that colour of sky is blue. So the third color from the top corresponds should be blue.
When light passes through prism, it spits and comes toward the base(BC) as shown.



Here, third colour from bottom is blue but we need blue colour from top. This can be achieved by flipping a prime by 180^0 .
As shown below:



13. In Tyndall effect, the colour of light that is scattered depends on:

- **A.** Size of the scattering particle.
- **B.** Colour of scattering particle.
- **C.** Temperature of the scattering particle.
- **D.** Both temperature and size of the particles.

The colour of light that is scattered depends on the size of the scattering particle. If the size of particle is small, blue colour of the visible spectrum is scattered. However, if the size of particle is big, longer wavelengths of light are also scattered.

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14. Statement I: Stars twinkle, while planets shine steadily.
Statement II: The refractive index of the atmosphere is different at different altitudes.

A. Only statement I is correct.

B. Only statement II is correct.

C. Both the statements are correct.

D. Both the statement are incorrect.

Stars act as point source of light as they very far from earth in comparison to planets. Earth's atmosphere disturbs the light emerging from point source easily. So, the stars appears to be twinkling.

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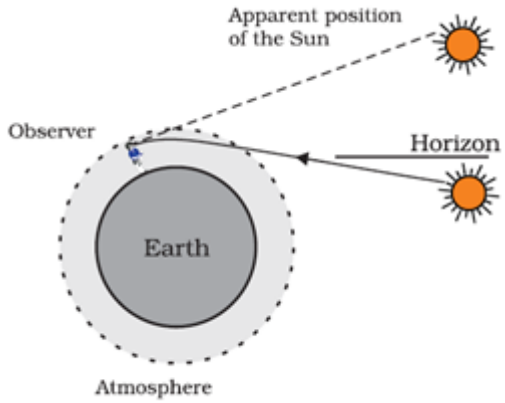
15. Statement 1: There is a time delay between actual sunrise and apparent sunrise.

Statement 2: Since the Earth is spinning on its axis, therefore day and night occur.

- **A.** Statements 1 and 2 are correct but statement 2 is not the reason of statement 1.
- **B.** Statements 1 and 2 are correct and statement 2 is the correct reason for statement 1.
- **C.** Both statements are wrong.
- **D.** Statement 1 is correct but statement 2 is incorrect.

Since we have an atmosphere which has a higher refractive index as compared to vacuum so, the sunlight entering the atmosphere bends and so we see the apparent sunrise two minutes before the actual sunrise (the actual crossing of the Sun with respect to horizon).



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16. A man observes the sunrise and sunset at $5:58\ AM$ and $5:32\ PM$ respectively. What is the length of the day between the actual sunrise and sunset?

A. $11\ hours\ 40\ minutes$

B. $11\ hours\ 34\ minutes$

C. $11\ hours\ 30\ minutes$

D. $11\ hours\ 26\ minutes$

We know that the actual time difference between the early sunrise and actual sunrise is about 2 minutes due to atmospheric refraction. So we see actual sunrise at $6:00\ AM$ i.e. two minutes after early sunrise.
Similarly man observe sunset at $5:32\ PM$ but Sun is actually below the horizon, it appears at the horizon due to atmospheric refraction. Actual sunset is at $5:30\ PM$ i.e. 2 minutes before delayed sunset.
Therefore, the length of the day between the actual sunrise ($6:00\ AM$) and sunset ($5:30\ PM$) is $11\ hours\ 30\ minutes$.

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17. In an experiment, Rakesh used an equilateral triangular glass prism and projected a narrow beam of white light source from one side of the surface of the prism. He placed a screen on the other side and saw many colours appearing as patches on the screen. But when he placed a second identical prism in an inverted position with respect to the first prism, he found a beam of white light emerging out from the other side of the second prism.

Why did the white light split into its constituent colours after passing through the first prism?

- ✗ **A.** Refractive index of each colour of light is different.
- ✗ **B.** Wavelength of each colour of light is different.
- ✗ **C.** Speed of each colour of light is different in the glass prism.
- ✓ **D.** All of the above

The speed of light is constant in vacuum for all colours, but it depends on the wavelength of light when it passes through a medium. We know refractive index of a medium depends on wavelength of light. When white light passes through a prism, each colour refracted to different extents. This results in seperation of colours, producing a spectrum.

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18. In an experiment, Rakesh used an equilateral triangular glass prism and projected a narrow beam of white light source from one side of the surface of the prism. He placed a screen on the other side and saw many colours appearing as patches on the screen. But when he placed a second identical prism in an inverted position with respect to the first prism, he found a beam of white light emerging out from the other side of the second prism.

    If Rakesh had passed a monochromatic light through the prism, then which of the following phenomenon would be observed?

    ✗ **A.** Dispersion

    ✓ **B.** Refraction

    ✗ **C.** Reflection

    ✗ **D.** Scattering

    He will only be able to see the refraction of the light through the prism, not the dispersion because the source of light he is using is monochromatic, which is the light of only single wavelength.

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19. In an experiment, Rakesh used an equilateral triangular glass prism and projected a narrow beam of white light source from one side of the surface of the prism. He placed a screen on the other side and saw many colours appearing as patches on the screen. But when he placed a second identical prism in an inverted position with respect to the first prism, he found a beam of white light emerging out from the other side of the second prism.

If the white ray falls on the system arranged in the given way, then what will be the topmost colour of the output light coming from the third prism?

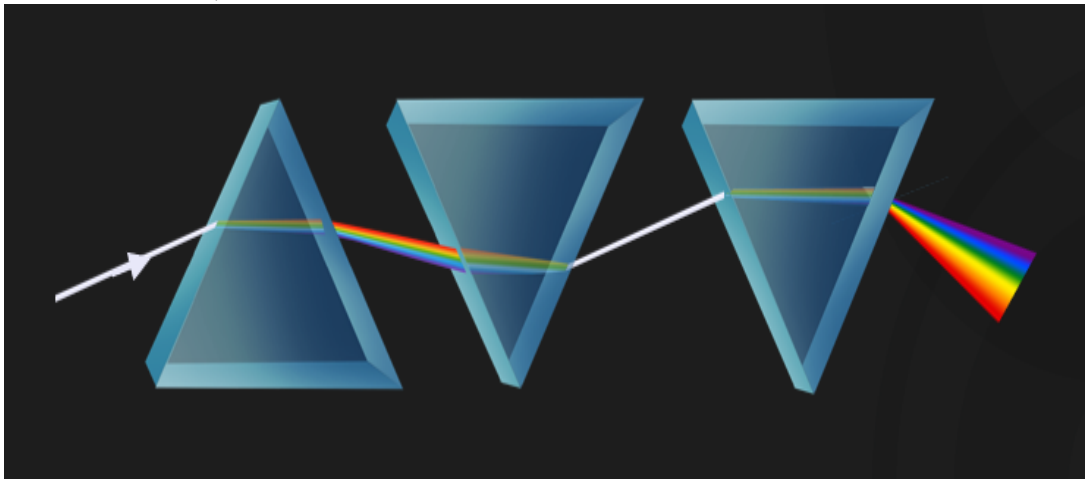
A. Red

B. Yellow

C. Violet

D. Blue

After passing through the combination of the first two prisms, light will come out undispersed. Now, this white light will pass through the upside down prism which will produce the spectrum with violet at top and red at the bottom. Hence, violet will be the answer.



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20. In an experiment, Rakesh used an equilateral triangular glass prism and projected a narrow beam of white light source from one side of the surface of the prism. He placed a screen on the other side and saw many colours appearing as patches on the screen. But when he placed a second identical prism in an inverted position with respect to the first prism, he found a beam of white light emerging out from the other side of the second prism.

What would've Rakesh observed if he had kept the prism inside the water instead of air and had passed the same white light through it?

✗ **A.** White light would've passed through prism without splitting.

✗ **B.** The angle of deviation of each splitted ray would've increased.

✓ **C.** The angle of deviation of each splitted ray would've decreased.

✗ **D.** Splitted red light would've bent more than the splitted blue light.

If we keep a prism inside water instead of air, the refractive index of prism with respect to water will decrease. Thus, the angle of deviation of each colour will also decrease.

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