Understanding
Colour Vision Deficiency

A Handbook on Ishihara Testing,
Classroom Adaptations & Career Guidance for School Children

What we see What colourblind sees

• Compiled By •
Freya Prajapati

SHINE
AIDING COLOURS
SHIVANI INITIATION FOR EYE HEALTH

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EDITOR'S MESSAGE

"In a world where colours play such an important role in learning, Colour Vision Deficiency (CVD) or colour blindness often goes unnoticed. Many students move through school without realising that they see colours differently, and this can quietly affect their understanding, confidence, and even their future choices.

For me, this journey is deeply personal. My brother, Aahan, is red-green colourblind. For years, no one realised it, not even us. I still remember moments when something as simple as using the "wrong" colour in class led to confusion and frustration. That experience made us realise how easily this condition can be misunderstood, and how important awareness truly is.

It gives me immense happiness to present "Understanding Colour Vision Deficiency – A Handbook on Ishihara Testing, Classroom Adaptations & Career Guidance for School Children." This handbook is built not just on knowledge, but on real experiences, with the aim of making classrooms more understanding and inclusive.

This handbook focuses on four important pillars: early identification through preliminary screening of school children using Ishihara testing, classroom support through simple adaptations, increasing teachers' awareness, and providing meaningful career guidance. Each section is designed to be practical, clear, and easy to apply in everyday teaching.

It is useful for school teachers, school counsellors, NGO volunteers, parents, health workers etc.

Through the AIDING COLOURS initiative, we have seen how early screening and timely support can completely change a child's learning experience. When teachers understand and adapt, students feel supported, confident, and capable.

Dr Shivani Bhatt Charitable Foundation (SBCF) has always been dedicated to supporting children's education and health, women's health, organ donation, medical education, and emergency medical services. With this initiative, SBCF extends its work to raising awareness about colour blindness, an invisible disability that is often overlooked in India.

I would like to extend my deepest gratitude to the Team SBCF and the great soul of Shivani Didi for blessing me with the opportunity to compile this book. Her belief in making essential knowledge accessible to society has been the true driving force behind this work.

I extend my heartfelt thanks to my parents for their constant support and encouragement, and to my brother, Aahan, whose journey inspired this work.

I would like to sincerely thank Dr. Purvi Soni, Dr. Dinesh Maru and Dr. Sapna Raval for their valuable guidance and insightful suggestions, which have strengthened this handbook. I would also like to thank all teachers, volunteers, and well-wishers who supported this initiative with dedication and positivity.

> "If colour is removed,
> your teaching should still work."

Let us ensure that no child is limited by how they see colours, but empowered by how we choose to support them.

Thank you."

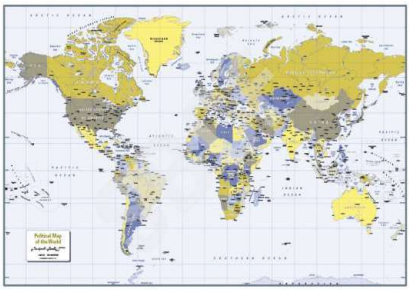
– Freya Ritesh Prajapati

What is Colour-blindness or Color Vision Deficiency (CVD)?

- Colour Vision Deficiency (CVD) is a condition in which a person has difficulty distinguishing certain colours (commonly red & green)
- Colour Vision Deficiency is not a disease.
- It is a genetic condition, not an illness.
- It does not require treatment or cure.
- It does not affect intelligence or academic ability, but it can influence certain learning activities and career choices.

How do colourblind children see?

Normal Vision



Colour Blind Vision

There are two main types of red-green colour blindness:

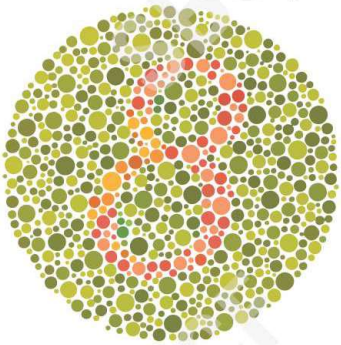
1. Protan Type (Red Weakness)
    - Protanopia – Complete red deficiency
    - Protanomaly – Partial red deficiency
2. Deutan Type (Green Weakness)
    - Deuteranopia – Complete green deficiency
    - Deuteranomaly – Partial green deficiency

About the Ishihara Test

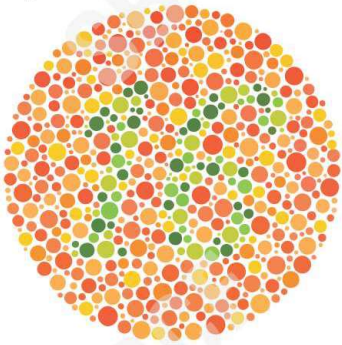
The Ishihara Colour Vision Test is the most widely used screening test for detecting red–green colour vision deficiency.

The test consists of plates with coloured dots that form numbers or patterns.

Individuals with normal colour vision can identify the numbers easily, while individuals with colour vision deficiency may see different numbers or may not see any number.



Normal Vision - 8
Colour Blind - Number not seen



Normal Vision - 16
Colour Blind - Number not seen

Instructions for Conducting the Test

The test should be conducted in a well-lit room using natural daylight whenever possible.

- Avoid:
  - Direct sunlight
  - Dim lighting
  - Coloured lighting
- Testing Procedure:

1 Seat the student comfortably.
2 Hold the plate at the reading distance (approximately 75cm away) from the student.
3 Ensure the plate is perpendicular to the student's line of vision.
4 Show each plate for no longer than 3 seconds.
5 Ask the student to read the number immediately.
6 Record the response.

ISHIHARA'S TEST

• Instructions for Testing •

- Ask the child to read the number they see.
- For small children, ask them to trace the number with their finger.
- Do not give hints.
- Do not ask about colour, focus only on identifying the number.
- Do not force the child to answer.
- Allow the child to answer comfortably, but limit the time to about 3-5 seconds.

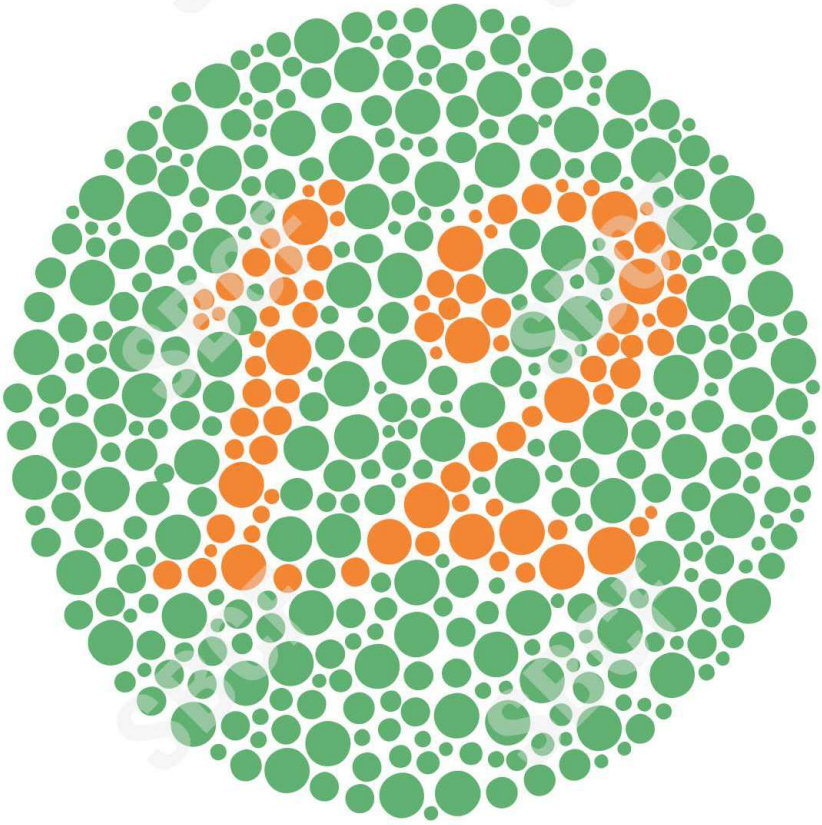
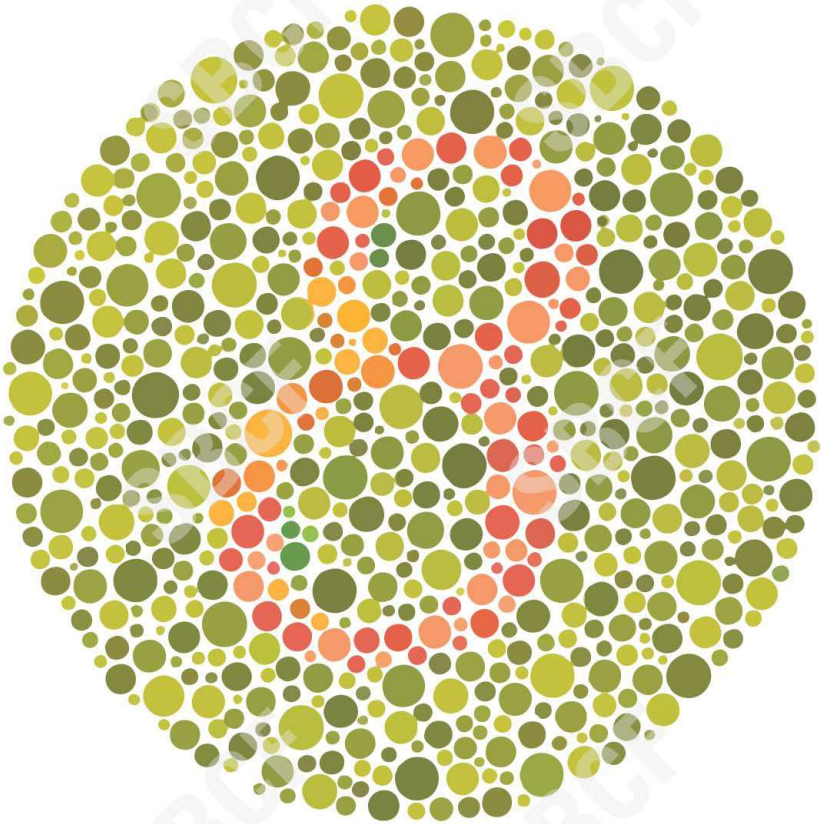


Plate No. 1

Plate No. 2



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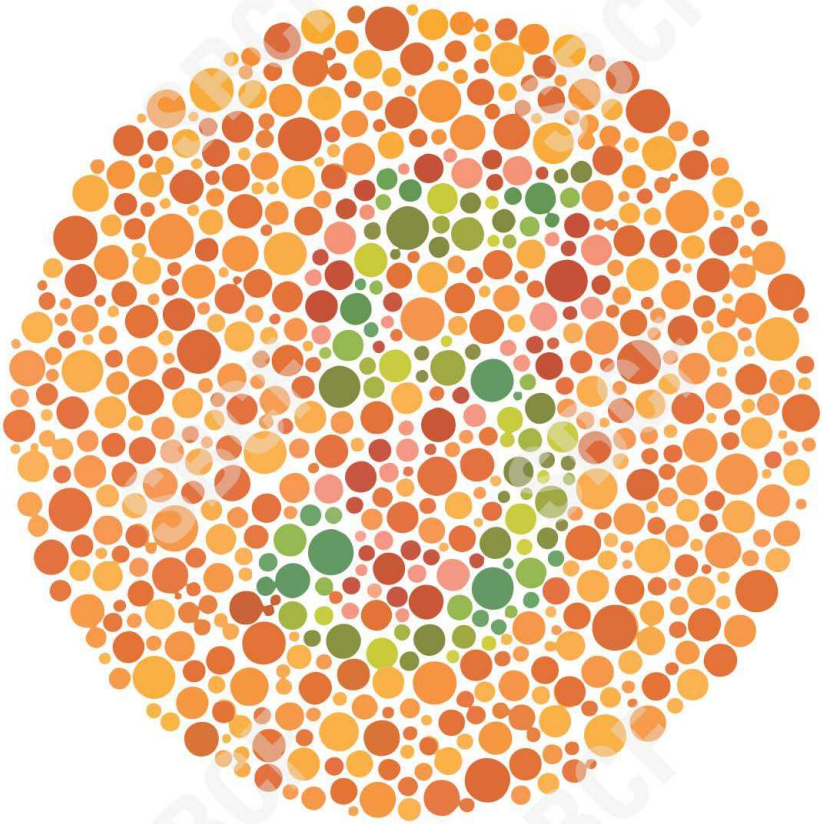

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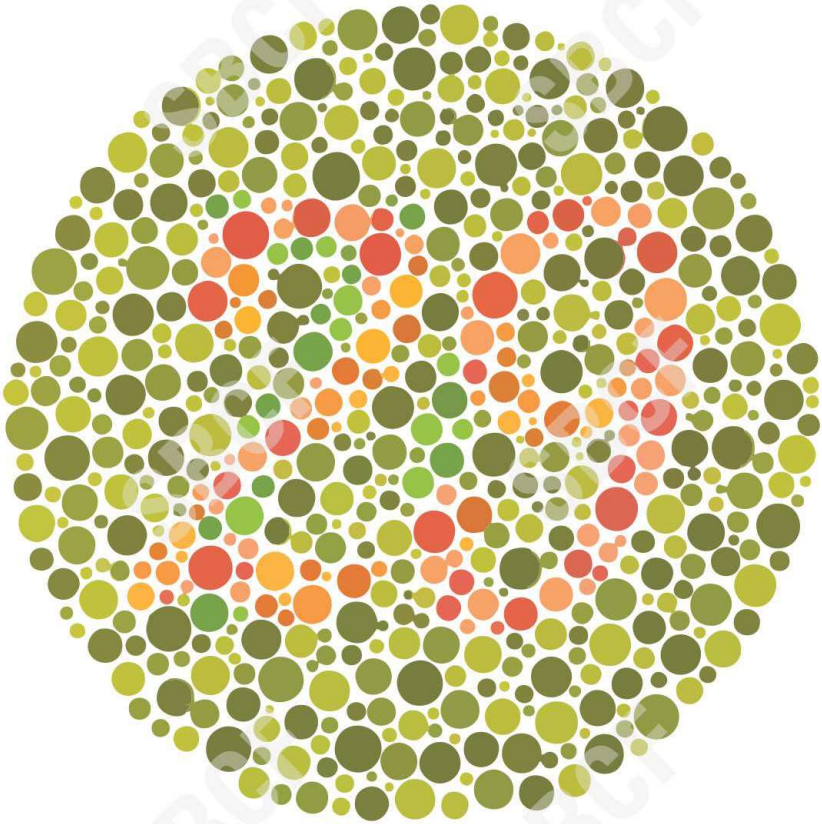

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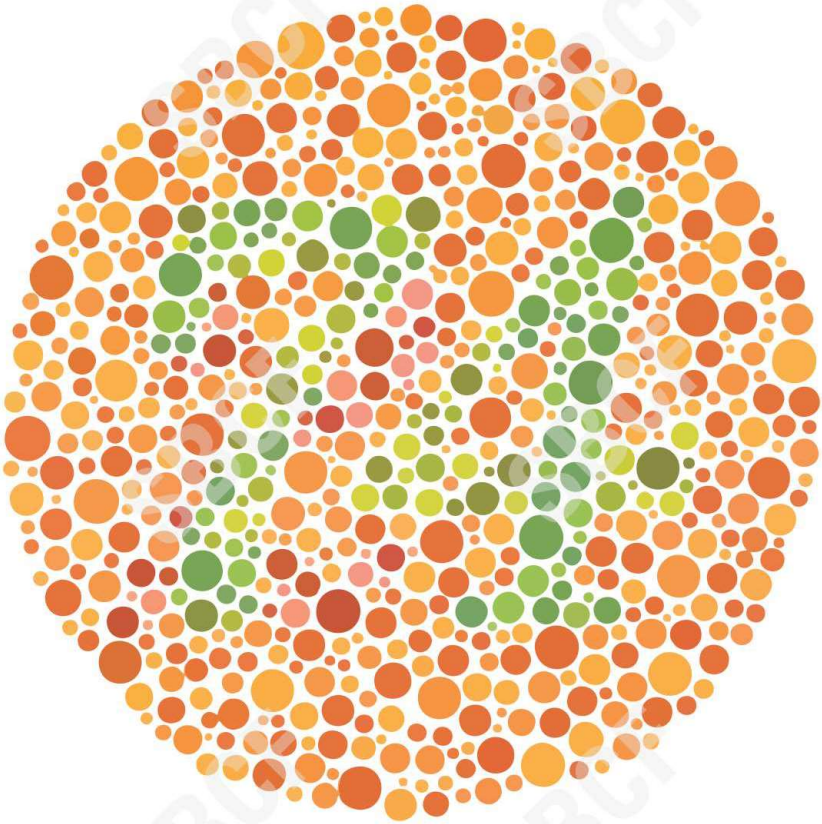

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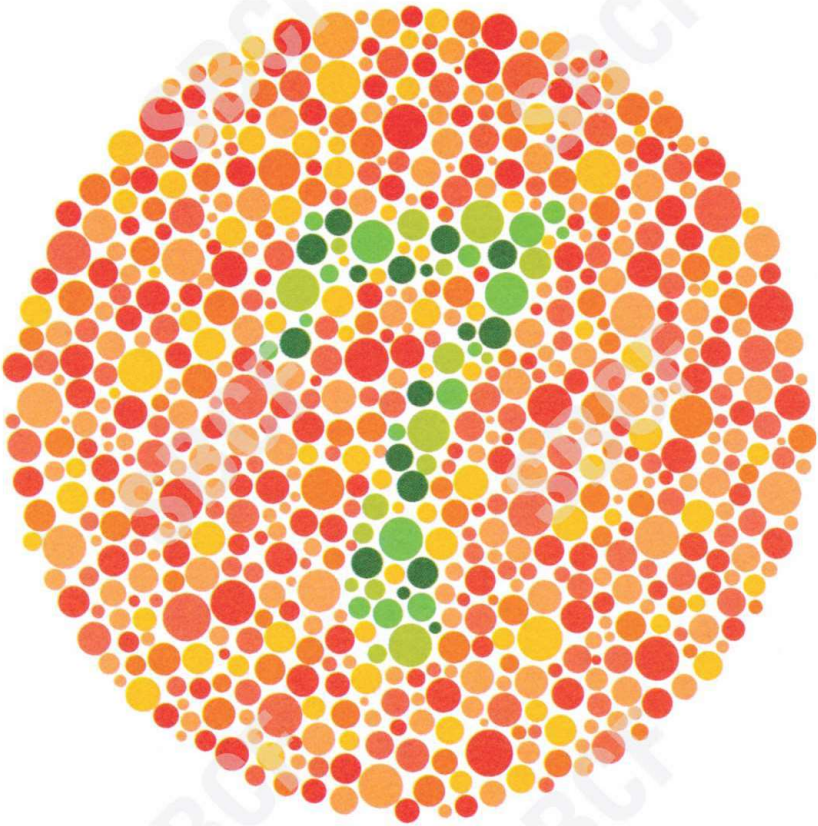

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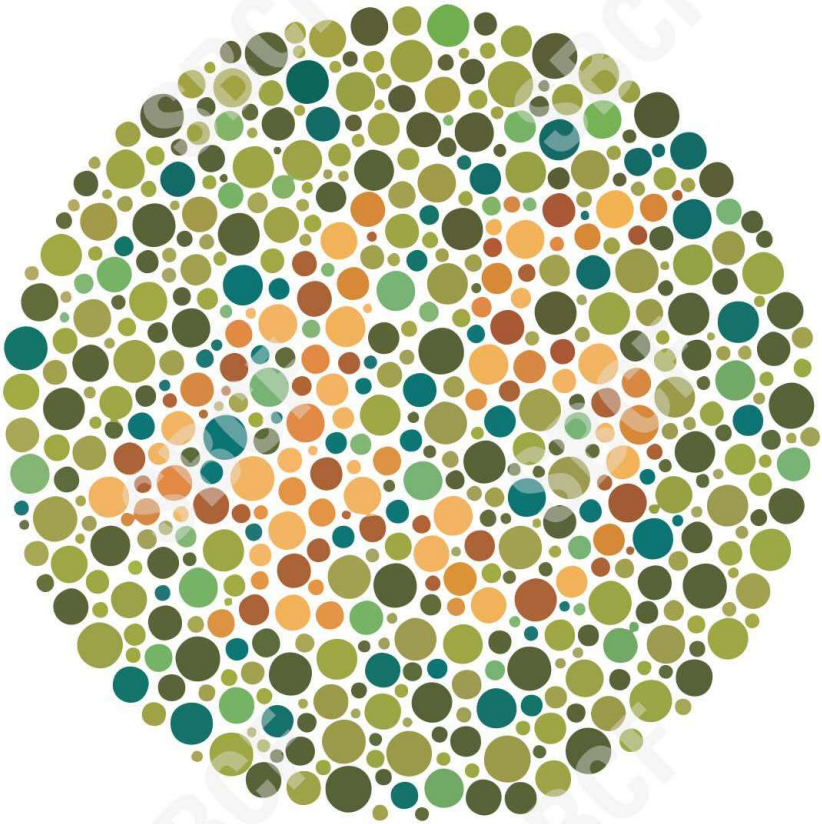

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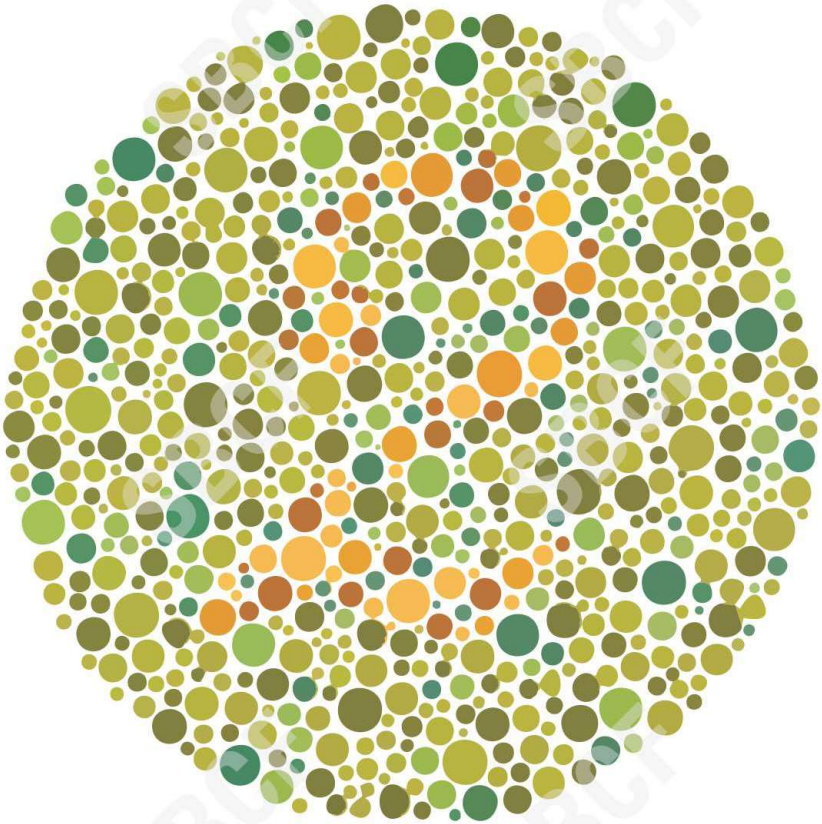

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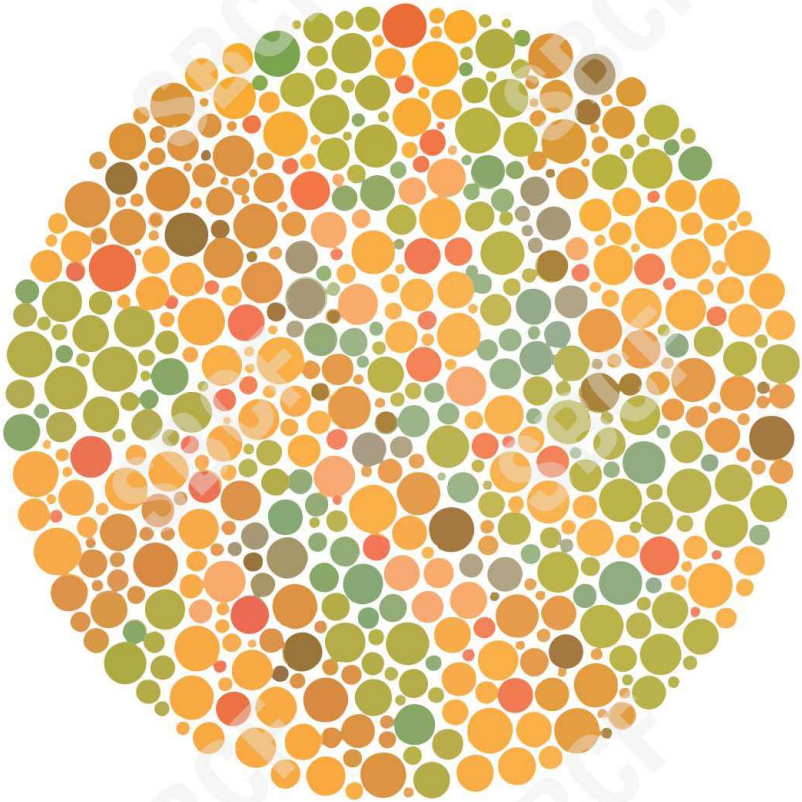

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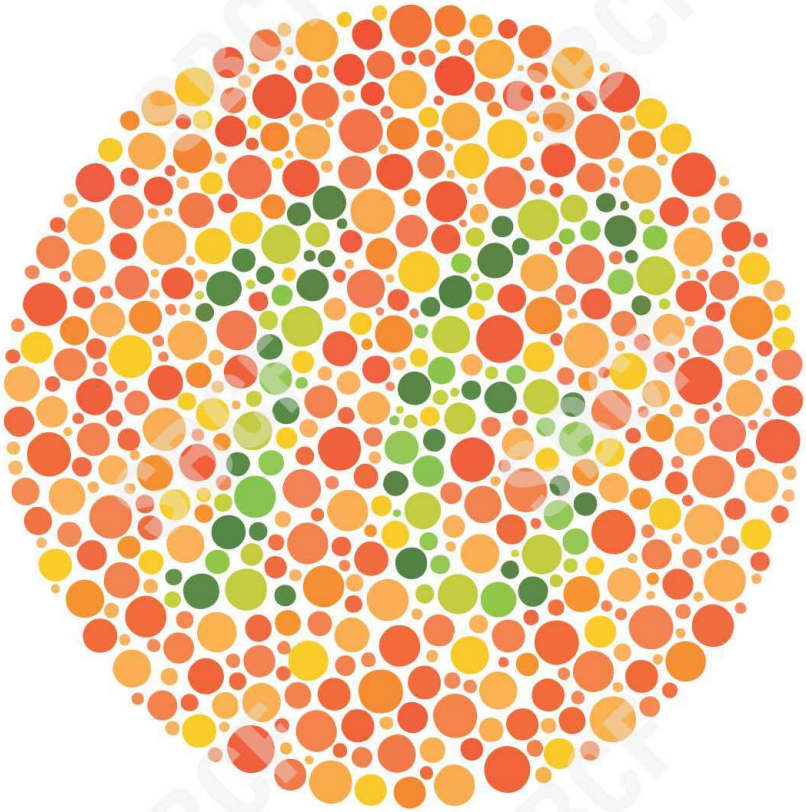

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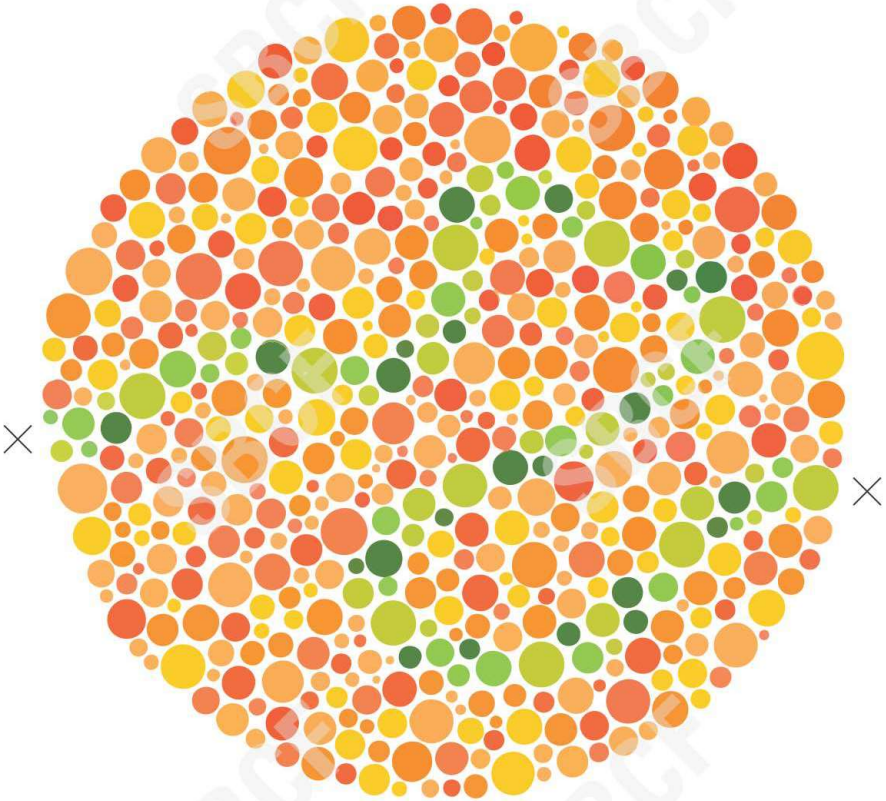

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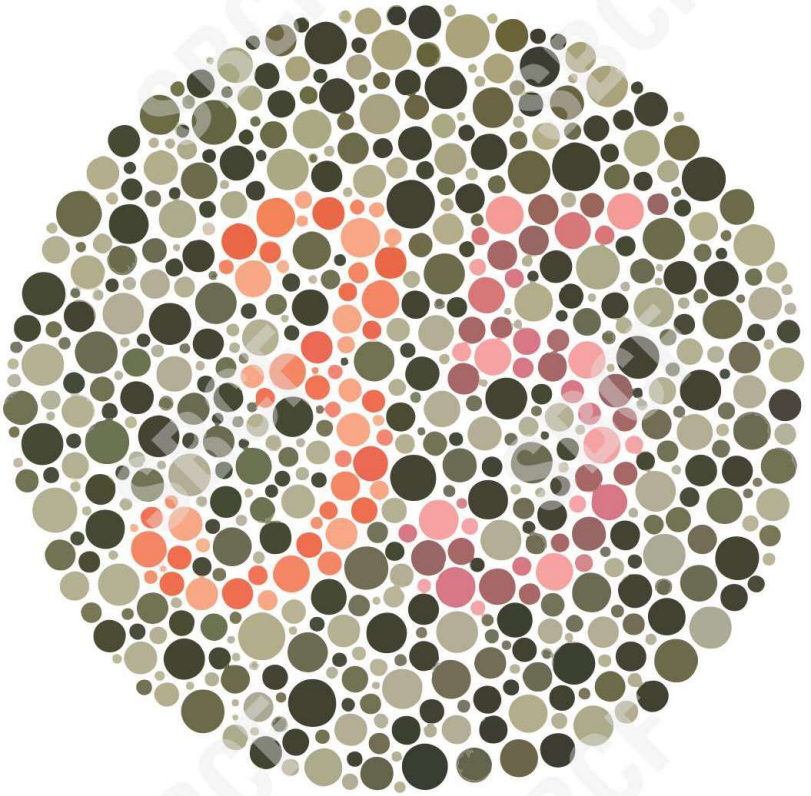

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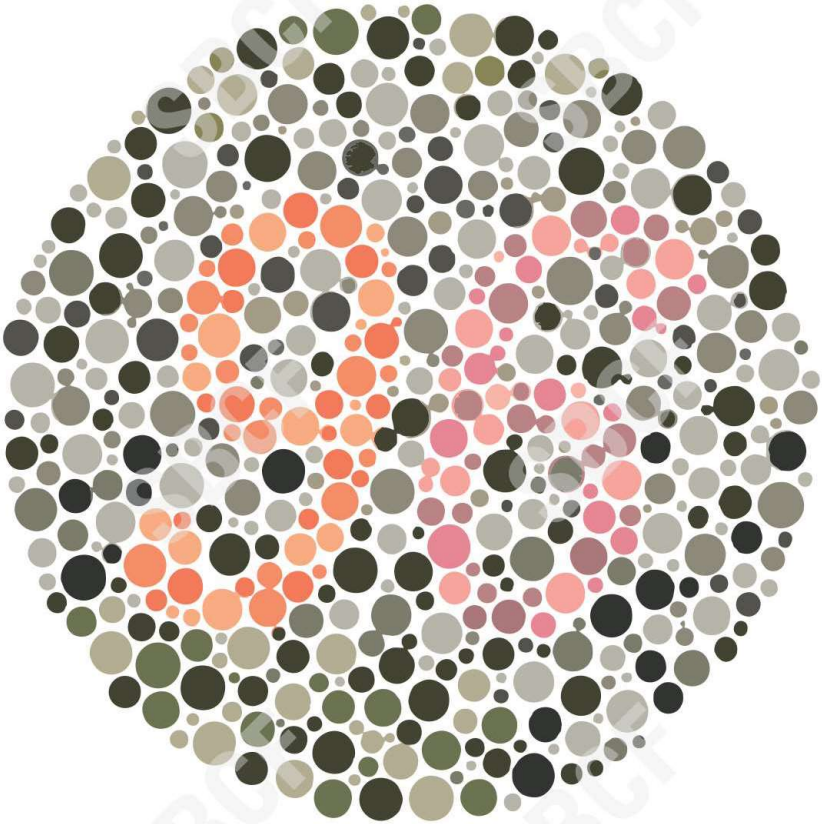

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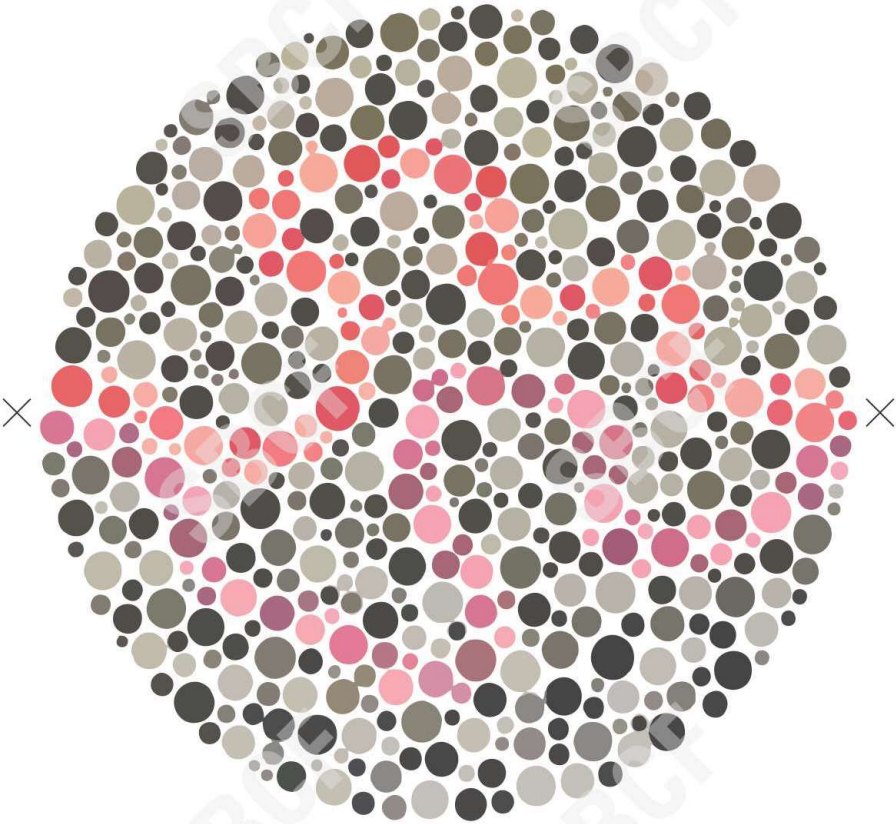


Answer to each plate

Plate Number	Normal Vision	Person with Red - Green Deficiency				Person with Total Colour Blindness
1	12	12				12
2	8	3				x
3	5	2				x
4	29	70				x
5	74	21				x
6	7	x				x
7	45	x				x
8	2	x				x
9	x	2				x
10	16	x				x
11	Traceable	x				x
		Protan		Deutan		
		Strong	Mild	Strong	Mild	
12	35	5	(3)5	3	3(5)	
13	96	6	(9)6	9	9(6)	
14	can trace two lines	Purple	Purple (red)	Red	Red (Purple)	x

The mark x shows that the plate cannot be read. The numbers and winding lines in brackets ( ), show that they can be read or traced but they are comparatively unclear.

Note : More than 2 - 3 errors, refer to ophthalmologist

HOW CAN TEACHERS HELP ?

How to Identify a CVD Student in Class ?

Look for signs:

- Confuses red/green, blue/purple, brown/green, light shades of red/green
- Struggles with colour-coded charts/maps
- Avoids / dislikes Art periods or colouring tasks
- Uses the wrong colours in art class

Do not assume; confirm through screening (Ishihara test)

Common Mistakes Teachers Make

A colour blind student cannot differentiate between shades of red and green, so if colour is needed, add text labels to the image. Red-green colour-blindness is the most common, and 99% of children with colour-blindness have red-green colour-blindness.

Avoid:

✗ "Identify the region in red"

ASK:

✓ "Identify region A" (shown in red)

Avoid:

✗ USING ONLY COLOUR TO EXPLAIN CONCEPTS

e.g.

✗ "The red line shows profit and the green line shows loss."

✓ "The red line (labeled A) shows profit and the green line (labeled B) shows loss."

Avoid:

✗ Saying "This is obvious; it's green!"

What we see

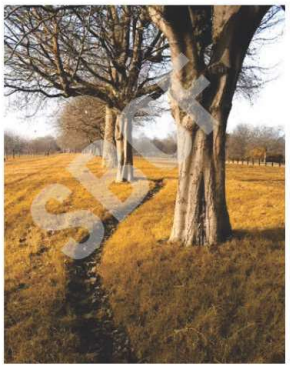
What red-green colourblind sees

Because they see green and yellow as the same.

Avoid:

✗ Penalizing wrong color usage

What we see



What red-green colourblind sees

Green colourblind person may not be able to differentiate between green and brown grass.

Classroom Adaptations

Board Teaching

- Use blue + black (avoid red/green combinations)
- Write labels or texts instead of relying on colour
- Speak while writing (verbal clues help)

Charts & Diagrams

Add:
- Labels (A, B, C)
- Patterns (dots, stripes)
- Use high contrast combinations

During Examination Paper Setting:

- Never rely only on colour differences
- Avoid colour-based questions

Example: ✗ "Identify the red region"

- If colour is needed, add text labels

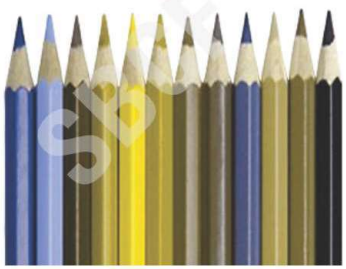
Example: ✓ "Identify region A (shown in red)

Subject-Wise Guidelines

Art Class

- Provide colour pencils and pens with clearly written labels.
- Encourage students to write colour names on their artwork when required.
- Focus more on creativity, patterns, and design rather than on colour accuracy alone.
- Avoid grading based purely on colour accuracy.

What we see

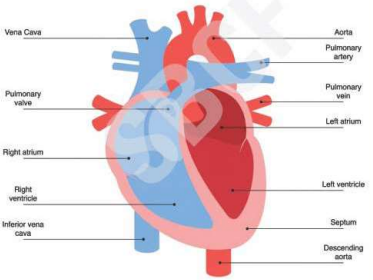


What red-green colourblind sees

Labelled colour sketch pens, designed by SBCF

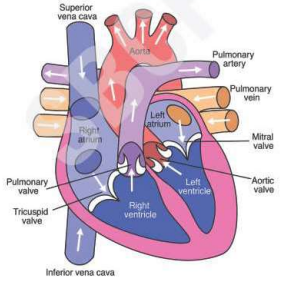
Biology

- Label all parts clearly
- Provide text-supported diagrams
- Avoid colour-only identification



CVD non-friendly image

(Here, there are no black boundaries, they will confuse between light shades of Red)



CVD friendly image

(black boundaries)

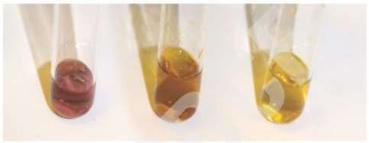
Chemistry

Help the student to identify the colour of substances/ chemicals/reagents, pH changes or endpoint colour changes in titration

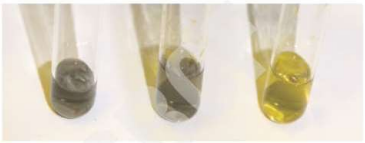
a. Normal Vision

b. Blue-Weak / Tritanomaly

c. Red-Weak / Protanomaly



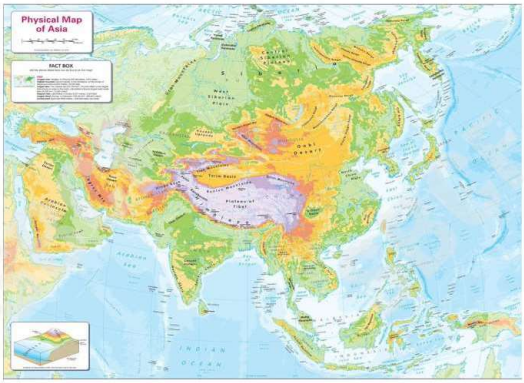
a. Red Blind / Protanopia



a) Color change observed by a person with normal vision during titration using methyl red. (b, c, d). The same colors as observed by individuals with varying degrees of color-blindness.

Geography

- Use Symbols and Labels
- Avoid only colour shading
- Be vigilant while using physical maps as they may be confused with different shades of green, yellow and brown.
- Use colour-blind-friendly maps that show *country borders* both on land and at sea, as well as the International Date Line. (Available Online)



Colour blindness friendly maps (Available Online)

Digital Teaching Tips

- Use high-contrast Power Points
- Avoid red-green combinations
- Enable: - Bold fonts - Clear labels

Psychological/Emotional Support

- Never embarrass a child for wrong colours. Normalise it by saying, "Everyone sees differently-that's okay."
- Provide examples of successful individuals with colour blindness to boost self-esteem (e.g. Mark Zuckerberg, John Brooks)
- Prevent peer teasing
- Encourage confidence
- Communicate with their Parents
- Inform early (do not delay till Grade 10–12 as they are important for career selection)
- Share career guidance (when needed)

Quick Teacher Checklist

- ✔ Do I use labels along with colours?
- ✔ Are my diagrams understandable without colour?
- ✔ Have I avoided red/green combinations?
- ✔ Did I support, not judge, the student?

One Golden Rule

"If colour is removed, your teaching should still work."

What Peers Should Take Care Of (For Colour-Blind Students) ?

- Avoid teasing or making jokes
- Be patient during activities with him
- Clarify when needed
- Be supportive, not overprotective

Career guidance for colour-blind students in India

This document provides practical career guidance for students with Colour Vision Deficiency (CVD), along with parents and teachers.

Each career is classified into:

- SAFE → Colour vision is not required
- ⚠ CAUTION → Depends on the role or specialization
- AVOID → Colour recognition is essential for safety or core tasks

- These labels are meant for guidance only and may vary depending on Institution rules, Employer requirements, Medical fitness criteria
- It Helps students make informed career choices, supports parents in early planning and enables schools to provide inclusive counselling
- This guide does not replace the admission criteria, Recruitment medical tests, or government regulations.

ARTS, HUMANITIES & SOCIAL SCIENCES	Suitability
Political Science, Sociology, Economics, History, Psychology, Social Work, Public Administration, Linguistics/Translation, Journalism (Editor, Writer)	✅ Safe

COMMERCE, FINANCE & ECONOMICS	Suitability
Accounting, Audit, Finance, Economics, Statistics, Banking (Admin roles)	✅ Safe

MANAGEMENT & ADMINISTRATION	✓ Safe

EDUCATION	Suitability
Teacher, Lecturer / Professor, Education Officer	✓ Safe

LAW & JUDICIAL SERVICES	✓ Safe

PURE SCIENCES & RESEARCH	Suitability
Physics, Chemistry (Theoretical), Biology (Theoretical), Scientific Research	✓ Safe

AGRICULTURE, ENVIRONMENT & NUTRITION	Suitability

MEDICAL (MBBS) – BRANCH-WISE

Admission to medical courses is permitted; however, choice of clinical specialisation may be limited later based on medical fitness requirements and patient safety considerations.

Branch	Suitability
Surgery, Obstetrics & Gynaecology, Emergency Medicine, Dermatology, Anaesthesiology	⚠ Caution
Ophthalmology, Pathology	✗ Avoid
Pharmacology, Forensic Medicine (non-field), Community Medicine / Public Health, Hospital Administration, Medical Education (Theory)	✓ Safe

DENTAL SCIENCES	✅ Safe

PHARMACY	Suitability
Pharmaceutics, Industrial Pharmacy, Pharmacovigilance, Regulatory Affairs Pharmacy Teaching	✅ Safe
Pharmaceutical chemistry / Quality assurance	⚠ Caution

PARAMEDICAL & ALLIED HEALTH Branch / Career	Suitability
Physiotherapy (BPT/MPT), Health Information Management, Biostatistics / Epidemiology, Speech Therapy / Audiology, Psychology / Counselling Public Health Nutrition	✅ Safe
Nursing, OT / Anaesthesia Technician	⚠ Caution

FORENSIC SCIENCES - Branch / Career	Suitability
Forensic Toxicology, Forensic Biology (DNA), Forensic Chemistry	✅ Safe
Crime Scene Investigation	⚠ Caution

ENGINEERING (ALL BRANCHES) - Branch	Suitability
Computer Science / IT / AI, Mechanical (Design/Analysis), Civil, Biotechnology / Biomedical, Environmental Engineering	✅ Safe
Electrical (Field work), Chemical Engineering, Electronics (Signal roles), Railway / Aviation Safety	❌ Avoid

OTHER BRANCHES	Suitability
Ayurvedic & Homeopathy (Surgical)	⚠ Caution
Agriculture & Environment	✅ Safe
Media & Design	⚠ Caution
Arts & Performing Arts	✅ Safe
Sports & Physical Education	✅ Safe
Library & Information Science	✅ Safe
Tourism & Hospitality	✅ Safe

GOVERNMENT JOBS WHERE NORMAL COLOUR VISION IS MANDATORY:

(Ref: Government of India, Handbook on Medical Examination for Government Services – Chapter XIII: Standards of Fitness. Ministry of Health & Family Welfare, Government of India.)

COLOUR VISION STANDARDS (CP-I, CP-II, CP-III)

These are government medical categories used to decide whether a person's colour vision is suitable for a specific job.

CP-I (Highest Standard)

Normal colour vision required

Where it is used:

- Defence forces
- Pilots & Air Traffic Control
- Railway drivers (Loco Pilots)
- Navigation roles (ships)

CP-II (Moderate Standard)

Adequate colour vision required

- Colour vision is important, but not always critical for safety
- Some roles may allow minor deficiency, others may not
- Depends on the department and job type

Where it is used:

- Some technical jobs
- Certain engineering roles
- Selected government posts

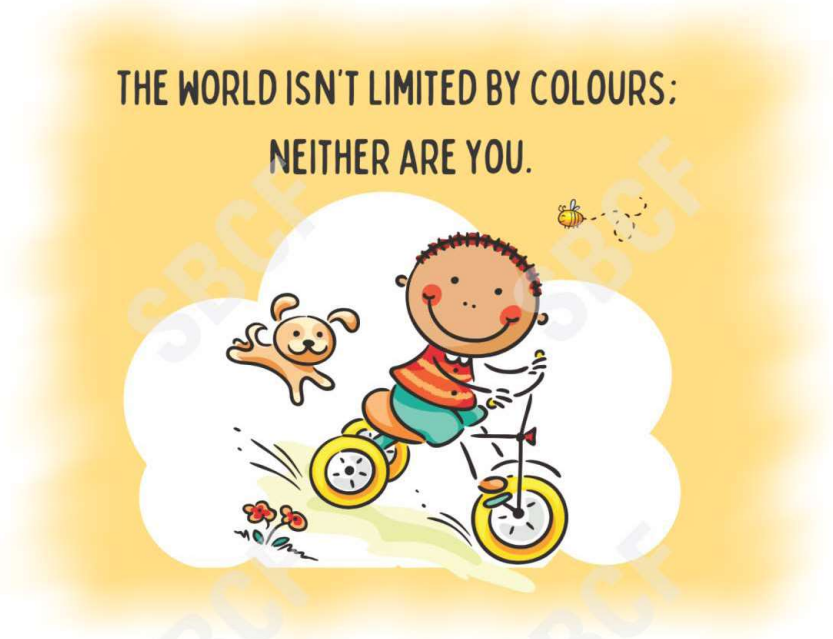
CP-III (Relaxed Standard)

Colour vision not essential

- Job does not depend on colour identification
- Suitable for most students with colour blindness

Where it is used:

- Administrative jobs
- Teaching, law, management
- IT, research, non-clinical healthcare



Disclaimer :

This handbook is intended solely for educational awareness and preliminary screening purposes.

Colour Vision Deficiency (CVD) screening using Ishihara plates is not a definitive diagnosis. All suspected cases should be referred to a qualified ophthalmologist for comprehensive evaluation and confirmation. The career guidance and recommendations provided are general in nature and may vary depending on institutional policies, employer requirements, medical fitness criteria, government regulations. While this handbook provides guidance on colour vision standards, final eligibility for any course, profession, or recruitment is determined by the respective authorities (e.g., UPSC, SSC, Railways, Defence Services, DGCA, etc.) and government and private institutional guidelines. The authors and publishers do not assume responsibility for decisions made based on this information.

References

1. Government of India
   Handbook on Medical Examination for Government Services – Chapter XIII: Standards of Fitness.
   Ministry of Health & Family Welfare, Government of India.
2. Ministry of Education, Government of India (2020)
   National Education Policy (NEP) 2020.
   Emphasis on inclusive, equitable, and student-centric career guidance.
3. Rights of Persons with Disabilities Act, 2016 (RPwD Act)
   Government of India.
   Legal framework supporting non-discrimination and reasonable accommodation in education and employment.
4. Mohit Mangal – A Complete Career Guide (2025)
   Parents' Handbook of Careers After School in India.
   Used for mapping higher education domains and career verticals relevant to Indian students.
5. Union Public Service Commission (UPSC)
   Official recruitment rules, service regulations, and medical fitness standards for Civil Services and Central Services.
6. State Public Service Commissions (State PSCs)
   Recruitment notifications and service rules for State-level administrative, judicial, and academic posts.
7. International Civil Aviation Organization (ICAO)
   Medical standards referenced only for exclusion of aviation roles requiring normal colour vision.

Frequently Asked Questions (For Parents)

1. My child failed the Ishihara - what next?

   Don't panic. CVD affects about 8 in 100 boys and 1 in 200 girls. The Ishihara is a screening test, not a final diagnosis. Schedule a confirmatory examination with an ophthalmologist. Keep the report safely, it will matter later for school adaptations and career planning.

2. Is it curable? Will it worsen?

   Inherited CVD is genetic and lifelong. There is no exercise, diet, or surgery that changes it. The reassuring news is that it does not get worse with age - your child sees colours today as they will at fifty. The only form that can change is acquired CVD, caused by certain medicines (ethambutol, hydroxychloroquine), diabetes, glaucoma, or optic nerve disease. A sudden change in colour vision, or a change in only one eye, needs urgent evaluation.

3. Should I tell the school?

   Yes, and the earlier the better. CVD is invisible, so a child who confuses red and green pens or misreads charts is often labelled "careless" instead of being understood. A short note to the class teacher enables simple adjustments: avoiding colour-only instructions, choosing high-contrast materials, and seating the child where the board is well-lit. Frame it as information, not a complaint.

4. Can my child still become a doctor, engineer, or pilot?

   Doctor — yes. After the 2017 expert committee review, the bar on CVD candidates was removed. MBBS and most postgraduate specialities are open.

   Engineer — yes, in almost every branch. A few electrical roles involving live colour-coded wiring may need workplace adjustments.

   Pilot — restricted. DGCA still requires normal colour vision for a Commercial Pilot License. Private flying, drone operation, and aviation management remain open.

   Other restricted roles: armed forces combat, Indian Railways loco pilot, merchant navy deck officer. Open: law, civil services, IT, architecture, teaching, finance, design, research, journalism, and the creative industries.

5. Are there apps or glasses that help?

   Tinted glasses (EnChroma, Pilestone) use filters to boost red-green contrast. They help some people enjoy colours more vividly, but do not restore normal vision, and will not let your child pass a medical test for a disqualifying job. Free apps like Color Blind Pal, Chromatic Vision Simulator, and Microsoft Seeing AI identify colours through a phone camera, which is useful for matching clothes or reading colour-coded charts. iPhones and Android phones also have built-in colour filters in accessibility settings, which are worth enabling for schoolwork on these devices.

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SBCF

STUTI

SMS - BUS

STOP

SHINE-AIDING COLORS

SMILE

SOUL

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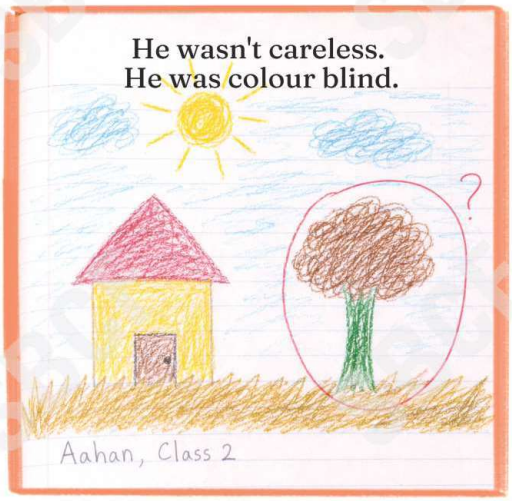
SHABD : Shivani Book Donation
BLS : Basic Life Support Program (Jeevan Sanjivani)
SHODH : Shivani Organ Donation Help
SAHELI : Detection & treatment of anaemia in school girls
SHINE : Shivani Initiation for Eye health for school children
: Aiding Colors : Detection of color vision deficiency in school children
SMILE : Shivani Memorial Initiative for Life Empowerment
SMS : Shivani Mobile School
SOUL : Shivani Outreach programme for Underpriviledged
STOP : Shivani Thalassemia Outreach Programme
STUTI : Shivani Teachers Understanding Training Initiative
: Observership in USA Promoting Quality Education.



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