



# A QUIZ OF BUILDING PHYSICS IN ENVIRONMENTAL DESIGN

**Pré e Pós questionário para o Workshop**

**Workshop: Environmental Principles & Architectural Design**

## **OBJETIVO DO QUIZ:**

### **Pré-Workshop:**

**Avaliar o conhecimento de conforto ambiental de cada participante, para melhor direcionamento dos temas a serem tratados no Workshop.**

### **Pós-Workshop:**

**Relatar a experiencia vivida e quais os conhecimentos adquiridos no Workshop, além de sugestões e comentarios.**

# Pré-Workshop

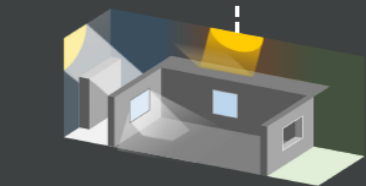


A QUIZ OF BUILDING PHYSICS  
IN ENVIRONMENTAL DESIGN

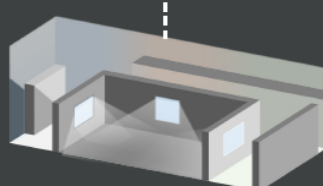
START

THIS QUIZ AIMS TO UNDERSTAND HOW MUCH OF THE BUILDING PHYSICS IN ENVIRONMENTAL DESIGN COVERED HERE IS FAMILIAR TO THE BUILDING DESIGNERS. THIS QUIZ IS LINKED WITH THE PROJECT OF ROOM, AN OPEN-ACCESS WEB PLATFORM FOR INTERACTING WITH BUILDING PHYSICS.

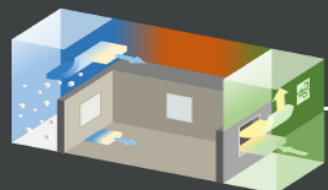
8 QUESTIONS, 4 PAGES ON THE FOLLOWING 4 TOPICS



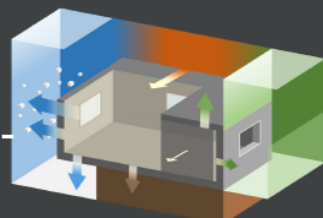
SOLAR ACCESS (Q1, Q2)



DAYLIGHT ACCESS (Q3, Q4)



NATURAL VENTILATION (Q5, Q6)

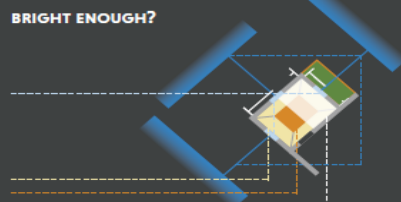
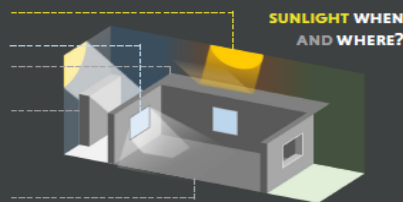


FABRIC HEAT TRANSFER (Q7, Q8)

ON EACH TOPIC

1<sup>ST</sup> QUESTION ASKS YOU TO LIST THE INFORMATION THAT YOU NEED, TO UNDERSTAND THIS ASPECT OF A ROOM'S ENVIRONMENT

2<sup>ND</sup> QUESTION ASKS YOU TO MAKE A JUDGEMENT ON THIS ASPECT OF THE ROOM'S ENVIRONMENT BASED ON THE INFORMATION PROVIDED



ARE YOU  STUDYING  WORKING  
 ARE YOU OR ?

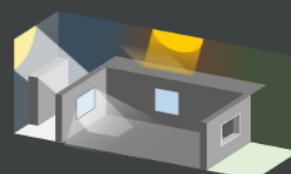
IN WHICH SUBJECT:

AS A:

YEARS OF STUDY:

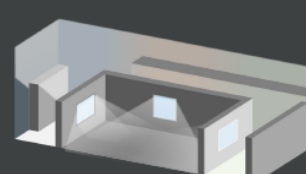
YEARS IN THE INDUSTRY:

ARE YOU INTERESTED IN THE TOPICS COVERED IN THIS QUIZ?



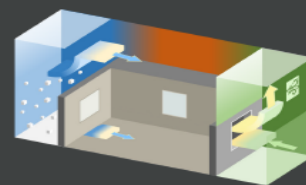
SOLAR ACCESS

- NO
- A BIT
- QUITE
- VERY



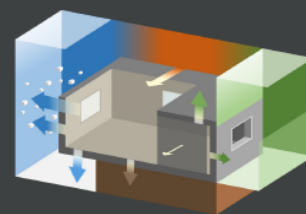
DAYLIGHT ACCESS

- NO
- A BIT
- QUITE
- VERY



NATURAL VENTILATION

- NO
- A BIT
- QUITE
- VERY



FABRIC HEAT TRANSFER

- NO
- A BIT
- QUITE
- VERY

1º Parte: descreve o format do QUIZ:

8 questões + 4 paginas + 4 tópicos, sendo:

Insolação + Luz Natural + Ventilação + Conf. Térmico

2º Parte:

Descrever seu perfil e área de interesse

YOU ARE DESIGNING A HOUSE IN BATH, A CITY IN THE SOUTHWEST OF UK, AND YOU ARE REVIEWING THE SOLAR ACCESS OF A LIVING-DINING ROOM.

Q1: IN WINTER AND IN SUMMER, TO TELL WHEN IN A DAY AND WHERE INSIDE THE ROOM SUNLIGHT CAN REACH, WHICH INFORMATION DO YOU NEED TO KNOW ABOUT THE CITY, THE SITE CONTEXT, AND THE ROOM? PLEASE LIST THEM BELOW (SEPARATE EACH INFORMATION WITH A COMMA):

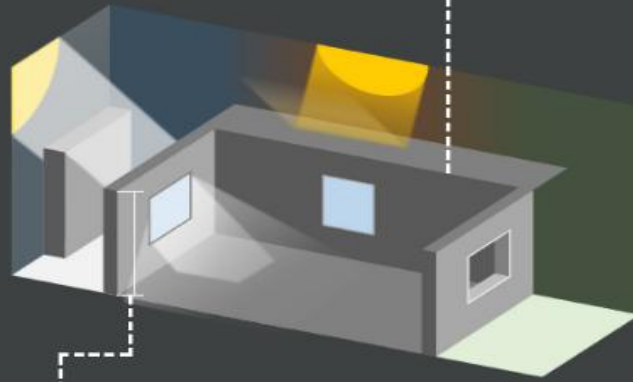
YOU ARE DECIDING THE LAYOUT OF THIS LIVING-DINING ROOM.

Q2: USE THE INFORMATION ON THE LEFT, WHICH LAYOUT WOULD YOU CHOOSE, THAT WOULD MEET THE CLIENT'S REQUIREMENTS?

LAYOUT 1:  LAYOUT 2:  LAYOUT 3:

HOW CONFIDENT YOU ARE: LOW 1 -  2 -  3 -  4 -  5 -  HIGH

PLEASE BRIEFLY EXPLAIN YOUR CHOICE:



FLOOR-TO-CEILING HEIGHT = 3.0M

WINDOW DIMENSIONS:  
FOR ALL THREE WINDOWS

CILL HEIGHT = 0.8M

WINDOW WIDTH = 2M

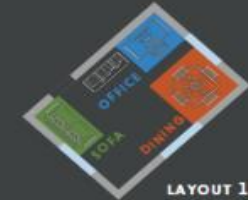
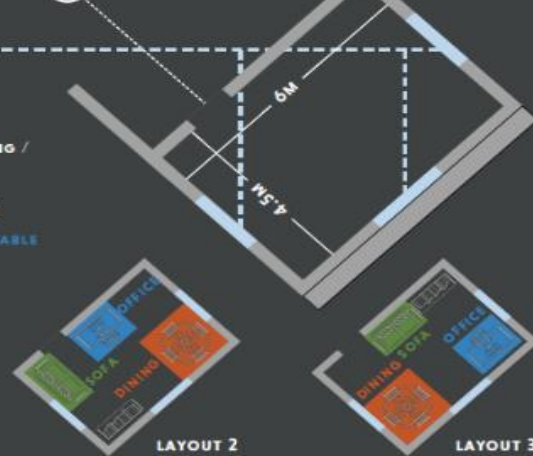
WINDOW HEIGHT = 1.5M

CLIENT'S REQUIREMENTS:

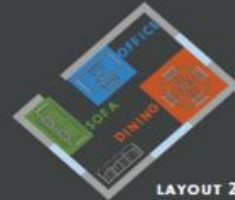
HAVE SUN NEAR THE SOFA IN MORNING / NOON, INCLUDING WINTER

HAVE SUN OVER THE DINING AREA IN LUNCH TIME / AFTERNOON, ALL YEAR

NO / LOW DIRECT SUN NEAR OFFICE TABLE



LAYOUT 1



LAYOUT 2



LAYOUT 3

QUIZ Apresenta:

Cenário com informações do ambiente e necessidades de um cliente

VOCÊ Responde:

Principais questões e informações que devem analisadas para atender ao cenário criado

## NATURAL VENTILATION

03

THE HOUSE IS VENTILATED NATURALLY, AND YOU ARE CHECKING IF THE OPENINGS YOU PROVIDED FOR THE LIVING-DINING ROOM ARE SUITABLE.

**Q3:** IN WINTER, THE OCCUPANTS KEEP MOST WINDOWS SHUT AND ONLY OPEN ONE SIDE WINDOW TO GET FRESH AIR. WHICH INFORMATION DO YOU NEED ABOUT THE ROOM AND THE OCCUPANTS TO ESTIMATE HOW MUCH FRESH AIR THEY NEED? PLEASE LIST THEM BELOW AND BRIEFLY DESCRIBE HOW YOU WOULD ESTIMATE THE AMOUNT OF FRESH AIR THEY NEED IN ONE HOUR.

ON THE WARM DAYS IN SUMMER, THEY OPEN ALL OPENABLE WINDOWS TO MAKE THE ROOM COOLER.

**Q6:** USE THE INFORMATION ON THE LEFT, WOULD YOU EXPECT THE VENTILATION TO BE SUFFICIENT TO DISSIPATE THE HEAT FROM THE ROOM?

SUFFICIENT:  NOT SUFFICIENT:

HOW CONFIDENT YOU ARE: LOW 1 -  2 -  3 -  4 -  5 -  HIGH

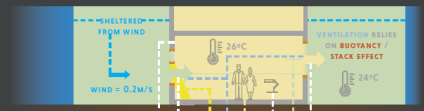
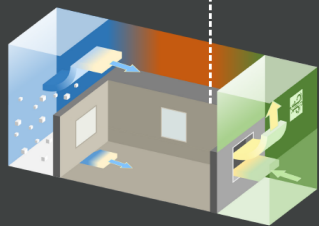
PLEASE BRIEFLY EXPLAIN YOUR CHOICE:

PREVIOUS PAGE

5 - 10 °C

TWO OCCUPANTS

18 - 24 °C



VOLUME OF THE ROOM = 83m<sup>3</sup>

OPENING PARAMETERS:

- LOWER WINDOW OPENABLE AREA = 1m<sup>2</sup>
- HIGHER WINDOW OPENABLE AREA = 1.5m<sup>2</sup>
- STACK HEIGHT BETWEEN THE OPENINGS = 0.75m
- DISCHARGE COEFFICIENT OF OPENINGS = 0.65

HEAT TO BE DISSIPATED:

- FROM THE OCCUPANTS = 150W (75W x 2)
- FROM THE EQUIPMENT AND LIGHTING = 150W
- FROM THE SUN = 200W
- TOTAL AMOUNT OF HEAT = 500W

CAN THE OPENINGS ACHIEVE THE NEEDED VENTILATION FLOW?

VENTILATION FLOW NEEDED TO DISSIPATE THE TOTAL AMOUNT OF HEAT = 0.8 ACH = 213.5A/S

## DAYLIGHT ACCESS

02

YOU ARE REVIEWING THE DAYLIGHT ACCESS OF A STUDY ROOM ON THE FIRST FLOOR OF THE SAME HOUSE IN BATH, UK.

**Q3:** ON A TYPICAL OVERCAST DAY, KNOWING HOW BRIGHT IT IS UNDER THE SKY IN AN OPEN FIELD, WHICH CHARACTERS AND PROPERTIES OF THE SITE CONTEXT, THE ROOM, AND ITS ELEMENTS DO YOU NEED, TO TELL HOW BRIGHT IT IS INSIDE THE ROOM? PLEASE LIST THEM BELOW (SEPARATE WITH COMMA):

YOU ARE CHECKING IF THE STUDY ROOM IS GENERALLY BRIGHT ENOUGH WITH ONLY DAYLIGHT ON A TYPICAL OVERCAST DAY.

**Q4:** USE THE INFORMATION ON THE LEFT, WOULD YOU EXPECT THE STUDY ROOM TO BE BRIGHT ENOUGH?

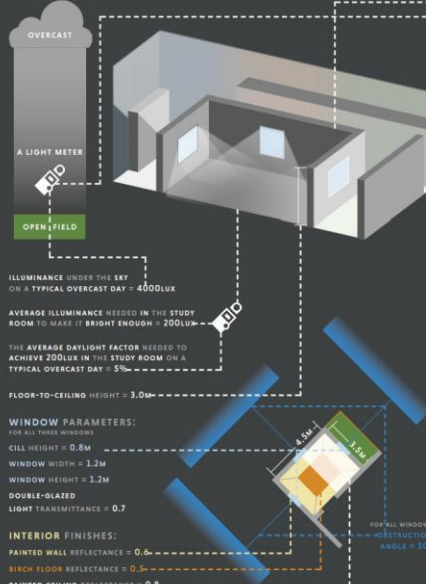
BRIGHT ENOUGH:  NOT BRIGHT ENOUGH:

HOW CONFIDENT YOU ARE: LOW 1 -  2 -  3 -  4 -  5 -  HIGH

PLEASE BRIEFLY EXPLAIN YOUR CHOICE:

PREVIOUS PAGE

50% DAYLIGHT PENETRATION



ILLUMINANCE UNDER THE SKY ON A TYPICAL OVERCAST DAY = 4000LUX

AVERAGE ILLUMINANCE NEEDED IN THE STUDY ROOM TO MAKE IT BRIGHT ENOUGH = 200LUX

THE AVERAGE DAYLIGHT FACTOR NEEDED TO ACHIEVE 200LUX IN THE STUDY ROOM ON A TYPICAL OVERCAST DAY = 5%

FLOOR-TO-CEILING HEIGHT = 3.0m

WINDOW PARAMETERS:

- FOR ALL THREE WINDOWS
- SILL HEIGHT = 0.8M
- WINDOW WIDTH = 1.2M
- WINDOW HEIGHT = 1.2M
- DOUBLE-GLAZED
- LIGHT TRANSMITTANCE = 0.7

INTERIOR FINISHES:

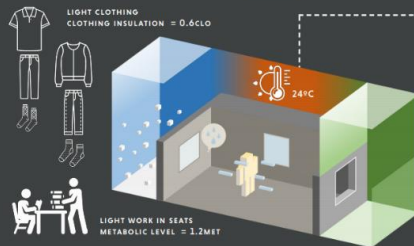
- PAINTED WALL REFLECTANCE = 0.5
- BIRCH FLOOR REFLECTANCE = 0.5
- PAINTED CEILING REFLECTANCE = 0.5

FOR ALL WINDOWS REFLECTION ANGLE = 30°

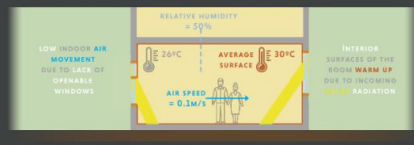
## THERMAL COMFORT

04

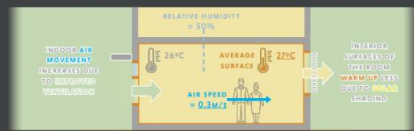
YOU ARE INVESTIGATING THE THERMAL COMFORT OF THE OCCUPANTS IN THE STUDY ROOM DURING THE WARM SUMMER DAYS OF UK.



NO SOLAR SHADING AND LOW AIR MOVEMENT - OVERHEATING PMV = 1.12 PPD = 31.4%



SOLAR SHADING AND VENTILATION APPLIED - COMFORTABLE PMV < 0.5 PPD < 10% IS CONSIDERED COMFORTABLE



**Q7:** KNOWING THE INDOOR AIR TEMPERATURE AND WHAT KIND OF ACTIVITY THE OCCUPANTS UNDERTAKE IN THE ROOM, TO TELL HOW COMFORTABLE THEY WOULD BE WITH THE CLOTHES THEY CURRENTLY WEAR, WHICH OTHER INFORMATION ABOUT THE INDOOR ENVIRONMENT DO YOU NEED TO KNOW? PLEASE LIST THEM BELOW:

YOU ARE CHECKING IF THE SOLAR SHADING AND VENTILATION APPLIED FOR DEALING WITH OVERHEATING ARE EFFECTIVE.

**Q8:** USE THE INFORMATION ON THE LEFT, WOULD YOU EXPECT THE OCCUPANTS TO FEEL COMFORTABLE?

COMFORTABLE:  STILL TOO WARM:

HOW CONFIDENT YOU ARE: LOW 1 -  2 -  3 -  4 -  5 -  HIGH

PLEASE BRIEFLY EXPLAIN YOUR CHOICE:

PREVIOUS PAGE

MOVE TO NEXT

CLICK TO SUBMIT

WE WANT TO HEAR YOUR SAY

ICONS USED IN THE QUIZ

ANY QUESTIONS?

ANY THOUGHTS TO SHARE?

ANY OTHER FEEDBACKS?



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Descrever Feedback, Dúvidas, e quaisquer questões percebidas no QUIZ.

Workshop: Environmental Principles & Architectural Design

- **Avaliar o conhecimento de conforto ambiental de cada participante, para melhor direcionamento do Workshop, focando em temas mais solicitados e apresentados no QUIZ.**
- **Consulte fontes de pesquisa, mas....**
- **A idéia é averiguar o seu conhecimento sobre conceitos básicos de conforto ambiental, como numa breve consulta ou conversa informal.**



- O QUIZ será encaminhado via e-mail para cada aluno;
- Ao completar o questionário, clicar em “CLICK TO SUBMIT” – pagina 7:

**FABRIC HEAT TRANSFER 04**

YOU ARE CHECKING THE HEAT LOSS THROUGH THE BUILDING FABRICS OF THE HOUSE IN WINTER.

**Q7:** KNOWING THE INDOOR AND OUTDOOR AIR TEMPERATURE, WHICH CHARACTERS AND PROPERTIES OF AN EXTERNAL WALL AND A WINDOW DO YOU NEED, TO ESTIMATE HOW MUCH HEAT EACH OF THEM LOSE? PLEASE LIST THEM BELOW AND BRIEFLY DESCRIBE HOW YOU WOULD USE THOSE PARAMETERS TO CALCULATE THE HEAT LOSS RATE:

U-VALUE (W/M <sup>2</sup> K)	WALL	0.35 x 379	0.25 x 158	0.21 x 189	0.35 x 158
K	ROOF	0.30 x 56	0.20 x 56	0.30 x 56	ADIABATIC
K	FLOOR	0.35 x 48	0.25 x 48	0.25 x 48	ADIABATIC
AREA (M <sup>2</sup> )	WINDOW	1.80 x 21	2.80 x 42	1.80 x 21	1.80 x 42

SCENARIO 1: 19°C (12°C GROUND) - BASE CASE

SCENARIO 2: 19°C (12°C GROUND) - MORE INSULATION (20mm OF EXTRA WALL)

SCENARIO 3: 22°C (12°C GROUND) - MORE INSULATION (20mm OF EXTRA WALL) - WARMER INDOOR (2°C EXTRA)

SCENARIO 4: 19°C (12°C GROUND) - INTERMEDIATE FLAT (30mm INSULATION & 20mm)

SCENARIO 5: 19°C (12°C GROUND) - LARGER WINDOWS (LARGER WINDOWS)

YOU ARE COMPARING THE TOTAL FABRIC HEAT LOSS OF FOUR SCENARIOS.

**Q8:** USE THE INFORMATION ON THE LEFT, WHICH SCENARIO WOULD GIVE THE LOWEST TOTAL FABRIC HEAT LOSS?

SCENARIO 1:  SCENARIO 2:  SCENARIO 3:  SCENARIO 4:

HOW CONFIDENT YOU ARE: LOW 1 -  2 -  3 -  4 -  5 -  HIGH

PLEASE BRIEFLY EXPLAIN YOUR CHOICE:

**CLICK TO SUBMIT**

- Salvar o arquivo em PDF e postar no STOA.  
(Somente após postar no Stoa, terá o acesso ao Software)
- O QUIZ Pós-Worshop será enviado após o Workshop, e segue o mesmo parâmetros do QUIZ Pré-Worshop.

# Exercício de Simulação Computacional – *Software Room*

## **Caso Base:**

Sala de aula medindo:

5,0m x 7,0m x 2,7m

Janela: Peitoril de h=1,0m

Altura de 1,2m

Largura de 4,8m

Janela centralizada em uma das paredes de 7m da sala.

# Exercício de Simulação Computacional – *Software Room*

## **Caso Base:**

Definição de Parâmetros de:

- 1 - Geometria da insolação
- 2 - Iluminação Natural
- 3 - Conforto Térmico

## Exercício de Simulação Computacional – *Software Room*

**Caso Base:** 1 - Geometria da insolação

**Questão 1:** Identificar os períodos de insolação do caso base (a partir da simulação da penetração da luz direta), **nos solstícios de verão e inverno e equinócio**, orientando **a janela** para as oito orientações principais (**N, S, L, O, NE, NO, SE, SO**), nas **latitudes 15° (Cuiabá), 23°S (São Paulo) e 52°N (Londres)**.

**Questão 2:** Tendo em vista os resultados da questão um, identificar qual a **1ª e 2ª melhor orientação da janela** para uma sala de aula, **nas três latitudes**.

## Caso Base:

## 2 - Iluminação Natural

**Questão 3:** Identificar o **Fator de Luz Natural** (FLN/FDL ou DF) para as **oito orientações solares**, nas **três latitudes**, considerando as seguintes refletâncias internas: **piso de cor escura, paredes de cor média e teto de cor clara.**

**Questão 4:** Tomando como referência o caso base inicial, **identificar o impacto de elevar a altura da janela até o teto**, em cada uma das **três latitudes.**

**Questão 5:** Tomando como referência o caso base inicial, **identificar o impacto de aumentar a refletância das cores das paredes internas**, em cada uma das **três latitudes.**

**Caso Base:**

**3 - Conforto Térmico:**

**REFERENCIAS PARA OS EXERCICIOS:**

Cuiabá 37°C externa e 33°C interna

Londres 10°C externa e 18°C interna

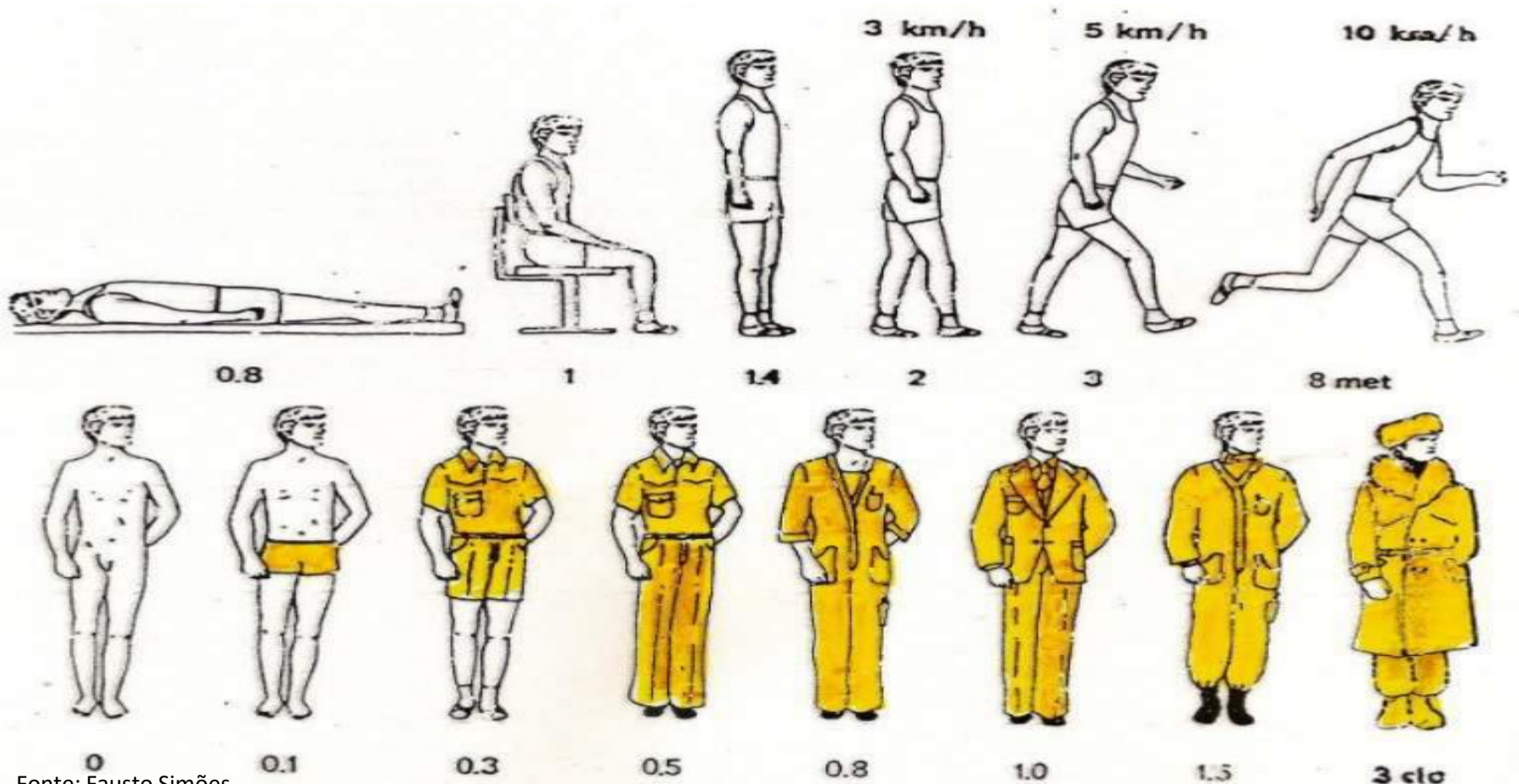
São Paulo 26°C externa e 28°C interna

A partir dai mexer nos valores de CLO e de MET...

# As variáveis de Conforto Térmico

## Homem

Atividade exercida (sentar, correr deitar etc.) MET  
+ Vestimenta (resistência térmica) CLO



**Caso Base:**

**3 - Conforto Térmico:**

**Questão 6:** Tomando como referência o caso base inicial, **alterar cenários para variação de Met**; identificando se o usuário estará ou não em condição de conforto.

**Questão 7:** Tomando como referência o caso base inicial, **alterar cenários para variação de Clo**; identificando se o usuário estará ou não em condição de conforto.