SPARKS

SPARKS Magazine – Winter Issue 2018 – Answer Sheet

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Selecting and using power and hand tools:

(Covering Unit 305 'Understand the procedures for selecting and using, tools, equipment…' (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 or EAL equivalent)

Practice multiple-choice questions for hand and power tools:

No 1	A plumb-line is used to provide which of the following?	**Answer**
a	Horizontal levels between two points	
b	Vertical alignment between two points	X
c	To measure the height of a vertical surface	
d	To measure the depth of a cavity in a wall	

No 2	A device used to determine heights at the same level over long distances, between locations of a different height or around corners is which one of the following?	**Answer**
a	Water level	X
b	Plumb-line	
c	Spirit level	
d	Extendable tape	

No 3	Which one of the following types of saw is best used when cutting timber to make noggins for fitting between wooden joists in a roof space?	**Answer**

a	Junior hacksaw	
b	Engineers hacksaw	
c	Electrically operated jig saw	
d	Carpenters panel saw	X

No 4	A hand-tool marked IEC 60900 'VDE tested' means that?	**Answer**
a	The tool can be used at 1200V	
b	The tool is insulated to a maximum of 1000V	X
c	The tool is mechanically tested	
d	The tool is only suitable for live electrical working	

No 5	It is dangerous to strike the faces of two claw hammers together, which of the following descriptions explains why?	**Answer**
a	The hammer heads could fall off the handles	
b	The surface of each face could become dented	
c	The shock can split the wooden handles of each hammer	
d	The hardened steel can fracture and fly off at high speed	X

No 6	A vice consisting of two parallel jaws is NOT suitable for holding which of the following?	**Answer**
a	Flat, square metal bar	
b	Tubes, pipes and round bar	X
c	Timber planks	

d	Plastic trunking	

No 7	The purpose of the flutes on a twist drill is to?	**Answer**
a	Allow coolant to be poured onto the point of drilling	
b	Allow good air flow to the point of drilling	
c	Ensure the drill rotates smoothly	
d	Allow the swarf or waste material to be removed freely	X

No 8	Which of the following safety equipment is essential when drilling holes in any material?	**Answer**
a	Neoprene gloves	
b	Face mask	
c	Safety helmet	
d	Safety glasses or goggles	X

No 9	When marking a line on a newly painted wall to ensure alignment of conduit saddle fixing points the best method is to use	**Answer**
a	A straight-edge and pencil	
b	A straight-edge and marker pen	
c	A spirit-level and chalk line	X
d	A spirit-level and scriber	

No 10	When storing flat files used for removing metal which one of the following is bad practice?	Answer
a	Throwing them together in a tool box	X
b	Wrapping each file in paper	
c	Keeping the file separate from each other	
d	Laying them down side by side	

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Laws of Illumination:

(Covering Unit 309 'Understand the electrical principles associated with the design, building, installation and maintenance of electrical equipment and systems' (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91)

Question 1:

Lighting terminology:

Define the flowing terms and show the symbol used to represent the unit and / or quantity:

Term	Definition	Unit/s
Luminous Intensity	The luminous intensity of a light source	Candela (Cd) symbol (I)
Luminous Flux	The total 'flow' of light from the source to the surface being illuminated	Lumens (Lm) symbol (Φ) or (F)
Illuminance	The light level on a surface	Lux (Lx) symbol (E) 1Lx = 1Lm per m²
Luminaire	The complete light fitting including lamp and any associated control gear required to start and run the lamp	N/A
Luminous efficacy	A value representing how efficient the light source, (lamp), converts electrical energy into light energy	Lumens per watt Lm per W

Question 2:

Point-to-Point Lighting problems:

Point –to-Point lighting calculations concern specific points of illumination taking into account the light intensity, the distance the light source is from the surface and the angle at which the light 'strikes' the surface. The calculations are precise do not consider the illumination of whole areas such as floors, walls and ceilings.

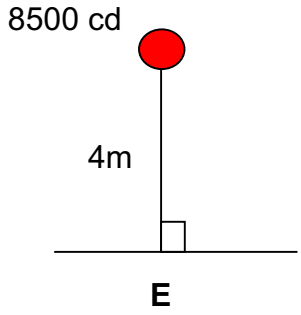
State the names of the **two** laws that apply to point-to-point lighting calculations:

i. Inverse Square Law

ii. Cosine Law

Question 3:

(i) The intensity of a light source is 8500cd and is located perpendicular to a surface 4m from it, what is the illuminance (E) at the surface?

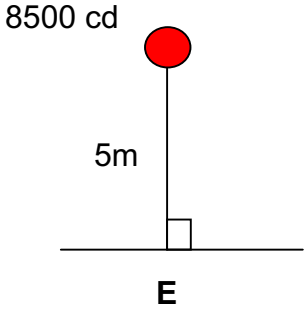


$E = I \div d^2$

$E = 8500 \div 4^2$

E = 531.25 lx

(ii) Calculate the illuminance if the surface is 5m away from the source.



$E = I \div d^2$

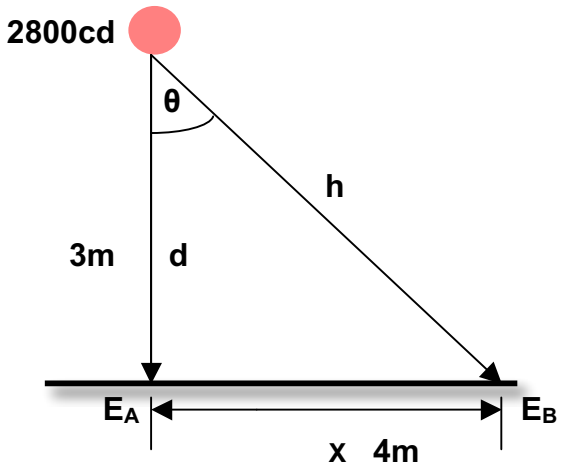
$E = 8500 \div 5^2$

E = 340 lx

Note: the illumination reduces the further the source is from the surface in accordance with the Inverse Square Law

Question 4:

Calculate each of the following:



i) $E_A = I \div d^2$

$E_A = 2800 \div 3^2 =$ **311.12 lx**

ii) $h = \sqrt{d^2 + x^2}$

$h = \sqrt{3^2 + 4^2} = \sqrt{25}$

h = **5m**

iii) $\cos \theta = d \div h$

$\cos \theta = 3 \div 5$

$\cos \theta =$ **0.6**

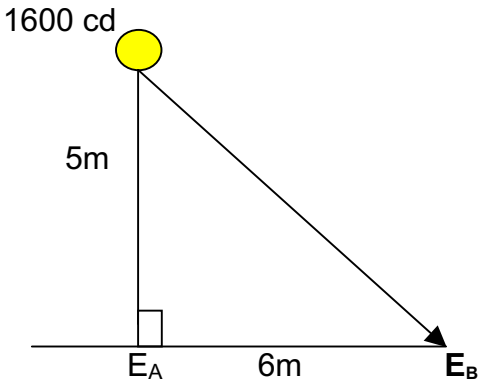
iv) $E_B = (I \div h^2) \times \cos \theta$

$E_B = (2800 \div 5^2) \times 0.6$

$E_B =$ **67.2 lx**

Question 5:

Calculate the light level that will be measured at point **E_B** assuming no other light is present



$E_B = (I \div h^2) \times \cos\theta$

First find h

$h = \sqrt{d^2 + x^2}$

$h = \sqrt{5^2 + 6^2}$

h = <u>7.8m</u>

Next find Cos θ

Cos θ = d ÷ h

Cos θ = 5 ÷ 7.8

Cos θ = <u>0.64</u>

Now find the illuminance at E_B

$E_B = (I \div h^2) \times \cos\theta$

$E_B = (1600 \div 7.8^2) \times 0.64$

E_B = <u>16.83 lx</u>

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Lighting: (Covering Outcome 4 'Understand the types, applications and limitations of wiring systems and associated equipment'. Unit 305 NVQ Level 3 Diploma 2357 – 13 and EAL equivalent)

The following questions concern **<u>Luminaires & Lighting</u>** Installations

You will need BS7671:2008 +A3 2015 Requirements for Electrical Installations

1) Identify **five** examples of outdoor lighting installations

Answer:

Highways or Roads; car parks; public gardens; sporting areas; monuments and floodlighting (See 714.1)

2) Give **one** example of *street furniture*

Answer:
Bus shelter, or advertising panels, road signs, telephone kiosk (See 714.1)

3) Define the term *'highway power supply'*

Answer:
An electrical installation comprising an assembly of associated highway distribution circuits, highway distribution boards and street furniture, supplied from a common origin

4) Identify the type and characteristics of a switch required for the isolation of supplies to high voltage (HV) signs.

Answer:
A Fire-fighters switch located in the low voltage circuit supplying the high voltage equipment (537-6.1)

5) Define the following terms associated with lighting equipment found in Regulation group (559.3 and 559.4)

- Festoon
- Pelmet
- Track

Answer:
Festoon – a number of lighting points connected to a common flexible cable

Pelmet – luminaire located behind a cover designed to direct the lighting and prevent discomfort glare

Track – a power track system onto which luminaires can be inserted and moved to a desired position

6) State the maximum operating voltage of a standard ceiling rose

Answer:
250V a.c. (559.5.1.201)

7) A device designed to support a pendant luminaire must be capable of carrying a mass of how many kg?

Answer:
5kg (559.5.2)

8) Explain the meaning of the following lamp-holder references:
(B15, B22, E14, E27 and E40),

Answer:
B refers to 'bayonet'; E refers to 'Edison Screw', the numbers represent the diameter of the lamp base in mm

9) Define the following **three** terms relating to lighting:
i) Luminaire
ii) Ballast
iii) Stroboscopic *effect*

Answer:
i) Equipment that distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing or protecting the lamps, but not the lamps themselves, and where necessary, circuit auxiliaries together with the means of connecting them to the supply.
ii) A device placed in-line with the lamp load to limit the amount of current flowing in the circuit.
iii) Pulsing of light from a discharge light source due to the frequency of the mains supply.

10) Answer the following questions relating to a low pressure mercury (MCF), luminaire:

a) Identify the functions of the following component found in the MCF luminaire



Answer:
i) To provide the initial discharge voltage to start the lamp

ii) To control the current flowing through the lamp when ON

b) State the meaning of the abbreviation 'MCF'

Answer:
Mercury Coated Fluorescent *referring to the tube or source of illumination*

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Types of cable and accessories:

(Covering Outcome 4 of Unit 305 'Understand the types, applications and limitations of wiring systems and associated equipment' (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 or EAL equivalent)

PVC Steel Wire Armour (SWA) cable: Complete the missing words using the IET BS7671:2008 +A3 2015 On-Site Guide (OSG) where appropriate

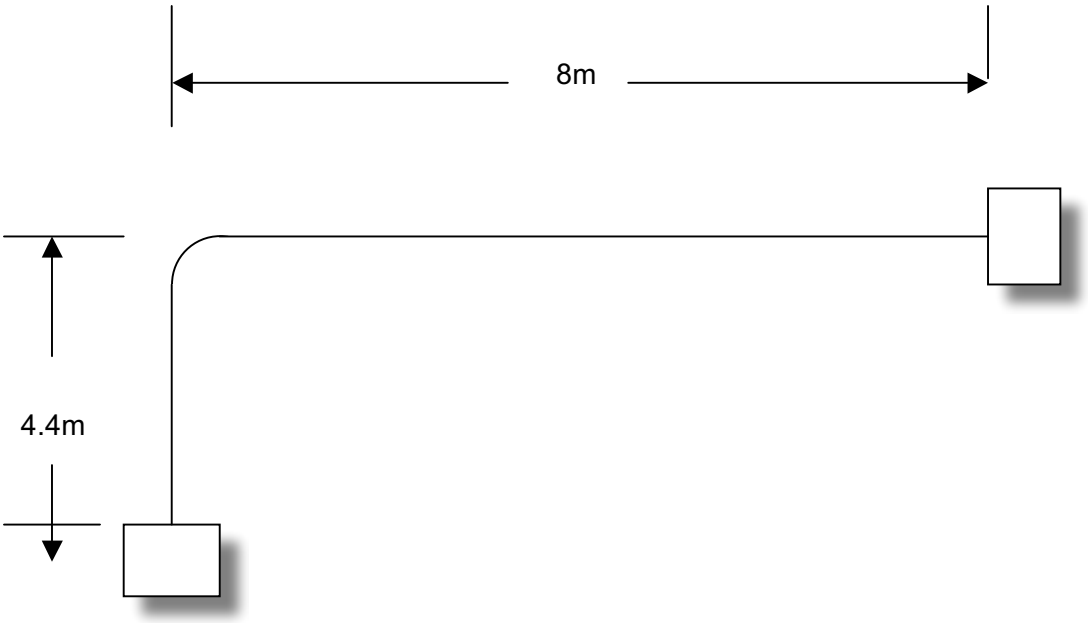
1) The difference between the **BW** and **CW** cable gland is that the **CW** gland can be used ____OUT-OF-DOORS_____

2) PVC SWA cable can be attached to cable tray, laid directly in the ground or _____CLIPPED DIRECTLY TO A SURFACE____

3) The minimum internal radius of a bend formed in a steel wire armoured cable with circular stranded conductors and a diameter of **60mm** is ___360mm____ *(Table D5 IET OSG)*

4) Some SWA cable may use solid aluminium conductors, the internal bend radius of a four – core cable that has a diameter of 120mm is __960m__ *(Table D5 IET OSG)*

5) A steel wire armour cable is to be clipped directly to a brick wall. The cable is first run vertically for approximately 4.4m and then horizontally for approximately 8m. The cable has a diameter of 18mm, the estimated number of cable cleats required is __APPROX 26___ *(Table D1 IET OSG)*



Solution:

Divide 4400 by 550 (maximum distance between fixings vertically) = 8

Divide 8000 by 400 (maximum distance between fixings horizontally) = 20

To allow for the bend the actual number of cleats will be one less for each dimension, so 8-1and 20-1 = ***26 in total****.*

Types of cable and accessories:

(Covering Outcome 4 of Unit 305 'Understand the types, applications and limitations of wiring systems and associated equipment' (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 or EAL equivalent)

The following questions relate to mineral insulated copper clad cable and the tools required when terminating this cable.

1) What is the main design feature of MICC cable?

Answer:

The cable can continue to function in high temperatures, for example 250°C. This makes MICC suitable for alarm circuits in critical situations such areas of high ambient temperature, fire risk, explosion risk and, an added advantage, locations with high levels of radiation.

2) State the intended purpose of MICC with the following PVC coloured sheath:

- Orange
- Red
- White

Answer:

- Orange – general circuit applications where the cable may be installed in damp, wet or corrosive environments.
- Red – fire alarm circuits or specific circuit associated with fire monitoring and / or control.
- White – general circuit applications where aesthetics are important such as public areas, hotels, offices.

3) The following images show tools specifically designed for use when working with MICC cable. Name each tool and state its function.

A - Circumferential Micrimp or Potting Tool for securing the plastic sealing disc to the brass pot when secured to the end of the MICC cable

B - Rotary stripping tool or rotary peeler used to remove the copper sheath from a MICC cable. The tool is adjustable for a range of different diameter cables

C - Peeling tool used to remove the copper sheath from the MICC cable, (Used like a can opener)

D - Ringing tool used to cut through the copper sheath of an MICC cable at the point chosen as the length of termination. The tool is adjustable for a range of diameters of cable

E - Small bending lever used to make bends sets and kicks in MICC cable. The bending point surfaces are covered with leather to prevent damage to the MICC cable sheath

4) State the insulation material used the separate the conductors in a MICC cable.

Answer:
Magnesium oxide; a white fine powder compacted around the copper conductors to insulate the conductors from each other and the copper sheath of the cable.

5) Briefly explain how the copper conductors of a MICC cable should be insulted at a typical termination.

Answer:
Neoprene sleeving is generally used to insulate each conductor. The sleeving has a high melting point typically up to150°C. Usually the sleeving is black and can be marked with appropriate markers for conductor identification. Red and green / yellow sleeving is also available.

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Circuit Protection:

(Covering Outcome 2 & 3 of Unit 304 (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 or EAL equivalent)

To answer the following questions you will need the IET Requirements for Electrical Installations: BS7671:2008 +A3 2015

Circuit protective devices:

Q1: State the **minimum** current rating currently available for a BS88-3 fuse.

Ans: **5A** (fig 3A1 Appendix 3)

Q2: A certain circuit is protected by a **60A** rated BS3036 fuse and is designed to disconnect in 5 seconds, what fault current will be required to achieve this disconnection time?

Ans: **205A** (fig 3A2 (a))

Q3: A **500A** BS88-2 fuse operates at a fault current of 5400A, how long does it take for the fuse to operate?

Ans: **1 second** (fig 3A3 (c) information in side panel)

Q4: Identify: (a) The name of the device shown below, and (b) the type of fuses used in the device.



Ans: (a) The device is a **fuse – switch**, and (b) HRC or HBC fuses to BS88-2 Fuse system E (bolted) (Appendix 3 figure 3A3 (c))

Q5: The Time / Current characteristic curves for circuit-breakers to BS EN 60898 and RCBO's to BS EN 61009-1 have a distinctive shape, what do the two parts of the curve represent?

Ans: The top or curved section represents the characteristics of the thermal component of the circuit-breaker and the bottom or straight section represents the characteristics of the magnetic component.

Q6: How long will it take to operate a **20A** rated **Type D** circuit-breaker to BS EN 60898 if the circuit is subjected to an overload current of 100A?

Ans: Approximately **14 seconds** (fig 3A6)

Q7: (i) State the operating current for Type B and Type C **63A** rated circuit-breakers.

(ii) State the multipliers applicable to each type of circuit-breaker current rating to determine the operating current of the circuit-breaker.

(i) Type B 315A

Type C 630A

(ii) Type B x5

Type C x10

Type D x20 or x10 *depending on disconnection time required*

Q8: A distribution circuit is designed to carry a maximum load current of 60A.

(i) State the disconnection time applicable to this circuit if the supply system is TN-S

(ii) State the rating of a suitable Type B circuit-breaker for this circuit

(iii) What is the operating current for the chosen circuit-breaker?

(iv) Identify the maximum earth-fault loop impedance permitted for this circuit

Ans:

(i) 5 seconds (411.3.2.3)

(ii) 63A (fig 3A4 Appendix 3)

(iii) 315A (fig 3A4 Appendix 3)

(iv) 0.69Ω (Table 41.3)