Fire Investigation: Sources of Ignition

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# Answer 01

The open flame fire (source of ignition) are as follows:

1. **Common** **Match**

Release rate is 50-80W.

1. **Lighter**

Release rate is 50-80 W.

1. **Candle**

Release rate is determined by amount of exposed wick.

1. **Electrical** **spark**

Release rate can be up to 300W or more.

1. **Cigarettes**

Release rate is 5W.

# Answer 02

Candles are a more common source of accidental ignition because as use of candles has increased, the number of accidents has risen too. Candles start a fire whenever a flammable material comes in contact. A larger fire is caused when the wick becomes more exposed. In case of vertical candles, there is huge risk of tipping over and starting a fire. In 2002, according to NFPA estimate, 18,000 residential fires were started by candles.

# Answer 03

The outdoor temperature of light bulb appears to be safer. Insulation poses an ignition risk to it. (Kirk & Haynes, 2017). The surface temperature of glass light bulb gives a steady state value when measured at 200°C in open air. It is due to temperature difference between inside of bulb and outside surface. The rise in temperature inside the bulb is due to heat flux because of hot filament, while the outside surface-temperature rise is because of heat loss which is due to convection, radiation and conduction. If it is buried in an insulating material, surface temperature rises intensely. Due to new risen temperature, the probability to start fire increases.

# Answer 04

The three ways in which gas appliances can initiate fire are as follows:

1. Instantaneous malfunction of the thermostat
2. Failure of thermal cut-off (safety measure when temperature of thermostat exceeds limit)
3. Failure of pressure regulators can cause massive flames to rise from burner compartments and start fire.

# Answer 05

Kerosene heaters can start fire when the capacity of the tanks surpasses the capacity of reservoir (Kirk & Haynes, 2017). If there is not much vacuum in tank, the excess amount of fuel spills outside the heater and it can start a massive fire.

# Answer 06

The temperature below 250°C or 482°F can start charring in fresh wood. The minimum temperature requirement of fresh wood is 77°C or 170°C. Charring of wood can occur when temperature is 105C (230F) or greater for a long time (Kirk & Haynes, 2017). When fresh wood is heated, gases and vapor are produced to add to combustion, although it requires a good amount of heat to enhance decomposition initiated by high temperatures and start a fire.

# Answer 07

Sources for frictional mechanical sparks are as follows:

1. Burning brands or extremely hot embers
2. Fragments of debris from an existing fire
3. Incandescent or burning metals from mechanical friction or impact

# Answer 08

Cigarettes do not ignite gasoline vapors because when liquid gasoline is not confined in a container like open-air in gas station, it is not possible for the cigarette to start combustion in those fumes. On the other hand, cigarettes can ignite **Hydrogen** and Acetylene because both are highly flammable. In case of hydrogen, the heat provides activation energy for reaction between hydrogen and oxygen, which emits a high amount of heat resulting in combustion. Also, **Acetylene** can cause ignition with even less energy sparks because it has low ignition required.

# Answer 09

Animals can start a fire in the following ways:

1. Rodent and birds gather assorted materials for building their nest and sometimes collect combustible items like cigarettes or other items that can ignite other flammable objects.
2. In case of a mouse or rat carrying a match stick in its mouth, if the chemical on match stick strikes against some rough surface while passing through narrow spaces, ignition can start.
3. Dogs and cats when knock over flammable liquid or burning objects like candle can start a fire.

# Answer 10

Following are conditions for Spontaneous Combustion in materials in which self-heating can occur:

1. Substance with low ignition temperature to release heat
2. Insufficient surface area
3. Irradiance
4. Lesser reactivity of material
5. Lesser material

References

Paul Leland Kirk: Icove, D. J., & Haynes, G. A. (2017). Sources of Ignition. In *Kirk's Fire Investigation* (8th ed., pp. 236-287). New York,NY: Pearson.