Level I Machine Lubricant Analyst (ISO 18436-4, I)
Body of Knowledge

- The Level I MLA Body of Knowledge is an outline of concepts that a candidate shall have in order to pass the exam, in accordance with ISO 18436-4, Category I, Annex A.

I. Maintenance Strategies (10%)
- **A. Why machines fail**
- **B. The impact of poor maintenance on company profits**
- **C. The role of effective lubrication in failure avoidance**
- **D. Lube routes and scheduling**
- **E. Oil analysis and technologies to assure lubrication effectiveness.**
- **F. Equipment tagging and identification.**

II. Lubrication Theory/Fundamentals (18%)
- **A. Fundamentals of tribology**
- **B. Functions of a lubricant**
- **C. Hydrodynamic lubrication (sliding friction)**
- **D. Elasto-hydrodynamic lubrication (rolling friction)**
- **E. Mixed-film lubrication**
- **F. Base-oils**
- **G. Additives and their functions**
- **H. Oil lubricant physical, chemical and performance properties and classifications.**
- **I. Grease lubrication**
  - **1. How grease is made**
  - **2. Thickener types**
  - **3. Thickener compatibility**
  - **4. Grease lubricant physical, chemical and performance properties and classifications.**

III. Lubricant Selection (10%)
- **A. Viscosity selection**
- **B. Base-oil type selection**
- **C. Additive system selection**
- **D. Machine specific lubricant requirements**
  - **1. Hydraulic systems**
  - **2. Rolling element bearings**
  - **3. Journal bearings**
  - **4. Reciprocating engines**
  - **5. Gearing and gearboxes**
- **E. Application and environment related adjustments.**

IV. Lubricant Application (18%)
- **A. Basic calculations for determining required lubricant volume.**
- **B. Basic calculations to determine re-lube and change frequencies.**
- **C. When to select oil; when to select grease.**
- **D. Effective use of manual delivery techniques.**
- **E. Automatic delivery systems.**
  - **1. Automated deliver options.**
    - **a) Automated grease systems**
    - **b) Oil mist systems**
    - **c) Drip and wick lubricators**
  - **2. Deciding when to employ automated lubricators.**
  - **3. Maintenance of automated lubrication systems.**

V. Lube Storage and Management (10%)
- **A. Lubricant receiving procedures.**
- **B. Proper storage and inventory management.**
- **C. Lube storage containers**
- **D. Proper storage of grease-guns and other lube application devices.**
- **E. Maintenance of automatic grease systems.**
- **F. Health and safety assurance.**

VI. Lube Condition Control (10%)
- **A. Filtration and separation technologies.**

- **B. Filter rating.**
- **C. Filtration system design and filter selection.**

VII. Oil Sampling (10%)
- **A. Objectives for lube oil sampling**
- **B. Sampling methods**
- **C. Managing interference**
  1. **Bottle cleanliness and management**
  2. **Flushing**
  3. **Machine conditions appropriate for sampling**

VIII. Lubricant health monitoring (10%)
- **A. Lubricant failure mechanisms**
  1. **Oxidative degradation**
     - **a) The oxidation process**
     - **b) Causes of oxidation**
     - **c) Effects of oxidative degradation**
  2. **Thermal degradation**
     - **a) The thermal failure process**
     - **b) Causes of thermal failure**
     - **c) Effects of thermal degradation**
  3. **Additive depletion/degradation**
     - **a) Additive depletion mechanisms**
     - **b) Additives at risk for depletion/degradation by the various mechanisms.**
- **B. Testing for wrong or mixed lubricants**
  1. **Baselining physical and chemical properties tests**
  2. **Additive discrepancies**
- **C. Fluid properties test methods and measurement units - applications and limitations.**
  1. **Kinematic Viscosity (ASTM D445)**
  2. **Absolute (Dynamic) Viscosity (ASTM D2893)**
  3. **Viscosity Index (ASTM D2270)**
  4. **Acid Number (ASTM D974 et al)**
  5. **Base Number (ASTM D974 et al)**
  6. **Fourier Transform Infrared (FTIR) analysis**
  7. **Rotating Pressure Vessel Oxidation Test (ASTMD2272)**
  8. **Atomic Emission Spectroscopy**

IX. Wear Debris Monitoring and Analysis (4%)
- **A. Common machine wear mechanisms**