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STANDARD OPERATING PROCEDURE

SOP 8.1 Real-Time Monitoring

Abstract: Real-time monitoring provides continuous information on the function of the JBPHH water system allowing operators better control of water quality and treatment.

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Revision Tracking Sheet			
Date of Revision	Changed from:	Changed to:	Revised By (Initial)
03/07/2025	N/A	Original "Draft"	(b) (6)
05/09/2025	Original	Revision 1	(b) (6)
12/02/2025	Revision 1	Revision 2	(b) (6)
Jan 2026	Revision 2	Revision 3	(b) (6)

Notes:

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Notes:_____
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TABLE OF CONTENTS

Notes:_____

LIST OF TABLES

LIST OF FIGURES

ATTACHMENTS

1. SOP Acknowledgement and Training Form
2. (b) (3) (B) Sensor Termination Enclosure and In-Situ (b) (3) (B) Data Logger Cut Sheets
3. (b) (3) (B) Pressure Transmitters Cut Sheet and Instructions. (Note: (b) (3) (B) is a standardized device for Potable Water SCADA)
4. (b) (3) (B) and (b) (3) Pressure Transducers Cut Sheet and Instructions. (Note: (b) (3) (B) is a standardized device for Potable Water SCADA.)
5. (b) (3) (B) Pressure Transmitter (b) (3) (B) Cut Sheet and Instructions. (Note: (b) (3) (B) is not a standardized device and should be replaced with a standardized device upon failure.)
6. (b) (3) (B) Water Meter Cut Sheet
7. (b) (3) (B) Differential Pressure Transmitter Operating Instructions
8. (b) (3) (B) Bidirectional Pitot Tube Sensor Cut Sheet and Instructions
9. (b) (3) (B) Seismic Velocity (Vibration) Transmitter Datasheet

Notes:

1. DEFINITIONS/ACRONYMS

1.1. Definitions

- Calibration: A testing process to determine if the actual performance matches the display settings or controls.
- Differential Pressure (DP): Pressure difference between two measuring points.
- Maximo™: Maximo is an Enterprise Asset Management platform designed to support the tracking and upkeep of assets throughout their entire lifecycle.
- Safety Data Sheet (SDS): An Occupational Safety and Health Administration (OSHA) standardized hazard communication document detailing a chemical's properties and hazards (physical, health, and environmental); protective measures; and safety precautions for handling, storing, and transporting the chemical.
- Supervisory Control and Data Acquisition (SCADA): A version of telemetry commonly used in wide-area industrial applications, such as electrical power generation and distribution and water distribution, which includes supervisory control of remote stations as well as data acquisition from those stations over a bidirectional communications link.
- Transducer/Transmitter: A device that converts physical quantities (e.g., water pressure or water height) into electrical outputs or signals in proportion to the pressure.
- Venturi meter: A flow rate measuring device that uses the pressure difference between the upstream full pipe diameter (D1) and the throat, a constricted diameter pipe section (D2). When a fluid flows through the throat (D2) section, its velocity increases while the pressure decreases. Thus, the flow rate can be determined by measuring the differential pressure between the D1 section and the D2 section.
- Vertical turbine water meter: A flow rate measuring device that uses the flowing fluid mechanical energy to rotate a freely turning "pinwheel" (rotor). The rotor turns in direct proportion to the volume of water passing through the meter.

1.2. Acronyms and Abbreviations

- AWWA American Water Works Association
- D/A digital to analog
- DP differential pressure
- DSO Water Distribution System Operator
- FISC Fleet and Industrial Supply Center
- ft feet
- JBPHH Joint Base Pearl Harbor Hickam
- Kgal kilogallons (thousands of gallons)
- MGD million gallons per day
- NAVFAC Naval Facilities Engineering Systems Command
- OIT operator(s)-in-training
- OSHA Occupational Safety and Health Administration
- PPE personal protective equipment
- ppm parts per million (equivalent to milligrams per liter)
- PRP32A Potable Water Branch
- PS pumping station

Notes:_____

- psi pounds per square inch
- psig pounds per square inch (gauge)
- RTU Remote Transfer Unit
- SCADA supervisory control and data acquisition
- SDS Safety Data Sheet
- S/N serial number
- SOP Standard Operating Procedure
- UFC Unified Facilities Criteria
- VSWR Voltage Standing Wave Ratio

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2. OVERVIEW

2.1. Scope and Purpose

This Standard Operating Procedure (SOP) discusses the operation, calibration, and maintenance of real-time water quality measurement equipment connected to the Joint Base Pearl Harbor Hickam (JBPHH) supervisory control and data acquisition (SCADA) system. The real-time water quality measurement sensors and instrumentation discussed include well level indicators, flow meters, pressure transducers, and pressure transmitters. The real-time water quality measurements for free chlorine residual and fluoride are discussed in *SOP 4.1 Chlorine Feed System* and SOP *4.2 Fluoride Feed System*, respectively. Compliance monitoring is addressed under the Drinking Water System Compliance Monitoring Plan.

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2.2. Equipment List

Real-time monitoring equipment is compiled in *Table 2-1* below. Specific equipment operational and maintenance instructions are detailed in the Attachments.

Table 2-1 Real-Time Monitoring Equipment Specifications

Location	Equipment
Waiawa Shaft	• Flow meter: [redacted]-inch differential pressure venturi • (b) (3) (B) circular chart recorder • Well level bubbler system
Aiea-Halawa Shaft	• Tank S-1 pressure transducer (tank level indicator) – (b) (3) (B) (b) (3) (B); Range: 0 – 30 pounds per square inch, gage (psig) • Tank S-2 pressure transducer (tank level indicator) – (b) (3) (B) (b) (3) (B); Range: 0 – 30 psig • (b) (3) (B) circular chart recorder
Aiea-Halawa Booster Pump Station	• Well level sensor – InSitu (b) (3) (B) data logger; Serial Number (S/N): (b) (3) (B) • Well level display – InSitu STE (b)(3)(B) • Flow meter - differential pressure venturi • Pressure transmitter • Pressure display

Manana Booster Pump Station	• Flow meter, High – (b) (3) (B), (b)(3)-in diameter, S/N: (b) (3) (B)
	• Flow meter, Low – (b) (3) (B), (b)(3) in diameter; S/N: (b) (3) (B)
	• Pressure transducer
	  ○ (b) (3) (B) #; S/N: (b) (3) (B); Range: 0 – 30 psig
	  ○ (b) (3) (B) #; Range: 0 – 100 psig

Moanalua Terrace Booster Pump Station	• Pressure transmitter – (b) (3) (B), S/N: (b) (3) (B); Range: 0 – 200 psig.
S-1 Storage Tank	• Tank S-1 pressure transducer (tank level indicator) – Ashcroft (b) (3) (B); Range: 0 – 30 psig
Red Hill Storage Tanks	• Tank S-685 Pressure transducer (tank level indicator) – (b) (3) (B), (b)(3)(B) • Tank S-316 Pressure transducer (tank level indicator) – (b) (3) (B), (b) (3) (B); Range: 0 – 30 psig
Camp Smith Storage Tanks	• Tank S326 submersible level transducer

Notes:

2.3. Operating Summary

System operation including target tank levels and residual levels is discussed in *SOP 1.1 Introduction Overview, SOP 2.1 Water Supply Pump Stations*, *SOP 3.1 Booster Pump Station, SOP 4.1 Chlorine Feed System*, *SOP 4.2 Fluoride Feed System*, and *SOP 6.1 Water Storage*. Tank levels, flow rate, pressures, chemical residual levels, and vibration are monitored in real-time, with additional spot monitoring to verify that real-time measurements are accurate; see *SOP 8.2 Spot Monitoring* for details.

The JBPHH SCADA system monitors the systems and processes described in the following sub-sections.

2.3.1. Main Pumps:

- Pump operating status
- Pump run time (hours)
- Pump status / alarm
- Flow rate (million gallons per day [MGD])
- Total Flow (thousands of gallons [Kgal])
- Fluoride concentration (parts per million [ppm])
- Chlorine concentration (ppm)
- Main pressure (pounds per square inch [psi])
- Well shaft water level (feet [ft])
- Remote Transfer Unit (RTU) power
- RTU battery level %
- Servo Room Temperature (Celsius degrees)

2.3.2. Chemical Residual Levels

Refer to *SOP 4.1 Chlorine Feed System* and *4.2 Fluoride Feed System* for real-time monitoring of residual levels for chlorine and fluoride. Spot monitoring is performed to verify the real-time monitoring values; refer to *SOP 8.2 Spot Monitoring*.

2.3.3. Vibration

Vibration is monitored in real-time to identify mechanical issues in high-value equipment. Baseline vibration is anticipated with any mechanical equipment, however excessive vibration beyond the normal baseline can indicate the need for additional maintenance. Vibration is spot monitored utilizing a portable handheld vibration meter to verify the real-time instrumentation.

2.3.4. Booster Pumping Stations

- Pump On / Off status
- Pump fail status
- Pump runtime (hours)
- Pump suction and discharge header pressures (psi)
- High and Low flow meter flow rates (MGD) and total flow (Kgal)
- RTU / Telemetry Power status

Notes:_____

2.3.5. Water Storage Tank Levels

Tank levels are monitored to ensure adequate storage is maintained within the distribution system, while enabling operators to verify tanks are properly cycling. Tanks are remotely monitored and controlled by adjusting pump station operations. It should be noted that the tanks are constructed with groups of adjacent tanks, and in some cases the system is set up to monitor a representative tank from the group rather than all tanks individually.

2.3.6. Flow Meters

Flow rates are monitored utilizing real-time measurement and should be recorded in operator's logbook and compared to historical values to identify anomalies including major leaks, excessive demand, or wells operating outside of permitted capacity.

2.3.7. Pressure

Pressures are monitored to identify major leaks, closed valves, or other major issues. Pressures are compared to historical values to verify that they are within normal expected ranges. Spot monitoring using analog pressure gauges should be used to verify real-time pressure measurements and to verify pressure at locations of reported low pressure.

Notes:_____

3. RESPONSIBILITIES AND QUALIFICATIONS

3.1. Responsibilities

The JBPHH Public Works Department owns and operates the JBPHH drinking water system. Operation and maintenance of the system is the responsibility of the Utilities Management Potable Water Branch (PRP32A). The real-time monitoring is performed by the Production Work Center (WHHP6A). Refer to *Figure 3-1* for details.

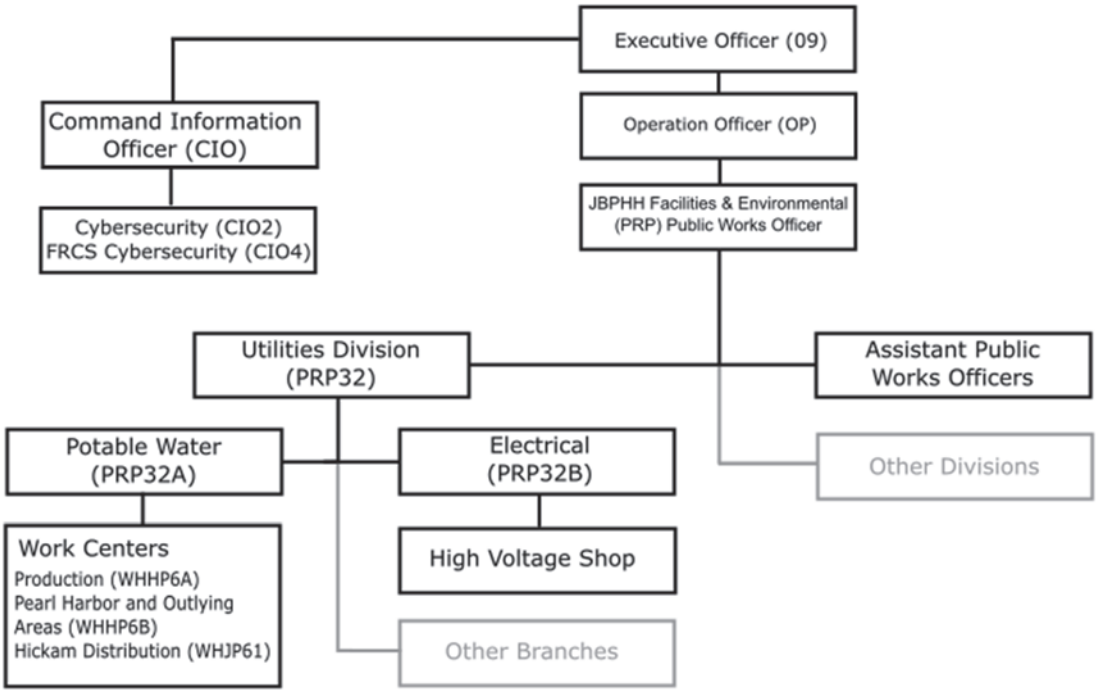

Figure 3-1 Public Works Department Organization

Lead operators and supervisors in PRP32A must ensure that the operators are trained and qualified prior to using this SOP. To support this process, a copy of this SOP should be made readily available to all users. Senior operators are required to update the SOP to reflect any changes in equipment, procedures, or regulations, and train the subordinate operators and maintenance crew(s) accordingly. It is important for senior operators to approve, coordinate, and maintain records of any major repairs on the equipment highlighted in this SOP. Training shall consist of in-depth, hands-on training for all new employees or employees new to this SOP and annual refresher meetings facilitated by the lead operator. All training should be documented using *Attachment 1 SOP Acknowledgement and Training Form*.

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3.2. Qualifications

All personnel involved in operations and maintenance activities for real-time monitoring systems must be trained and qualified to perform their assigned tasks:

- If required, personnel are responsible for obtaining and maintaining a Water Distribution System Operator's (DSO) certificate, Grade 1 or higher from the State of Hawaii, Department of Health, Safe Drinking Water Branch.
- Unlicensed and uncertified operators and Operators-in-Training (OIT) shall not make process control or system integrity decisions about water quality or quantity that affect public health.
- Follow Navy and base-specific safety regulations and directives and obtain appropriate safety training (see *Section 4*).
- Be familiar with the following:
  - Emergency protocols and communications
  - Operation of tools and equipment
  - Procedures outlined in this SOP

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4. HEALTH AND SAFETY

4.1. General Guidelines

With respect to health and safety, operators shall implement the following:

- Comply with the JBPHH Safety Manual.
- Use engineering, operational, or administrative controls or other means of performing work to eliminate or minimize health and safety hazard risk. Eliminating or minimizing health and safety hazard risk is preferred over the use of personal protective equipment (PPE). Use PPE to reduce hazard exposure when the hazard cannot be eliminated.
- Follow all OSHA requirements for work in confined spaces, trenching, roadways, etc.
- Pay specific attention to the hazards outlined in *Section 4.2*.
- Be familiar with all applicable SDSs. Ensure SDSs are up to date. Ensure the SDSs displayed / available match the chemical being used (i.e., do not use an SDS for the same chemical from another manufacturer).

4.2. Anticipated Hazards

- Electrical shock
- Heavy equipment
- Moving equipment
- Work environment (hot weather, excessive heat, sun exposure, wet or humid environment, wet slippery grounds, elevated platform, uneven/unstable ground, noise, etc.)

4.3. Required PPE (Based Upon Performed Activities)

Utilize the following PPE based on anticipated activities:

- Safety steel toe shoes with anti-slip soles
- Work gloves for non-chemical tasks
- Hearing protection, when required by proximity to operating equipment
- Class 2 safety vest (class 3 vest is required when visibility conditions are limited)

4.4. First Aid

Stocked first aid kits shall be kept in two primary locations: service trucks and water supply pump stations. Operators should promptly remove any expired stock from first aid kits and replace. Operators shall follow detailed instructions in the JBPHH Safety Manual and EM-385-1-1, *Section 3* regarding first aid kit requirements, documentation, and follow up procedures.

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5. EQUIPMENT AND MATERIALS

The section lists the equipment and materials that are relevant to perform this SOP. For detailed information regarding location and quantity of each item, please refer to the JBPHH inventory provided as an attachment to *SOP 1.1 Introduction and Overview*.

Parts:

- Pressure Transducer: (b) (3) (B) #
- Pressure Transducer: (b) (3) (B) #
- Pressure Transducer: (b) (3) (B)
- Pressure Transmitter: (b) (3) (B)

Consumables:

- Multisorb Technologies DriCan® desiccant

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6. SCHEDULE AND PROCEDURES

6.1. Schedule

Refer to *Table 6-1* for real-time monitoring operation and maintenance schedule. Detailed procedures are discussed in subsequent sections.

Table 6-1 Real-Time Monitoring System Schedule

Frequency	Task	Section
Weekly	Control panel and appurtenance inspection	6.2
Monthly	Control panel inspection and calibration; RTU inspection and calibration; differential pressure cell calibration; evaluate vibration and tank level trend data	6.3
Quarterly	Evaluate water consumption, distribution system pressure, and pump status/run time trend data	6.4
Semi-Annual	RTU antenna inspection and testing; clean flow meter strainers	6.5
Annual	General instrumentation cleaning; perform refresher training on this SOP	6.6
Biennial	Mechanical meter calibration	6.7

6.2. Weekly Control Panel and Appurtenance Inspection

- If inclement weather is possible, set up cover and worktable to protect sensitive electronics in the event of rain.
- Inspect controls equipment and panels for coating failure, corrosion, excessive dust build-up, visual signs of degradation, animal/insect nests, proper closing and fit of covers, missing hardware, missing fasteners, or other problems that could cause shorts or failures.
- Inspect appurtenances including antenna, solar panels, observable cable runs, and conduit seals
- Note and reset reboot count. If reboot count is excessively high, investigate connectivity issues further, see monthly and semi-annual tasks below as required.
- Clean control panels carefully with air, per manufacturer's recommendations.
- Record all findings in operator's logbook.

6.3. Monthly Tasks

JBPHH operators should evaluate the main pump vibration data trends for early detection of main pump operational issues and evaluate the storage level tank data trends for detection of irregular water consumption issues and potential water quality issues due to insufficient tank turnover. Coordinate data processing with a potable water branch electronic instrumentation SCADA technician and engineer for data processing inside of and external to the SCADA system, respectively. Record all calibrations and findings in operator's logbook.

Notes:_____

6.3.1. Control Panel Inspection and Calibration

- If inclement weather is possible, set up a cover and worktable to protect sensitive electronics in the event of rain.
- Communicate planned inspection and calibration with the Production Supervisor, so they can anticipate the communication and signal outages or errors.
- Record ambient temperature and humidity.
- Check calibration labels on all test equipment.
  - Analog equipment must be calibrated every six months.
  - Digital equipment must be calibrated annually.
- Observe control panel as it operates, ensuring the following:
  - All communication to the SCADA system is functioning properly.
  - Control panel is accomplishing its intended function.
  - No abnormal noise is present including loud operation, contactor or relay chatter, whining, or humming.
- Check all indicator lights for proper operation; test any “push to test” lights. Replace lights as required.
- Operate all equipment in manual mode, to the greatest degree practical.
- Verify panel is returned to AUTO mode.
- Note and address any observed alarms; if alarms cannot be readily addressed, coordinate with lead technicians to open a separate work order.
- Perform thermographic survey.
- Touch up paint as required.
- Record run times in operator’s logbook
- Report any discrepancies, additional work required, or observations to the lead technician.

6.3.2. Differential Pressure Cell Calibration

In addition to the weekly inspection and control panel monthly inspection and calibration, perform the following:

- Communicate planned inspection and calibration with the Production Supervisor, so they can anticipate the communication and signal outages or errors.
- Coordinate calibration with RTU inspection and calibration.
- Clean device and appurtenances.
- Perform routine maintenance and calibrate differential pressure cell:
  - Open bypass valve and close high-pressure valve.
  - Bleed air out of both sides of tubing.
  - Calibrate differential the pressure cell and confirm all settings.
  - Zero RTU to match differential pressure cell measurement.
  - Allow differential the pressure cell to sit and confirm the measurement is not drifting.
  - Confirm set points of RTU.
  - Close bypass valve and open high-pressure valve.
  - Exercise low-pressure valve.
  - Observe readout at differential pressure cell and RTU. Confirm the readouts are the same.
- Record degradation index in operator’s logbook.

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6.3.3. Vibration Data Trend

This analysis' objective is to identify potential issues with the vertical turbine pumps and motors in the pump stations. Operators shall compare the following vibration data and investigate any discrepancies for each individual pump in each axis (X-axis, Y-axis, and Z-axis).

- Current week (7 consecutive days) average
- Current month (30 consecutive days) average
- Previous month (Previous 30 consecutive days) average
- Quarterly average for the past four quarters

Consistent vibration data (no change over time) indicates normal operating conditions. Increasing vibration data over time suggests an anomaly or imbalance with the pump rotating equipment such as the impeller, shaft, or motor. Operators should initiate investigations and implement corrective action in accordance with the manufacturer's instructions to minimize pump damage and maintain long term pump operations. The SCADA system has vibration alarms set as follows:

- Low vibration alarm set at [redacted] inches/second
- High vibration alarm set at [redacted] inches/second

6.3.4. Tank Level Data Trend

This analysis' objective is to determine if the water storage tanks are meeting the minimum recommended daily turnover to maintain water quality by minimizing water age. Unified Facilities Criteria (UFC) 3-230-02 recommends turning the tank over 30% daily.

- Check for minimum water turnover by reviewing the tank level data from the past month and verify that 30% turnover was achieved through one or more drain and fill cycles every day. The minimum recommended daily level variation should be:
  - S-1 tank: [redacted] ft
  - S-325/326/327 tanks: [redacted] ft
  - S-316/685: [redacted] ft
- If the turnover is higher than the recommended amount, maintain existing operations.
- If the turnover is less than the recommended amount, evaluate alternatives to reduce the water age:
  - Adjust low water level to cycle the tank deeper on each cycle.
  - Decrease the available storage volume by lowering the high-water level.
- If normal operations cannot be adjusted to obtain the recommended tank cycling, manually cycle tank by temporarily adjusting the operating levels as needed to avoid excessive water age. Circumstances that could hinder adjusting operations are storage requirements, diurnal patterns with large peaks, redundancy concerns, etc. Note that the minimum storage volume must be available for each water system as per UFC 3-230-01 (2021).
- Record tank levels in operator's logbook

6.4. Quarterly Tasks

Analyze SCADA data for long term trends. Compare data for the present quarter to the same quarter last year to see if any substantial changes have occurred, investigate potential causes, and initiate corrective actions. Coordinate data processing with a potable water branch electronic instrumentation SCADA technician and engineer, for data processing inside of and external to the SCADA system, respectively. Evaluate the following data trends:

- Distribution system pressure at each pressure transmitter location

Notes:_____

- Water consumption
- Pump status / run time

6.4.1. Water Consumption Data Trend

This analysis' objective is to determine if distribution system water loss is occurring.

- Verify flow rates are within expected range by comparing to current month average, current quarter average, previous month average, previous quarter average, and previous year average.
- Coordinate with Engineering staff for additional trending, as required based upon observed changes or capacity concerns.

6.4.2. Distribution System Pressure Data Trend

This analysis' objective is to determine if widespread distribution system deterioration and/or water loss is occurring.

- Compare the recorded pressures at a specific location for the current quarter and one year and two years prior.

Determine if the pressure has remained consistent or decreased over time; evaluate based on historical data. Consistent distribution system pressure indicates normal distribution system operating conditions, and changes in pressure can be indicative of system issues.

- Decreasing pressure in conjunction with consistent water consumption over time suggests deteriorated water mains upstream of the pressure sensor and/or distribution system valve issues downstream of the pressure sensor.
- Decreasing pressure in conjunction with increased consumption over time suggests leaks and/ or other unaccounted for water losses.
- Record findings in operator's logbook

6.4.3. Pump Status - Pump Run Time Data Trend

This analysis' objective is to determine, based on pump run time, if the main well or booster pump impellers are deteriorating and may need service.

- Sum the pump run time (hours) for each pump over the entire quarter and compare to previous quarter values.
- Coordinate with Engineering staff for additional trending, as required, based upon observed changes or other concerns.

6.5. Semi-Annual (6-Month) Tasks

6.5.1. RTU Antenna Inspection and Testing

- If inclement weather is possible, set up cover and worktable to protect sensitive electronics in the event of rain.
- Communicate planned inspection and calibration with the Production Supervisor, so they can anticipate the communication and signal outages or errors.
- Check calibration labels on all test equipment.
- Perform voltage standing wave ratio (VSWR) testing for antenna.
- Perform VSWR testing for cable.

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- Check radio power output.
- Check system addressing.
- Check polling effort.
- Inspect tower structural integrity as required.
- Perform general housekeeping including cleaning panel, cleaning antenna, clearing branches that interfere with or pose a risk to the antenna, etc.
- Document findings in operator's logbook.
- Report any discrepancies, additional work required, or observations to the lead technician.

6.5.2. Miscellaneous Tasks

Clean the integral strainers of all vertical turbine flow meters.

6.6. Annual Tasks

6.6.1. General Instrumentation Cleaning

- General instrumentation including pressure gauges, pressure transducers, pressure switches, level transducers, bubbler systems, and other miscellaneous instruments should be cleaned and inspected annually.
- Cleaning shall consist of removing the instrument from service and rinsing off with potable water and mild detergent if required. Prior to reinstalling the instrumentation, ensure it has been properly disinfected as per *SOP 5.1 Water Mains*. Cleaning shall be per manufacturer's recommendations.
- Inspection shall consist of both visual inspection and manual verification of readings.

6.6.2. RTU Inspection and Calibration

- If inclement weather is possible, set up a cover and worktable to protect sensitive electronics in the event of rain.
- Communicate planned inspection and calibration with the Production Supervisor, so they can anticipate the communication and signal outages or errors.
- Note and address any observed alarms; if alarms cannot be readily addressed, coordinate with lead technicians to open a separate work order.
- Confirm time on RTU; adjust as required.
- Check RTU readings for all analog and discrete inputs and compare to the sensor readings and any available manual readings (tank level, pressure gauge, etc.). Coordinate sensor verification with sensor calibration; see other sections as required. Calibrate RTU as required.
- Note and reset all totalizers.
- Check battery voltage with voltmeter and amp hours with battery tester.
- Check RTU for communication to and from the SCADA system and confirm all inputs are properly being received by the SCADA system. Calibrate as required.
- Inspect direct current and alternating current voltage and loads to ensure that the system is functioning properly, including the following:
  - Voltage of signals from instrumentation
  - Incoming panel power, using the outlet plug
- Record inspection and calibration information in operator's logbook
- Report any discrepancies, additional work required, or observations to the lead technician.

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6.6.3. Annual SOP Refresher Training

- Schedule Training
  - Review operator schedules to identify a convenient time and date for most or all operators to attend the training session.
  - Provide Refresher Training
- Review key aspects of this SOP
  - Observed operating trends and potential causes
  - Equipment accuracy issues
  - Operators' questions or concerns
  - Areas identified to improve the SOP
- Documentation
  - Record the date, time, and attendees of the training sessions in *Attachment 1*.
  - Note any updates or revisions made to the SOP.

6.7. Biennial Meter Calibration

Flow meters that rely upon differential pressure are not directly calibrated; only the differential pressure cell is calibrated. This calibration is performed monthly as described in *Section 6.3.2*. Mechanical flow meters shall be calibrated biannually. See *Table 6-2* for reference regarding types of meters and calibration. Calibrate the mechanical flow meters by utilizing a single portable flow meters or multiple portable flow meters that are known to be calibrated accurately or fill a known volume of water in a set amount of time. If a meter is identified as being inaccurate, repair or replace as required. All mechanical system meters shall be calibrated biannually to the greatest extent possible to verify water usage and identify major water consumers. If system demand or redundancy concerns limit water usage and meter calibration, prioritize meters by flow rate and usage type, giving higher priority to larger meters and meters utilized for billing purposes. Cleaning shall be per manufacturer's recommendations and American Water Works Association (AWWA) Manual M33. Basic mechanical meter calibration shall be as follows:

- Calibrate the meter at the lowest rated flow, highest rated flow, and any crossover points based upon meter size.
- Based upon the results of the calibration tests, the flow meter will either be deemed accurate, or the tests will help to direct the operators to the faulty components.
- Replace or repair meter components as required.
- Perform final calibration to ensure mechanical components and register reading components are properly aligned.
- Document calibration in operator's logbook.

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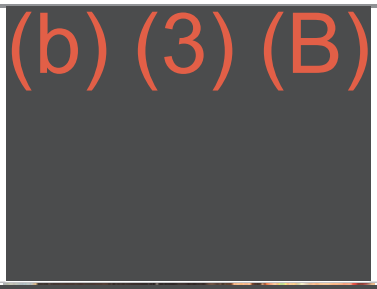
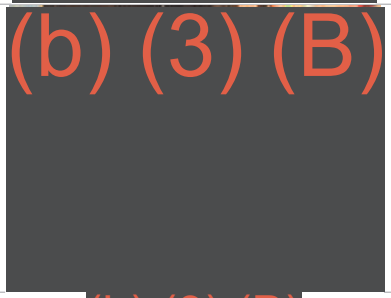
Table 6-2 Flow Meter

Meter Style	Picture	Calibration Notes
Venturi		Calibrate differential pressure transducer and confirm transmitter calculation assumptions. Flush pilot tubing to ensure there are no clogs.
Paddle/Turbine		Test meter at rated low flow, rated high flow, and any crossover points. Replace measuring module or entire meter as required.
Pitot		Calibrate differential pressure transducer and confirm transmitter calculation assumptions. Flush pilot tubing to ensure there are no clogs.

6.8. Miscellaneous Tasks

Replace Well Level Display desiccant. When the desiccant display changes from blue to pink, the DriCan® desiccant pack should either be replaced or reconditioned. The desiccant pack can be reconditioned by heating the pack in a vented oven at 300°F for approximately 3 hours or until the blue color returns.

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7. TROUBLESHOOTING

This section offers an approach to troubleshooting common issues encountered while following this SOP. *Table 7-1* offers solutions to each common problem associated with Venturi Flow meters.

Table 7-1 Venturi Flow Meters Troubleshooting Guide

Issue	Potential Related Issue or Cause	Remedy
Low or No Output	Primary Element	• Check the installation and condition of primary element.
	Loop Wiring	• Check for adequate voltage to the transmitter. • Check the total current being drawn for all transmitters/devices being powered. • Check for shorts and multiple grounds, including insulation. • Check for proper polarity at the signal terminal. • Check loop impedance.
	Impulse Piping	• Ensure that the pressure connection is not reversed. • Check for leaks or blockage in the piping and process flange including entrapped air. • Ensure valves are fully open and that bypass valves are tightly closed.
	Sensing Element (transmitter sensor)	• Check for any obvious defects/damage such as dents or punctures in the diaphragms; replace as required.
High / Low Output	Primary Element	• See above.
	Impulse Piping	• See above.
	Power Supply	• See above under “Loop Wiring”.
	DP Transmitter Electronics	• See above under “Loop Wiring”. • Make sure square root extraction is applied once in the transmitter/programmable logic controller/SCADA, etc. If the square root transfer function is not applied at all, the flow reading will be lower than actual. If square root is applied twice, the flow reading will be higher than actual.
	Sensing Element (transmitter sensor)	• See Above.

Notes:_____

Table 7-1 Venturi Flow Meters Troubleshooting Guide (Continued)

Issue	Potential Related Issue or Cause	Remedy
DP transmitter does not calibrate properly	Pressure Source/Source Connections	• Check for restrictions or leaks in the calibrator connections. • Check for proper leveling or zeroing of the pressure source. • Check to see if temperature change has affected the pressure readings. • Check weights/gauge to ensure proper pressure setting. Determine if your pressure calibrator has sufficient accuracy.
	Meter	Determine if the transmitter and calibrator are functioning properly.
	Power Supply	Check the power supply output voltage at transmitter.
	DP Transmitter Electronics	• Make sure the transmitter connectors are clean. • Check the digital to analog (D/A) conversion by performing a D/A trim with a calibrated multimeter in series with the field wiring. If the electronics are still suspect, substitute with new electronics.
	Sensing Element (transmitter sensor)	See Above.
Erratic Output	Loop Wiring	See Above.
	Process Pulsation	Adjust damping.
	DP Transmitter Electronics	See Above.
	Impulse Piping	See Above.

Notes:_____

8. REFERENCES

- AWWA Manual M6 – Water Meters: Selection, Installation, Testing and Maintenance, Fifth Edition, November 2018.
- AWWA Manual M33 - Flowmeters in Water Supply, Third Edition, 2018.
- Department of the Army, EM-385-1-1 Safety and Occupational Health (SOH) Requirements Manual, 15 March 2024.
- Department of the Navy, OPNAV M-5100.23: Navy Safety and Occupational Health Manual, 5 June 2020.
- JBPHH Safety Manual
- Recommended Standards for Water Works, 2022. Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers as published by Minnesota Government Publications.
- UFC 3-230-01: Water Storage and Distribution July 2021.

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9. ATTACHMENTS

- Attachment 1: SOP Acknowledgement and Training Form
- Attachment 2: (b) (3) (B) Sensor Termination Enclosure and In-Situ (b) (3) (B) Data Logger Cut Sheets
- Attachment 3: (b) (3) (B) Pressure Transmitters Cut Sheet and Instructions. (Note: (b) (3) (B) is a standardized device for Potable Water SCADA)
- Attachment 4: (b) (3) (B) and (b) (3) (B) Pressure Transducers Cut Sheet and Instructions. (Note: (b) (3) (B) is a standardized device for Potable Water SCADA.)
- Attachment 5: (b) (3) (B) Pressure Transmitter (b) (3) (B) Cut Sheet and Instructions. (Note: (b) (3) (B) is not a standardized device and should be replaced with a standardized device upon failure.)
- Attachment 6: (b) (3) (B) Water Meter Cut Sheet
- Attachment 7: (b) (3) (B) Differential Pressure Transmitter Operating Instructions
- Attachment 8: (b) (3) (B) Bidirectional Pitot Tube Sensor Cut Sheet and Instructions
- Attachment 9: Metrix (b) (3) (B) Seismic Velocity (Vibration) Transmitter Datasheet

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Attachment 1:
SOP Acknowledgement and Training Form

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SOP ACKNOWLEDGEMENT AND TRAINING FORM

This SOP must be read and signed each time training is provided, or modifications are made to the SOP. This form should accompany the current SOP version.

Document Title:	Real Time Monitoring
Document Revision Number:	
Document Revision Date:	

Please sign below in accordance with the following statement: "I have read and understood the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent, approved revision."

Print Name	Signature	Date

Notes:_____

SOP Acknowledgement and Training Form (continued)

Trainee:
Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer.

Trainer:
Sign below to acknowledge that training on this SOP was completed for the individual listed and that the trainee is competent to perform the procedures described within.

Date of Training [mm/dd/yyyy]	Trainee Print Name	Trainee Signature	Trainer Print Name	Trainer Signature

Notes:_____

Attachment 2:
(b) (3) (B) SensorTermination Enclosure and In-Situ (b) (3) (B) Data Logger Cut Sheets

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Attachment 3:
(b) (3) (B) Pressure Transmitter Cut Sheet and Instructions

(Note: (b) (3) (B) is a standardized device for Potable Water SCADA)

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Attachment 4:

(b) (3) (B) and (b) (3) (B) Pressure Transducers Cut Sheet and Instructions

(Note: (b) (3) (B) is a standardized device for Potable Water SCADA)

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Attachment 5:
(b) (3) (B) Pressure Transmitter (b) (3) (B) Cut Sheet and Instructions

(Note: (b) (3) (B) is not a standardized device and should be replaced with a standardized device upon failure.)

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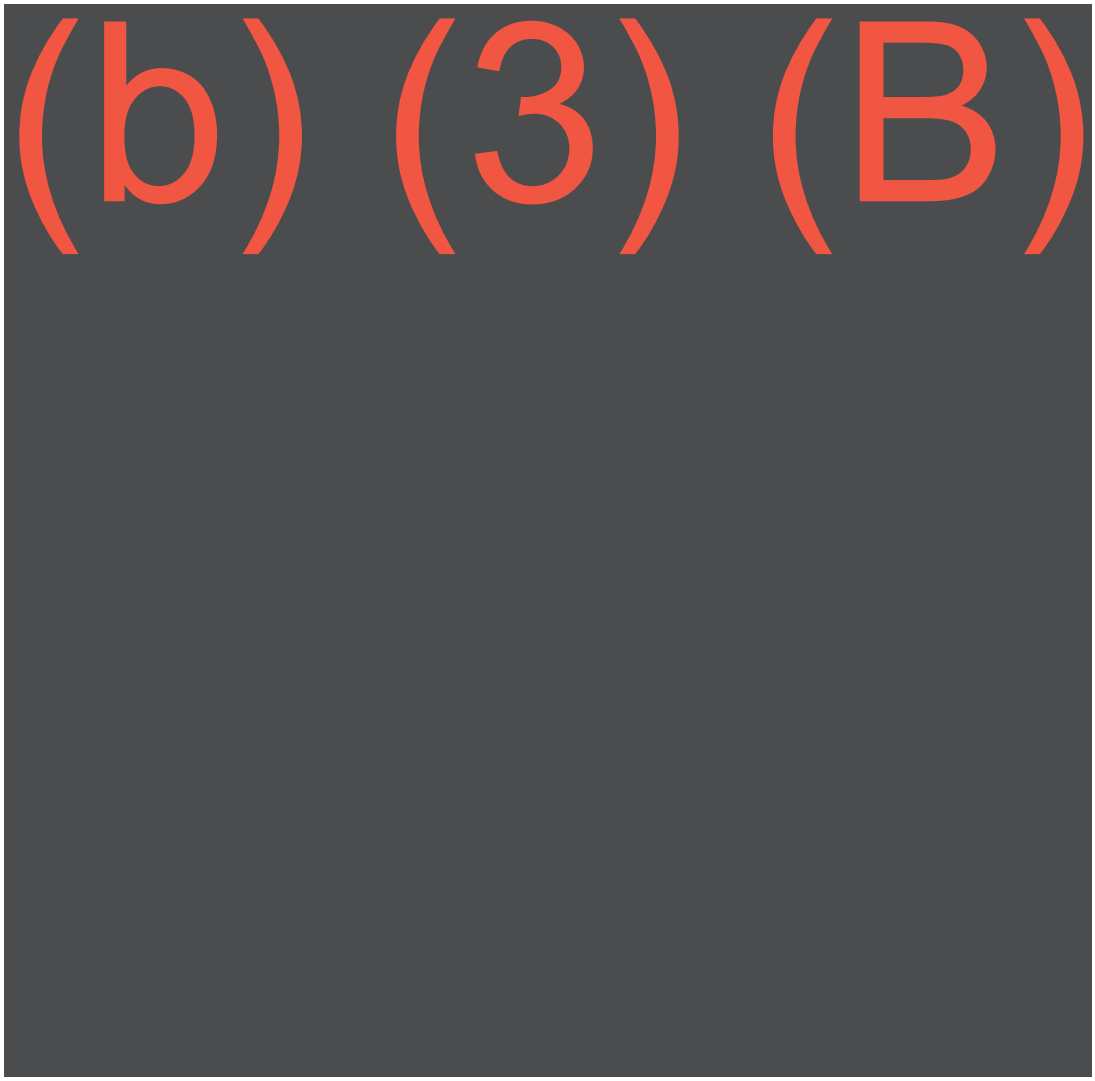
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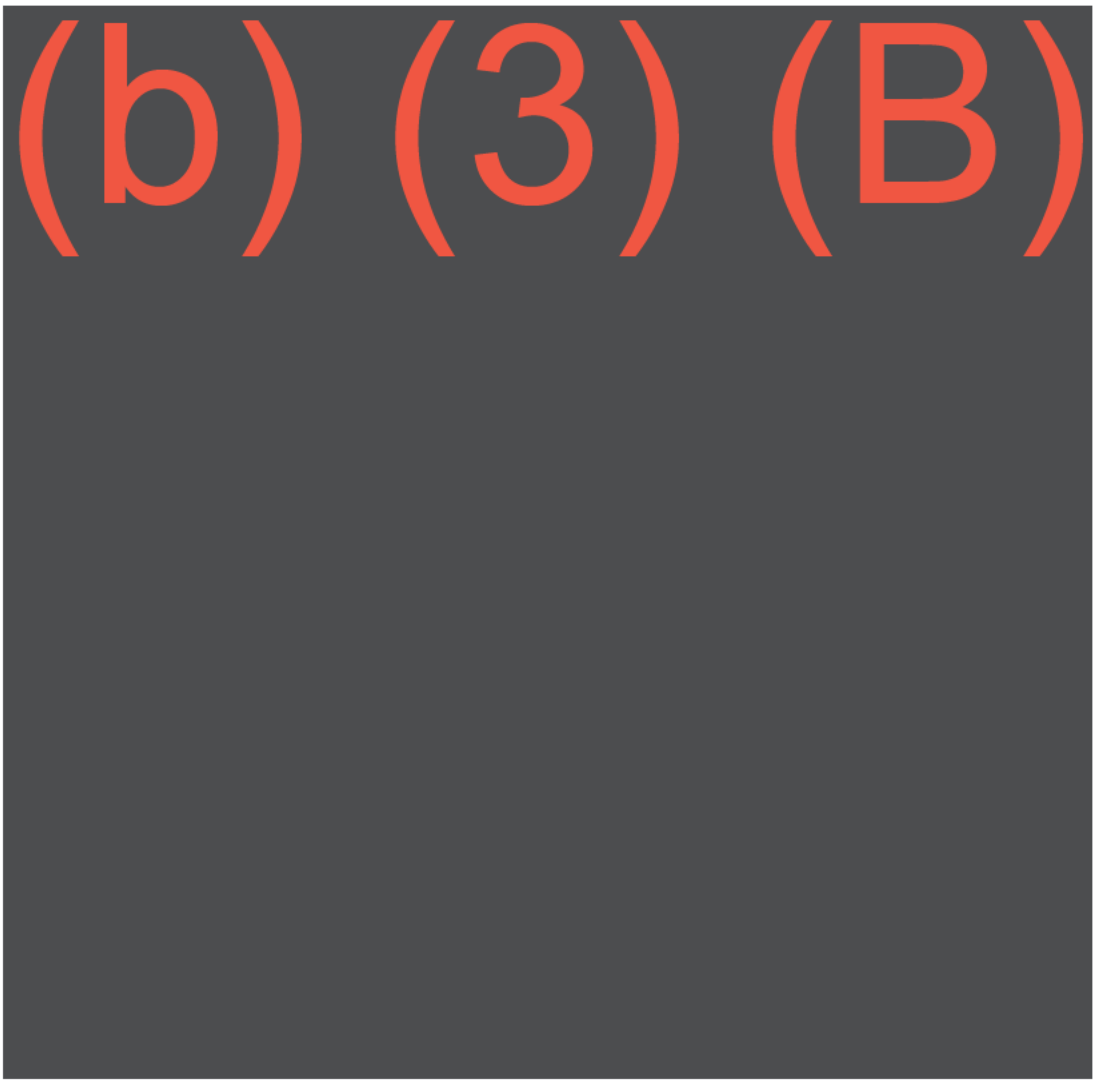
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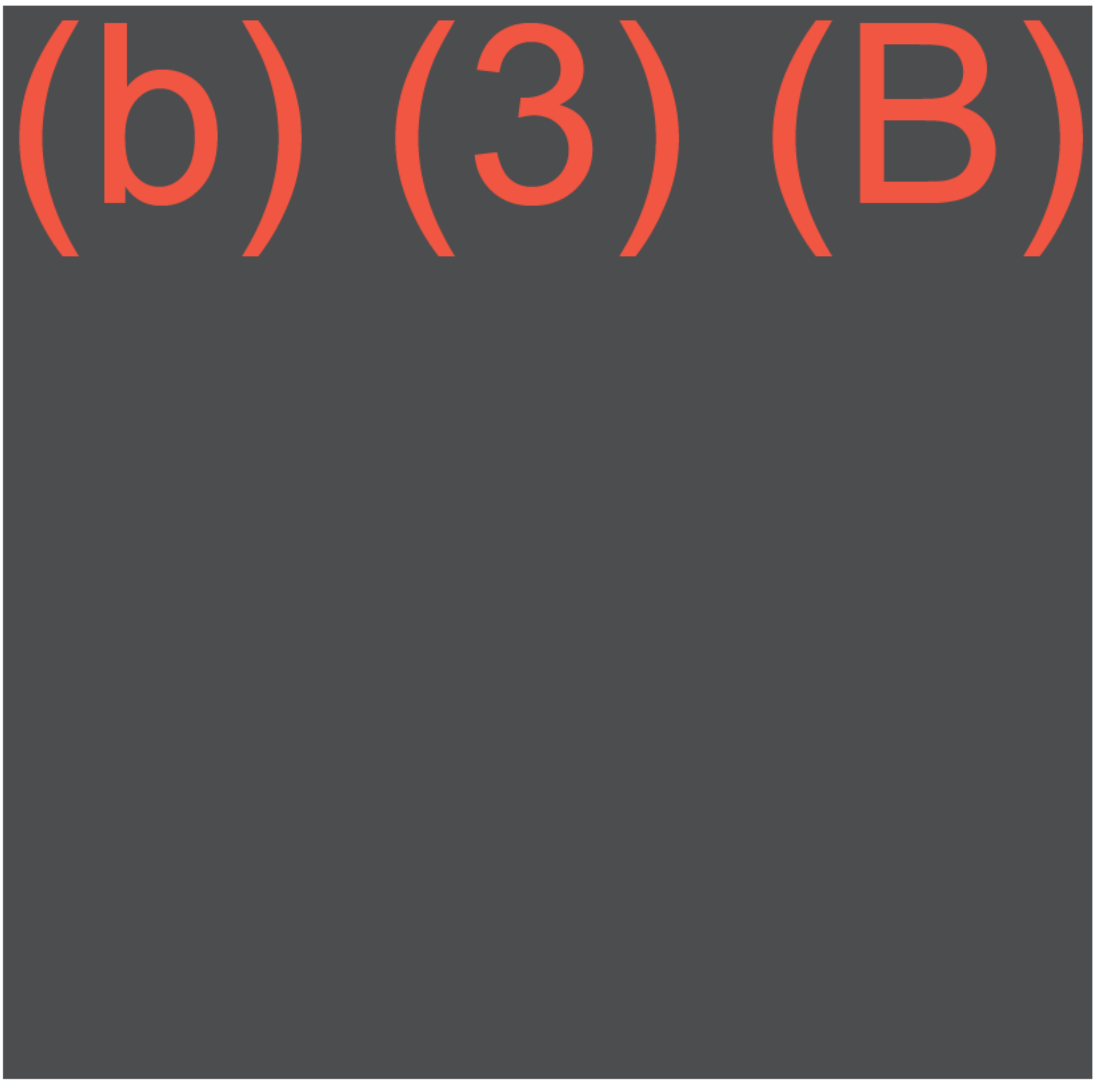
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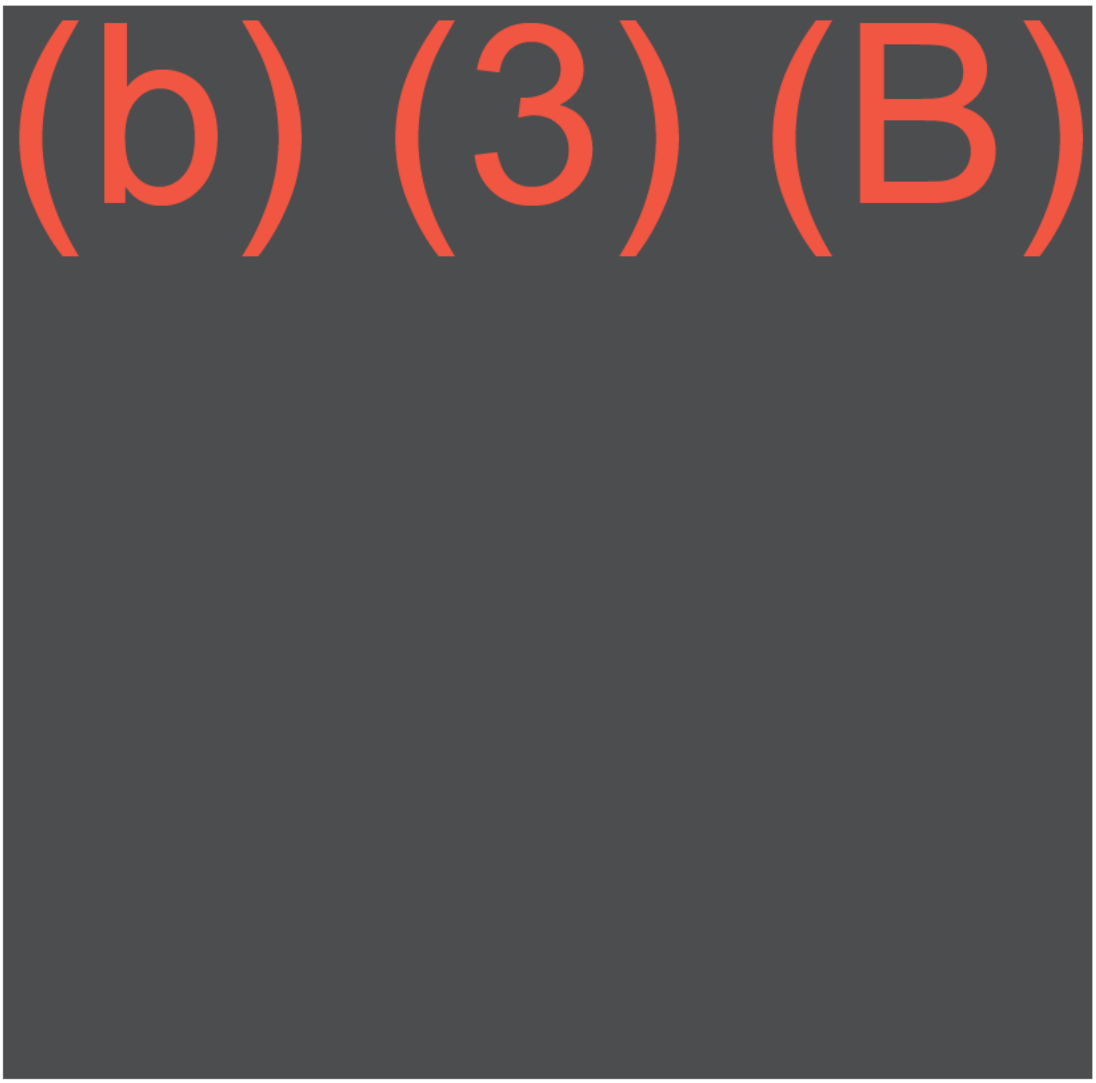
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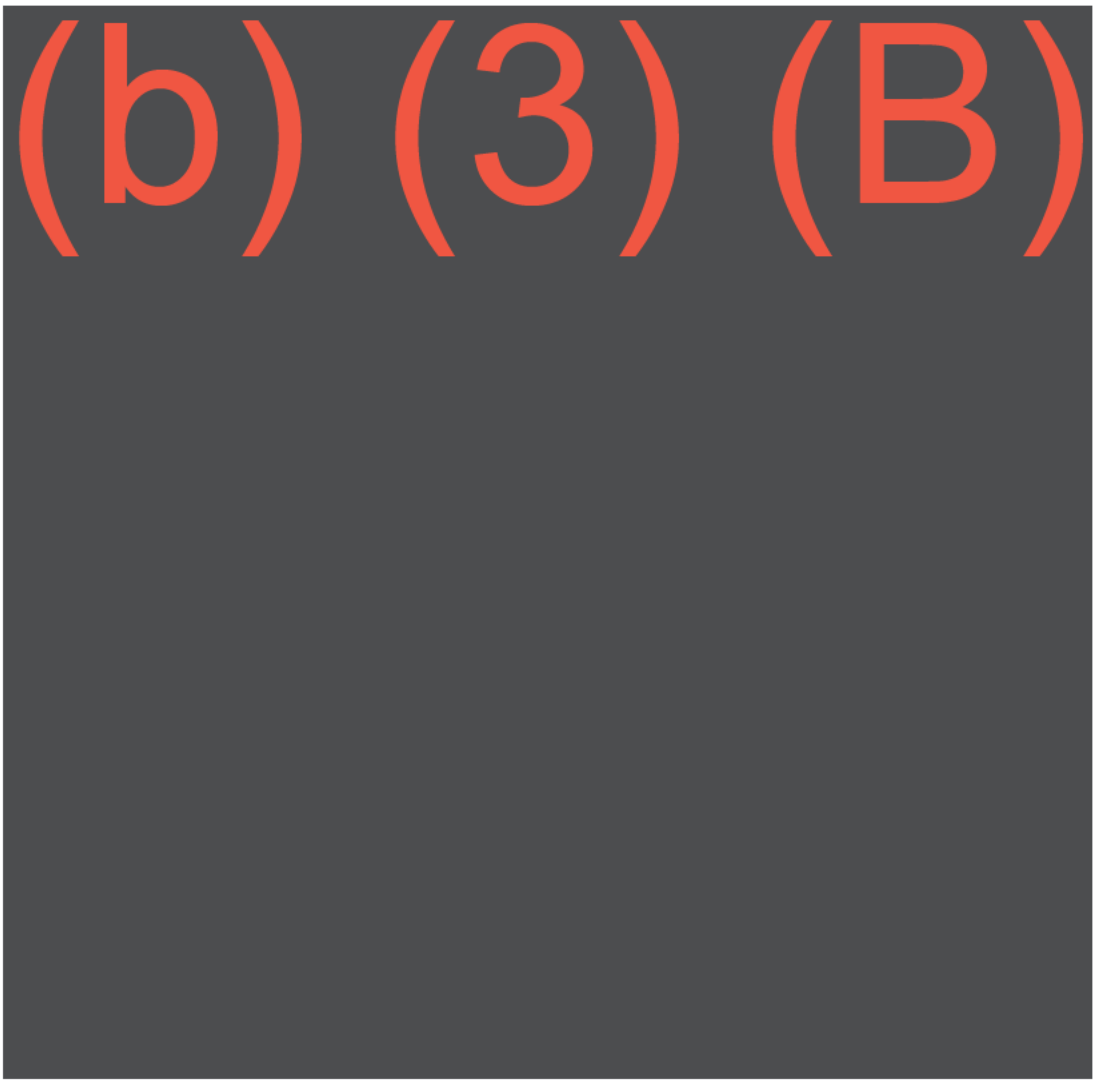
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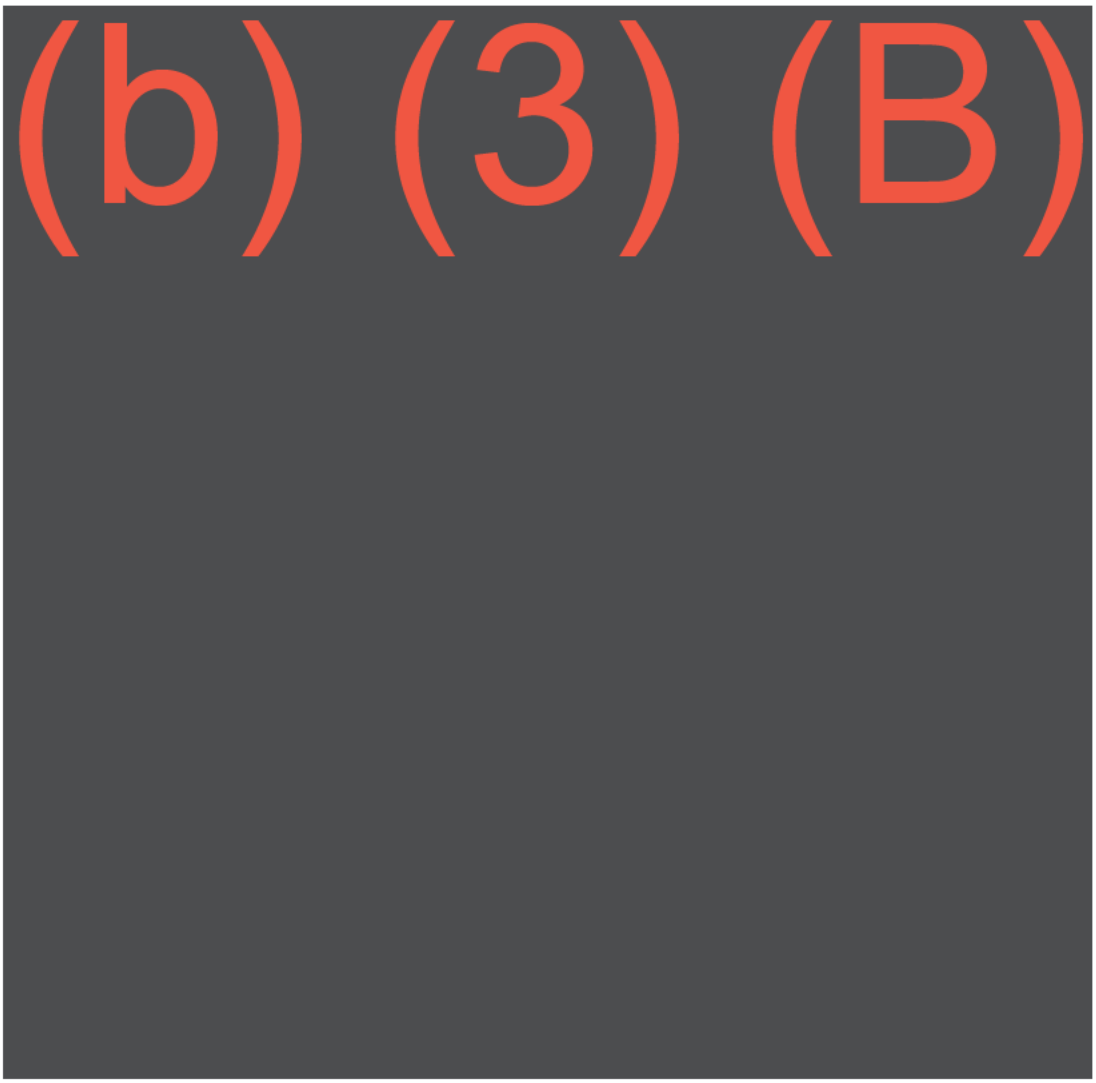
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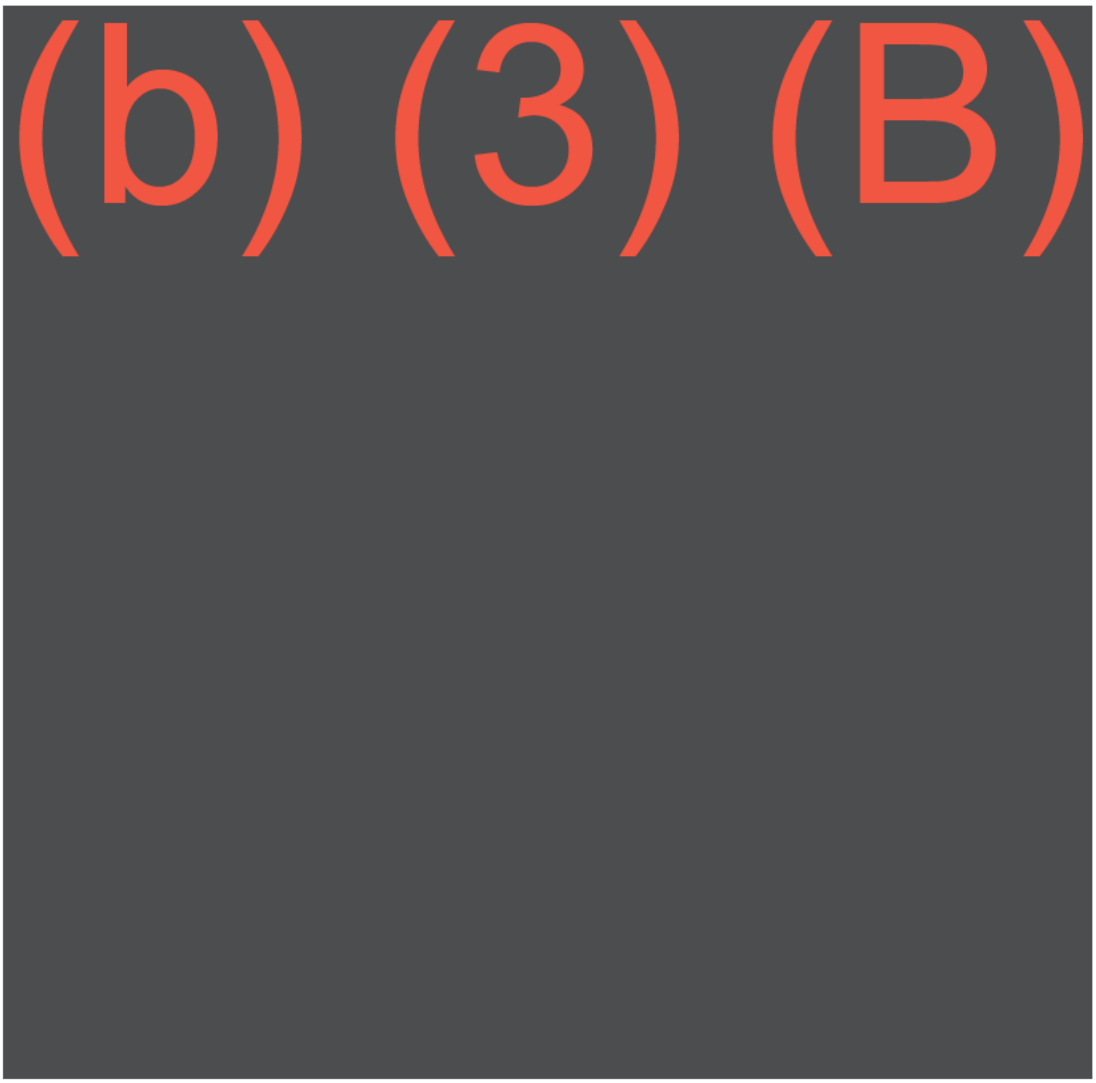
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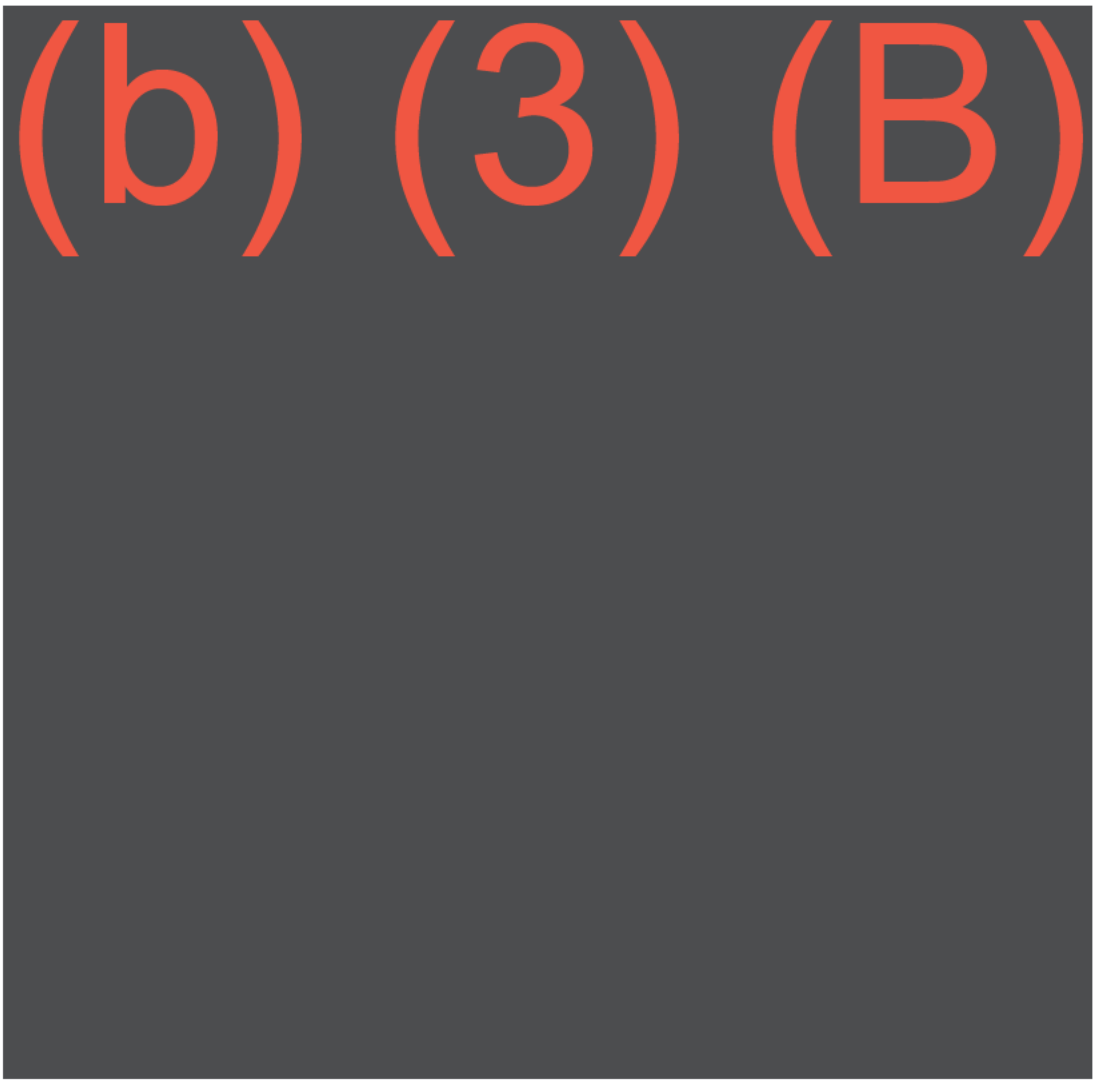
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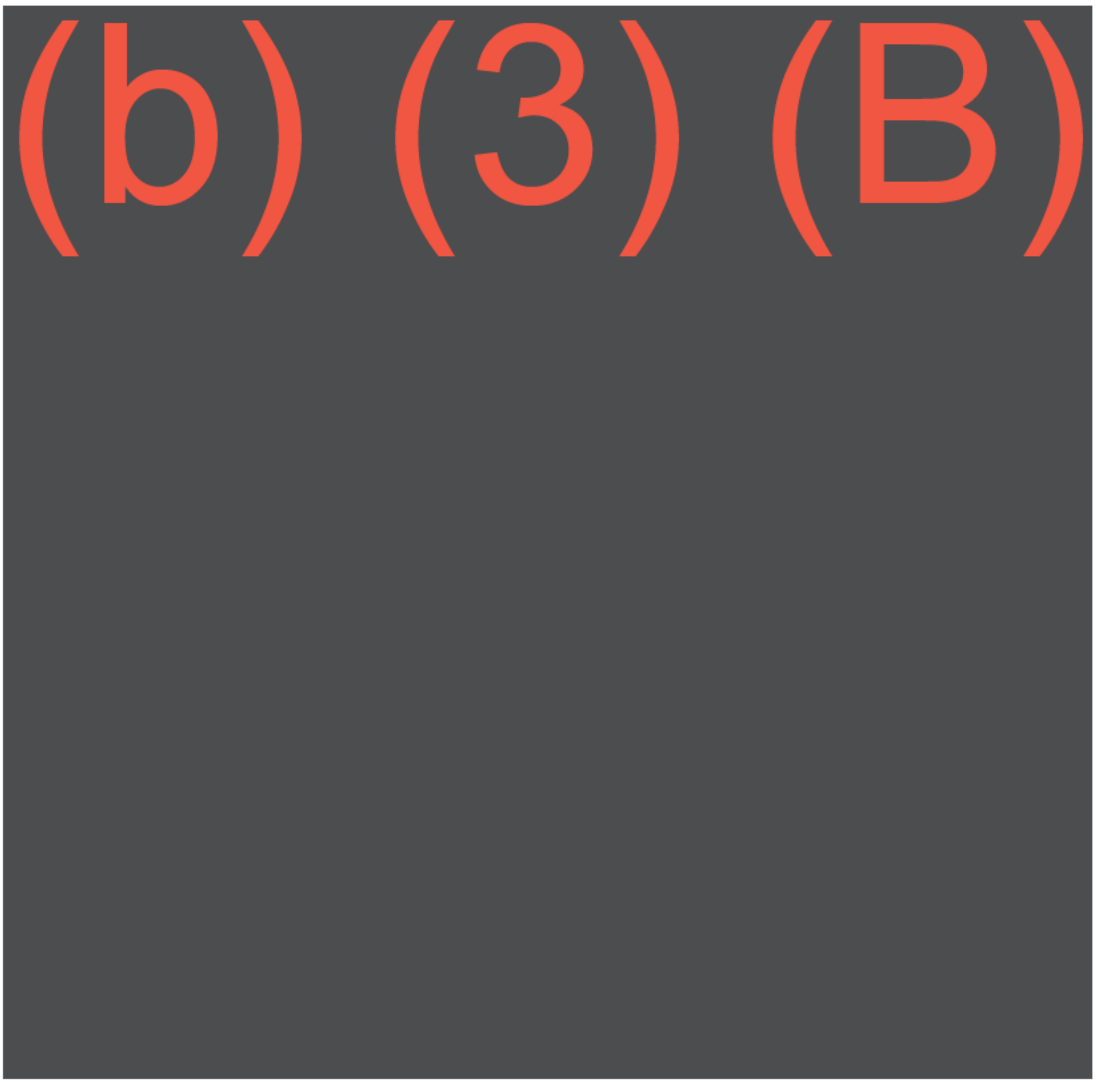
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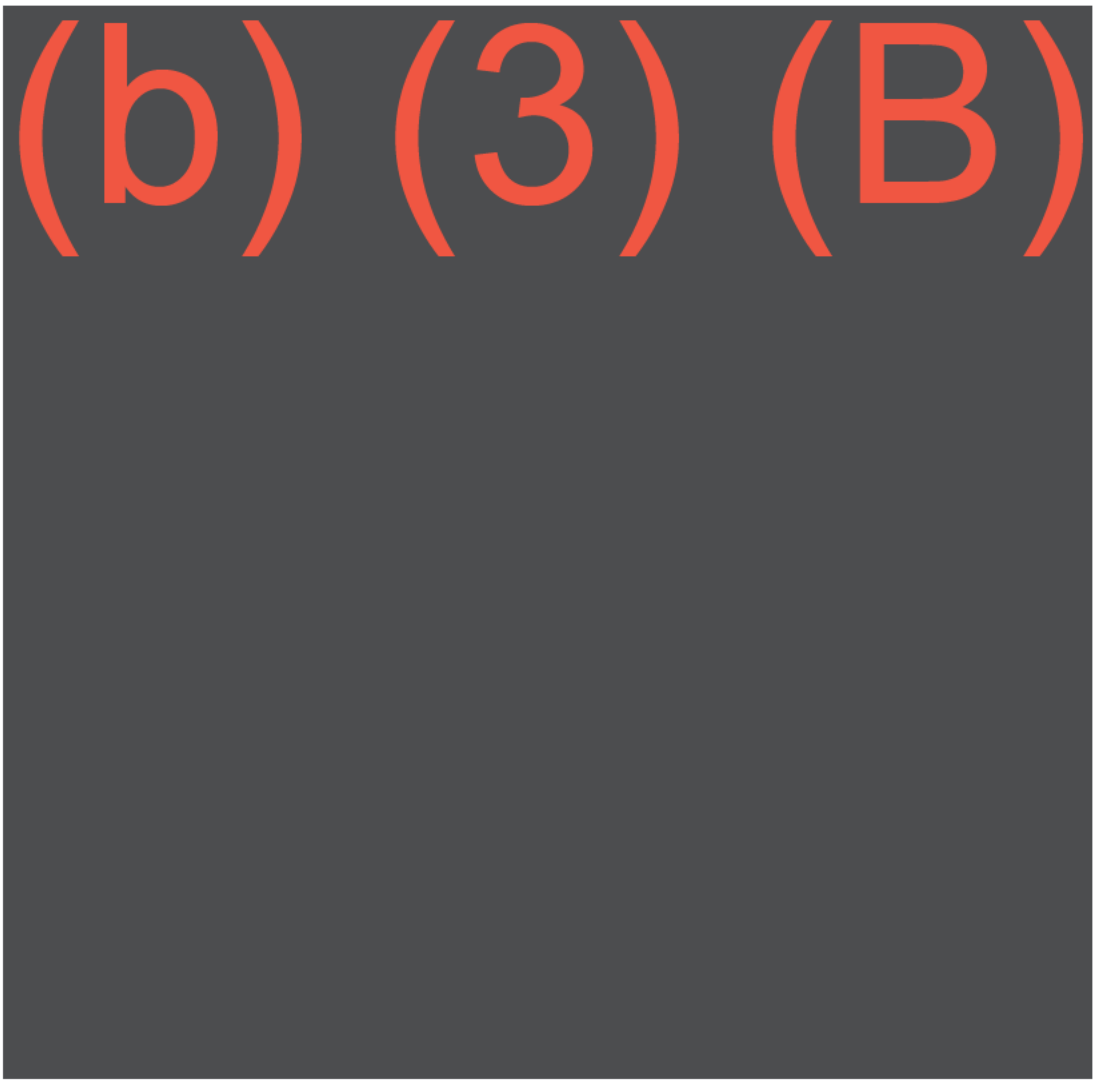
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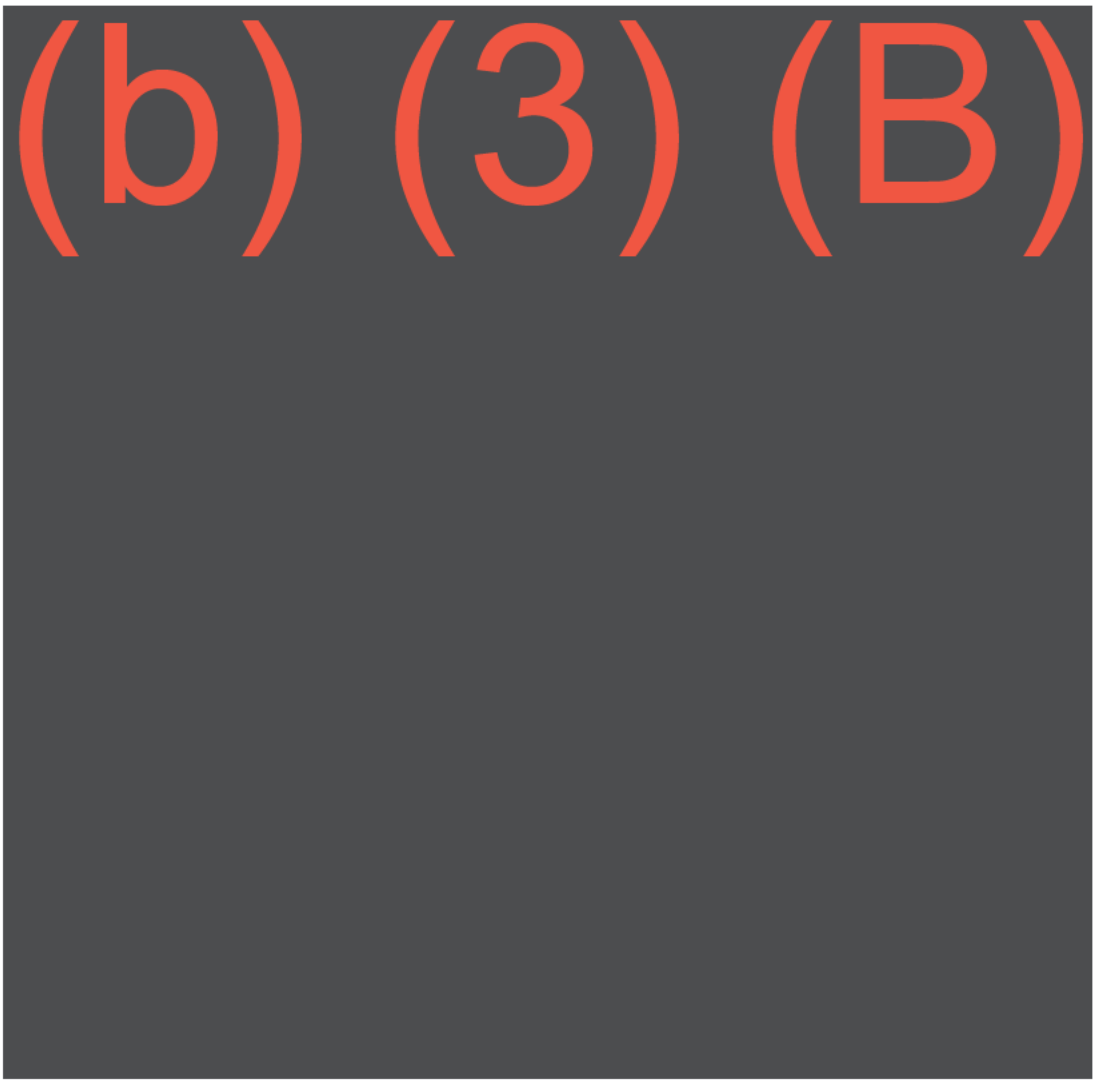
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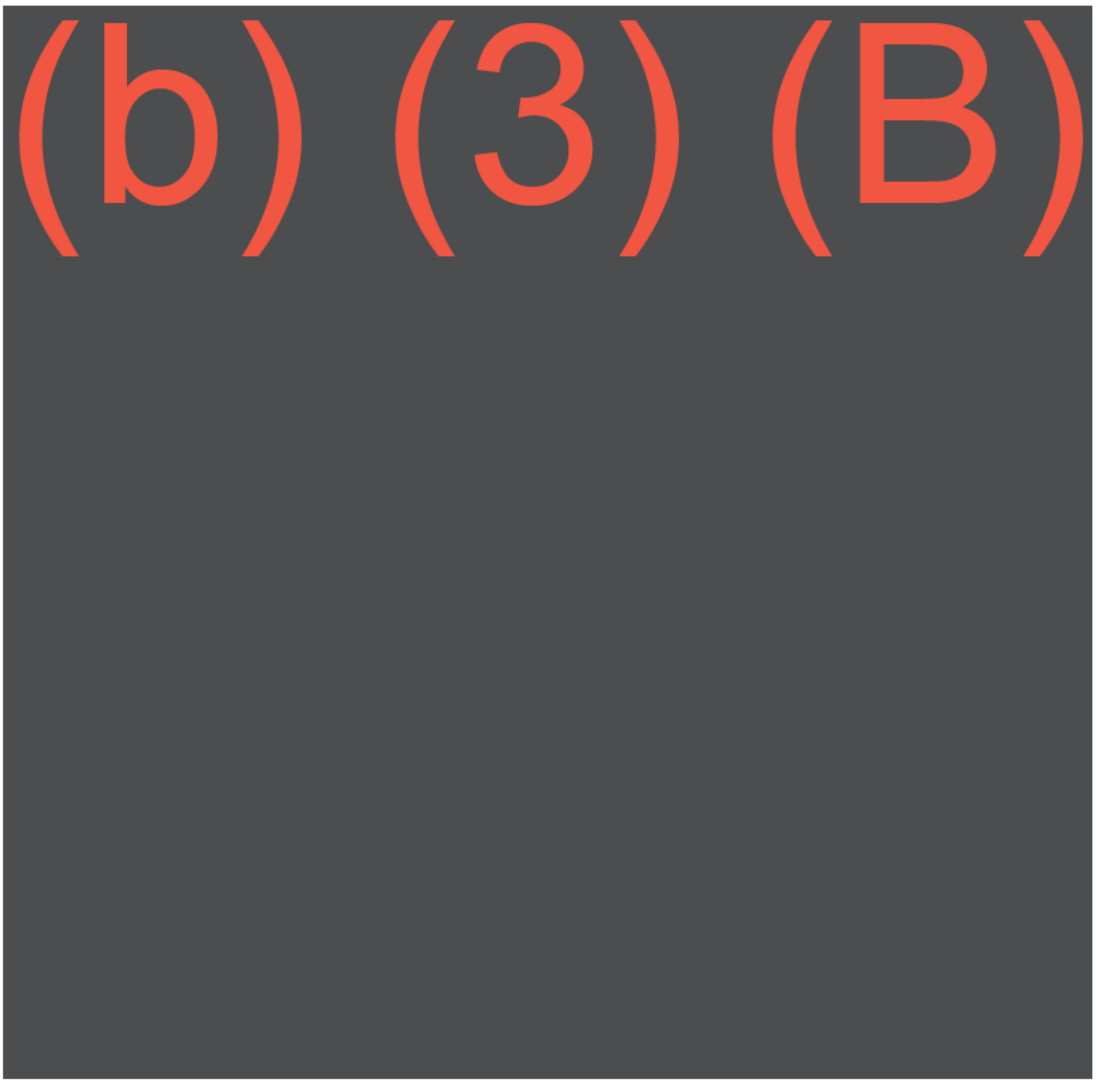
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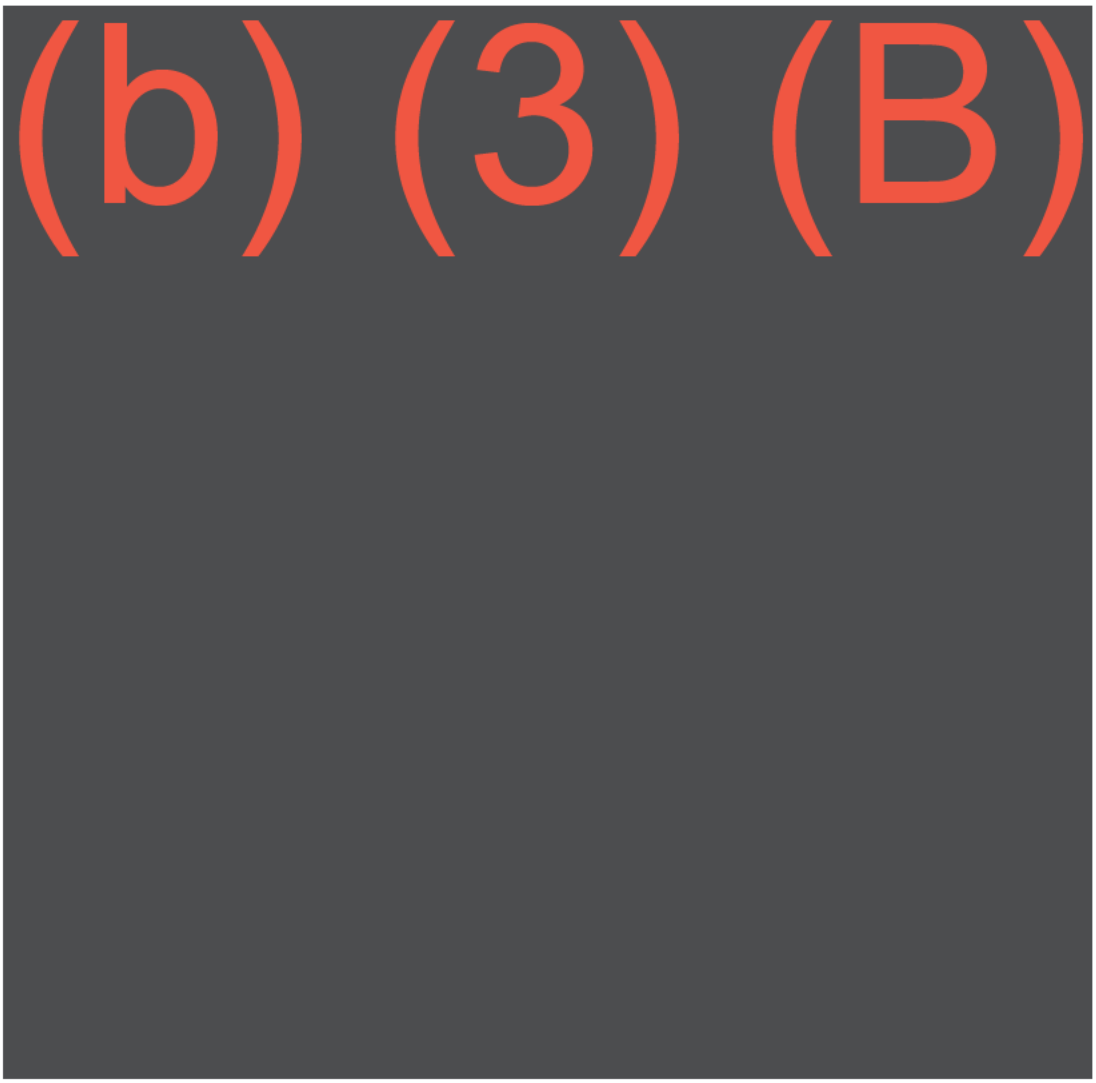
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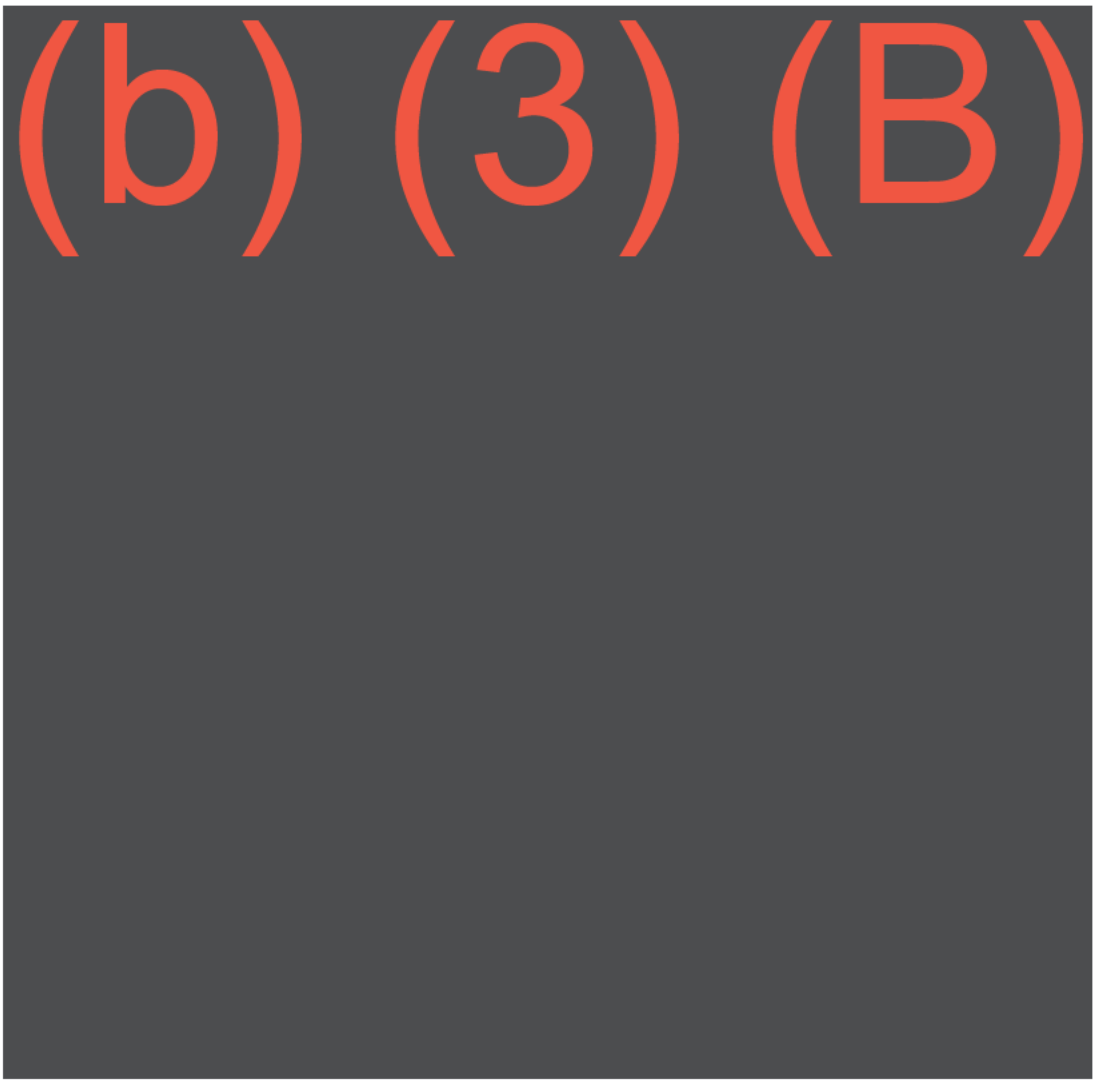
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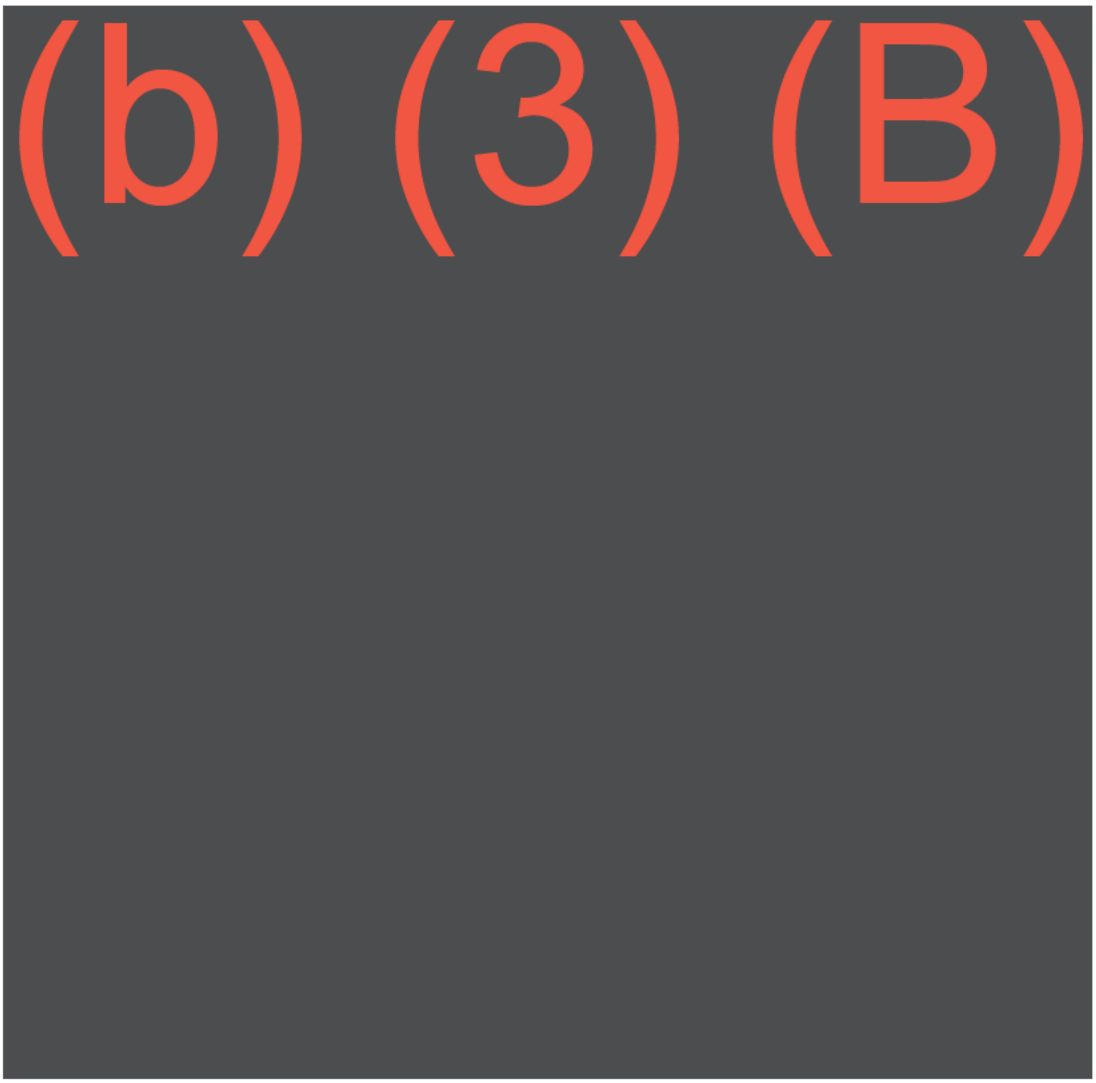
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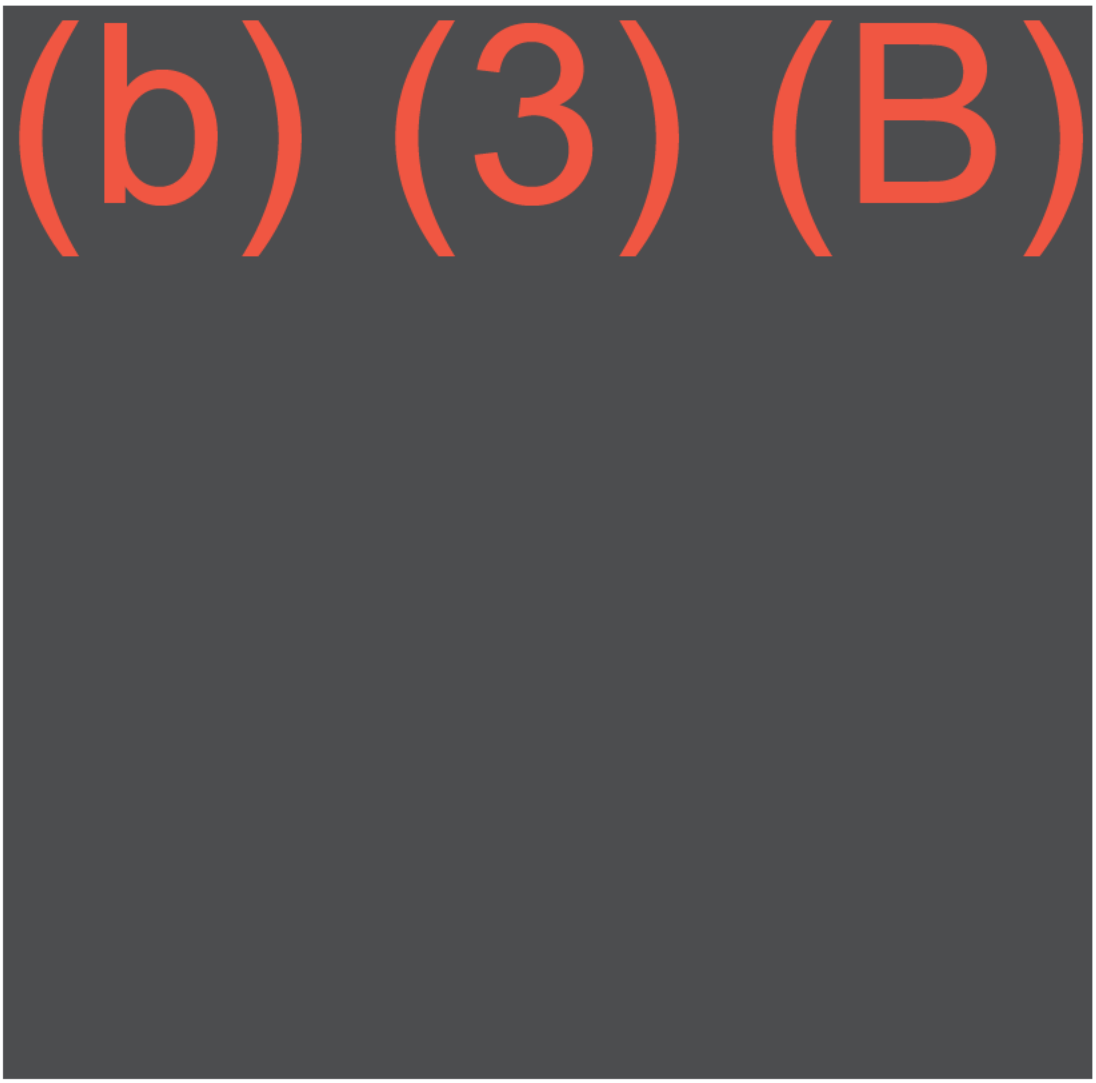
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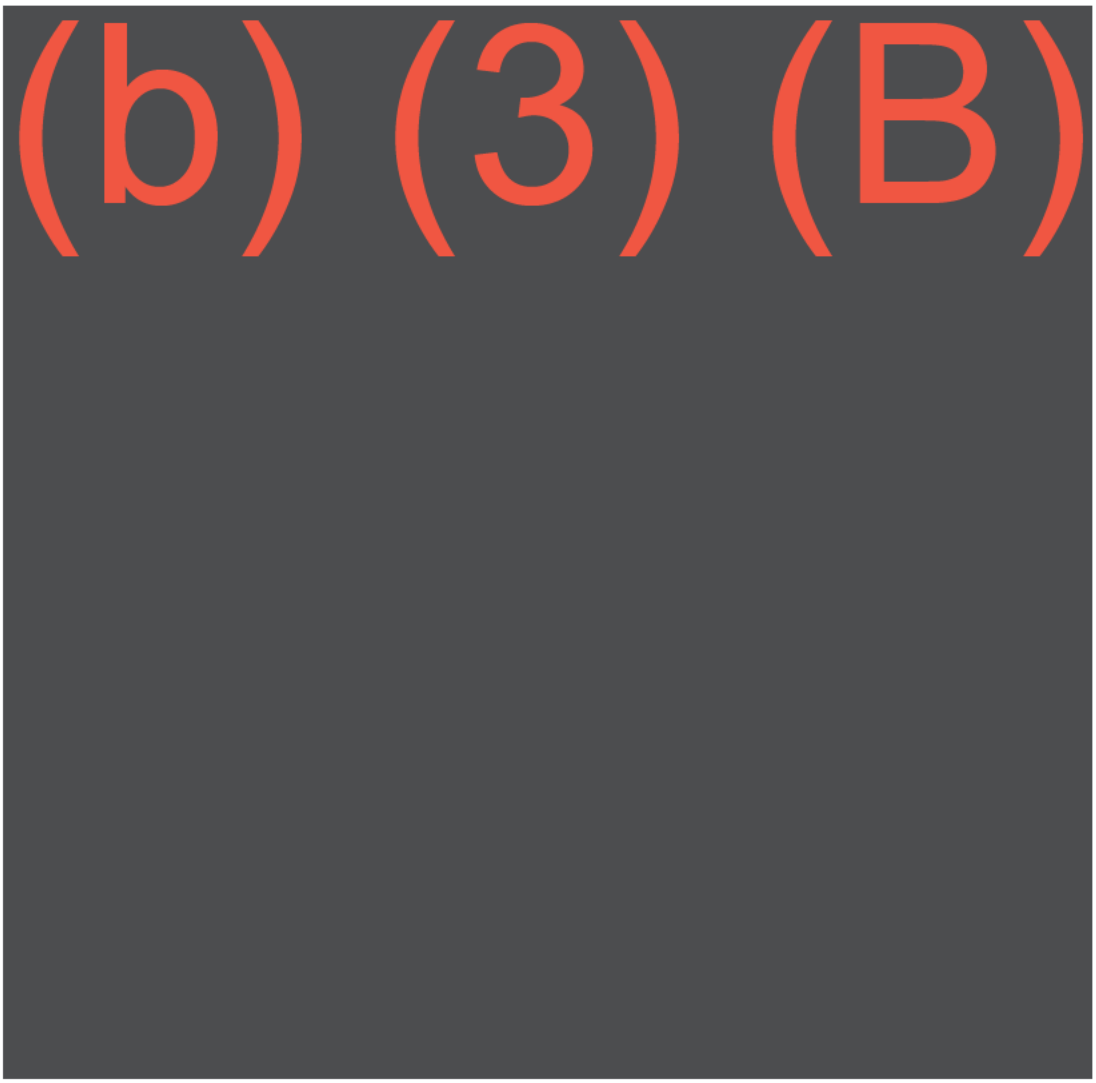
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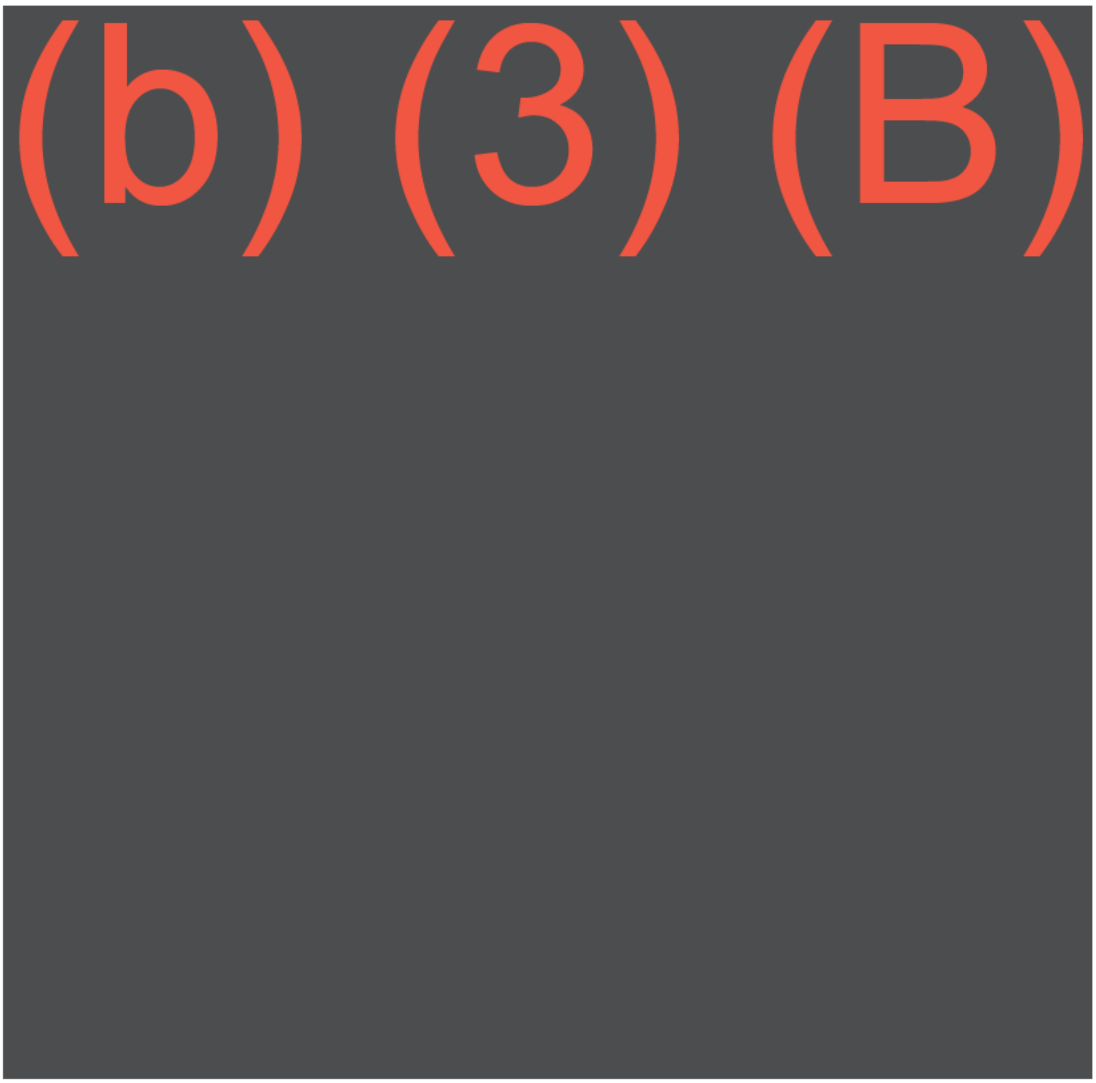
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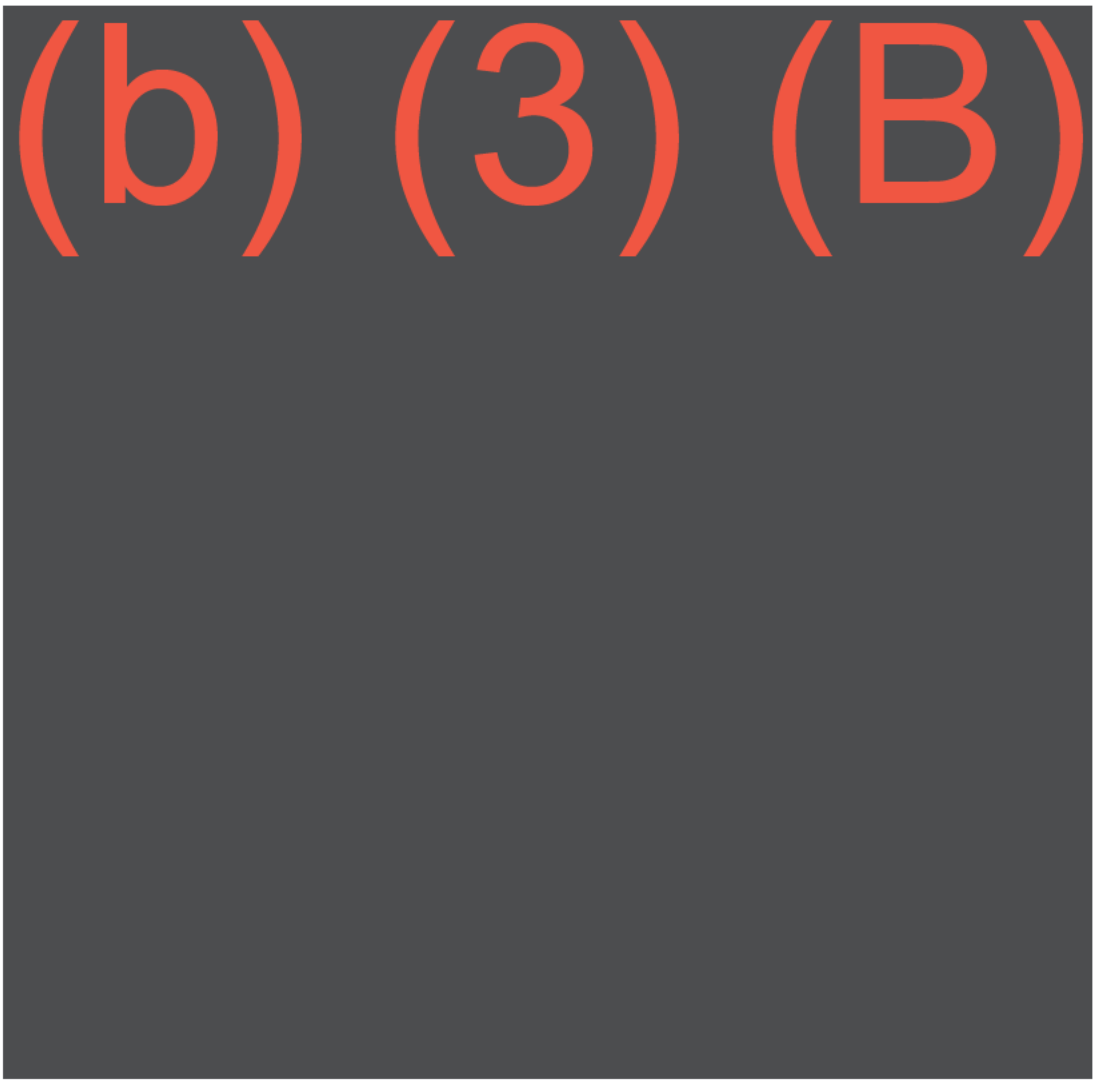
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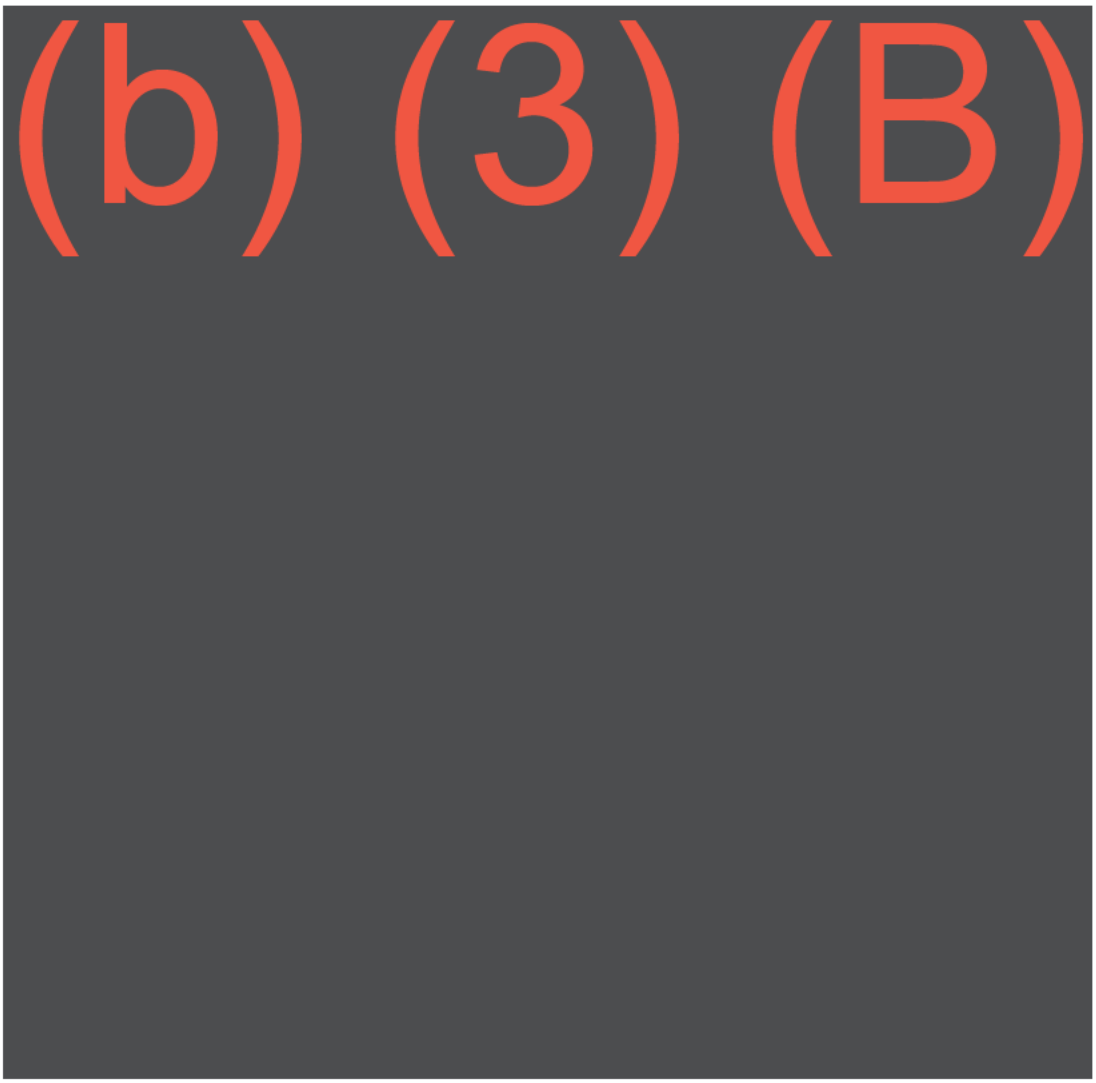
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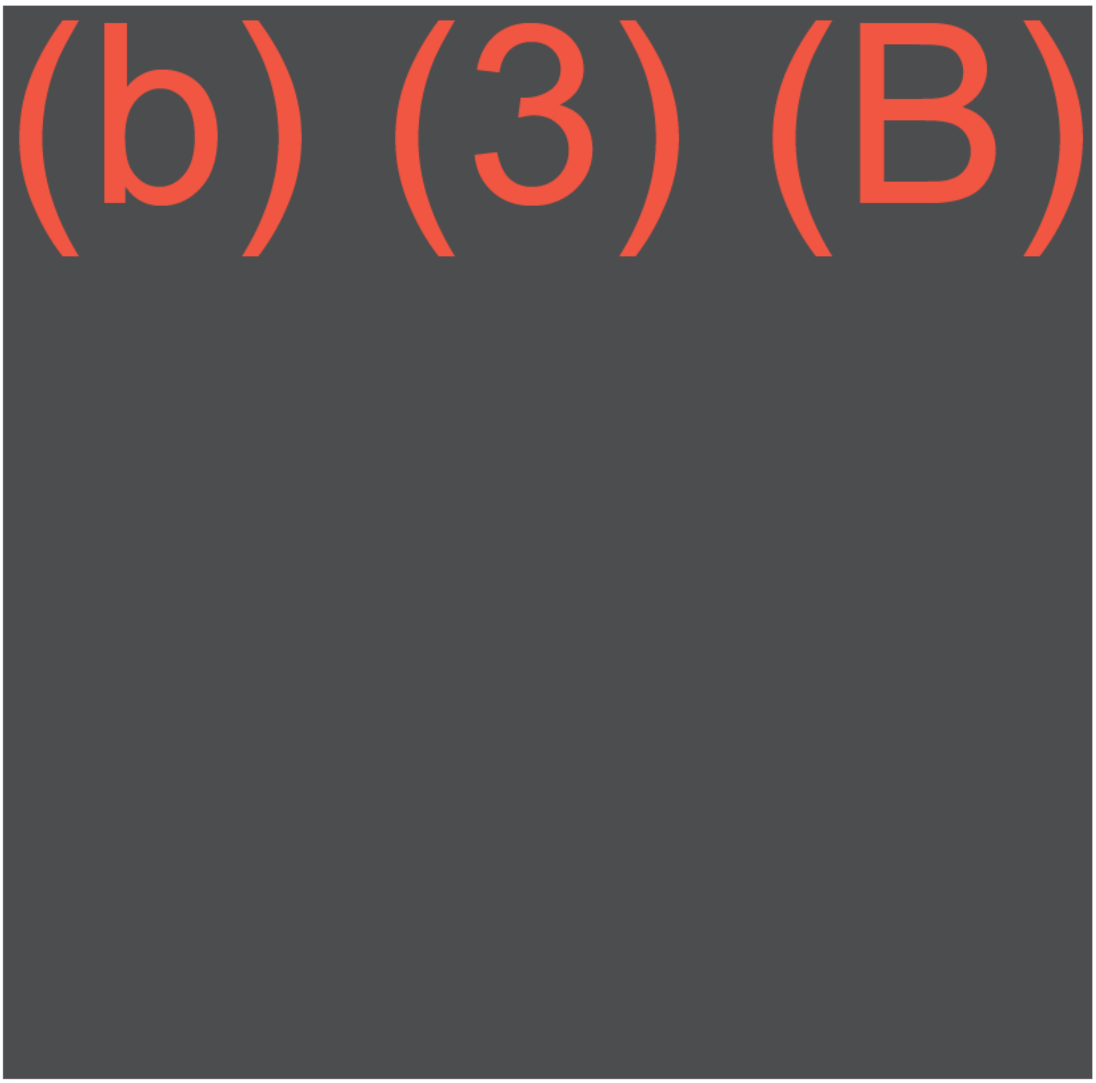
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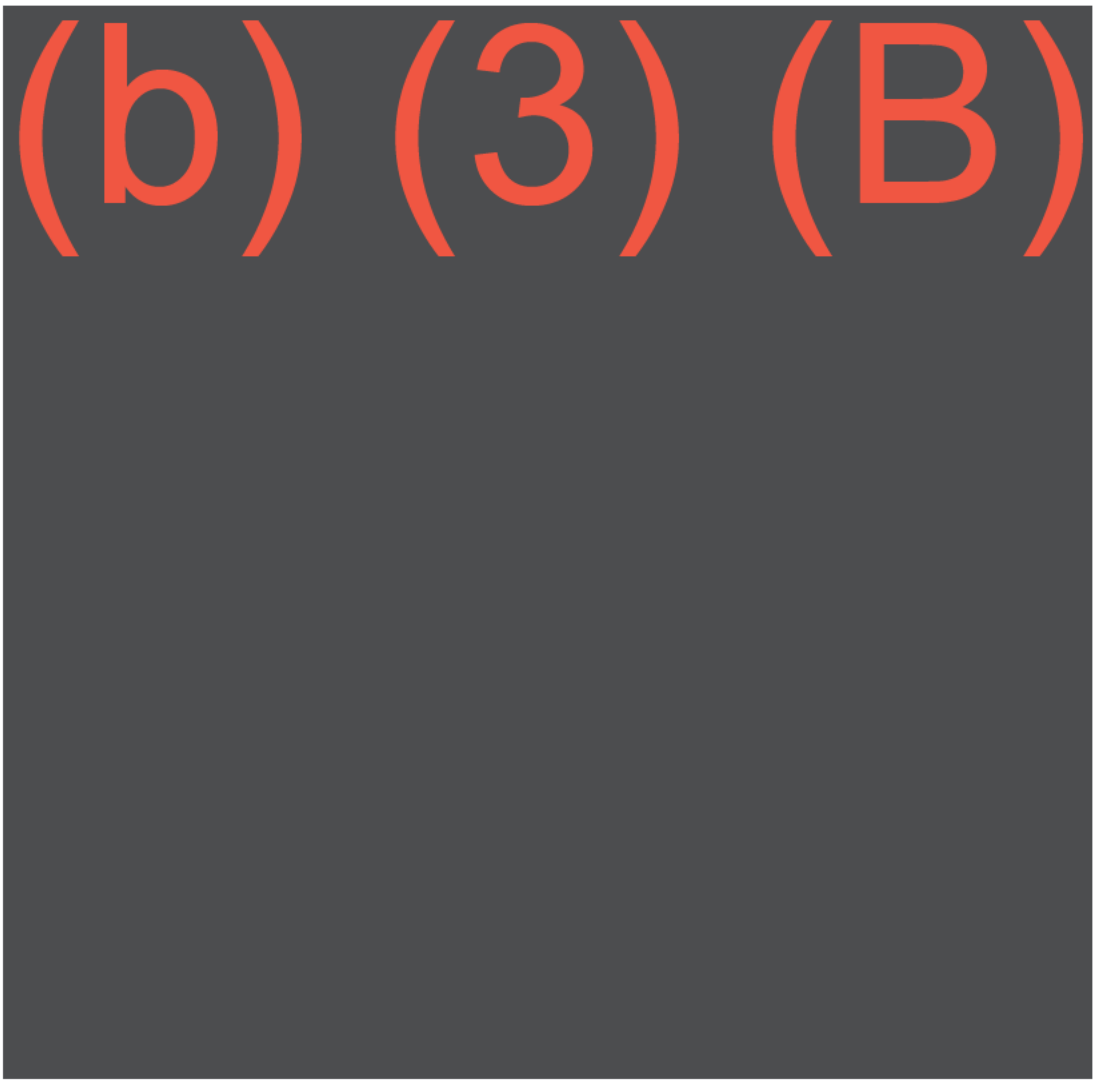
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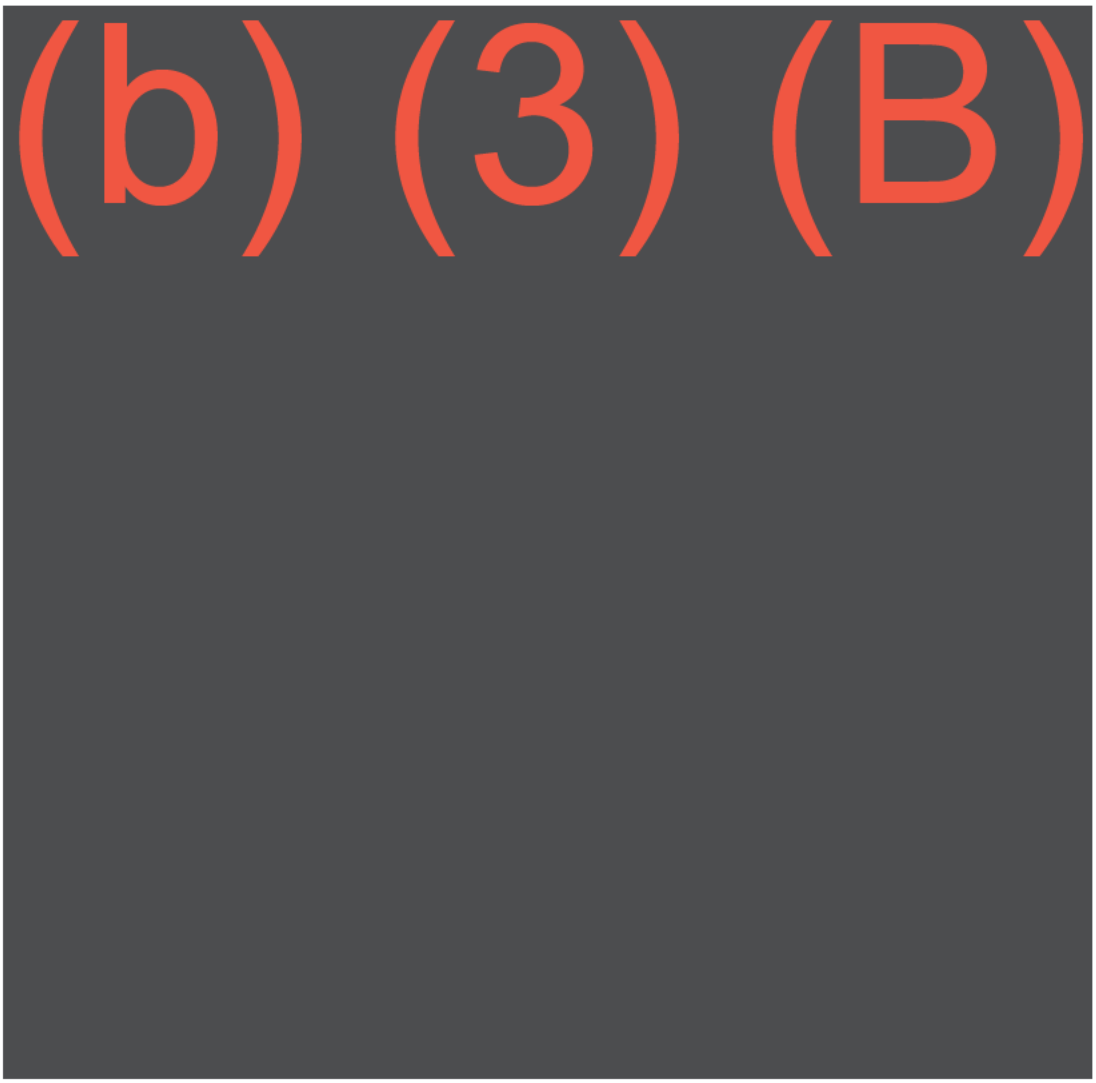
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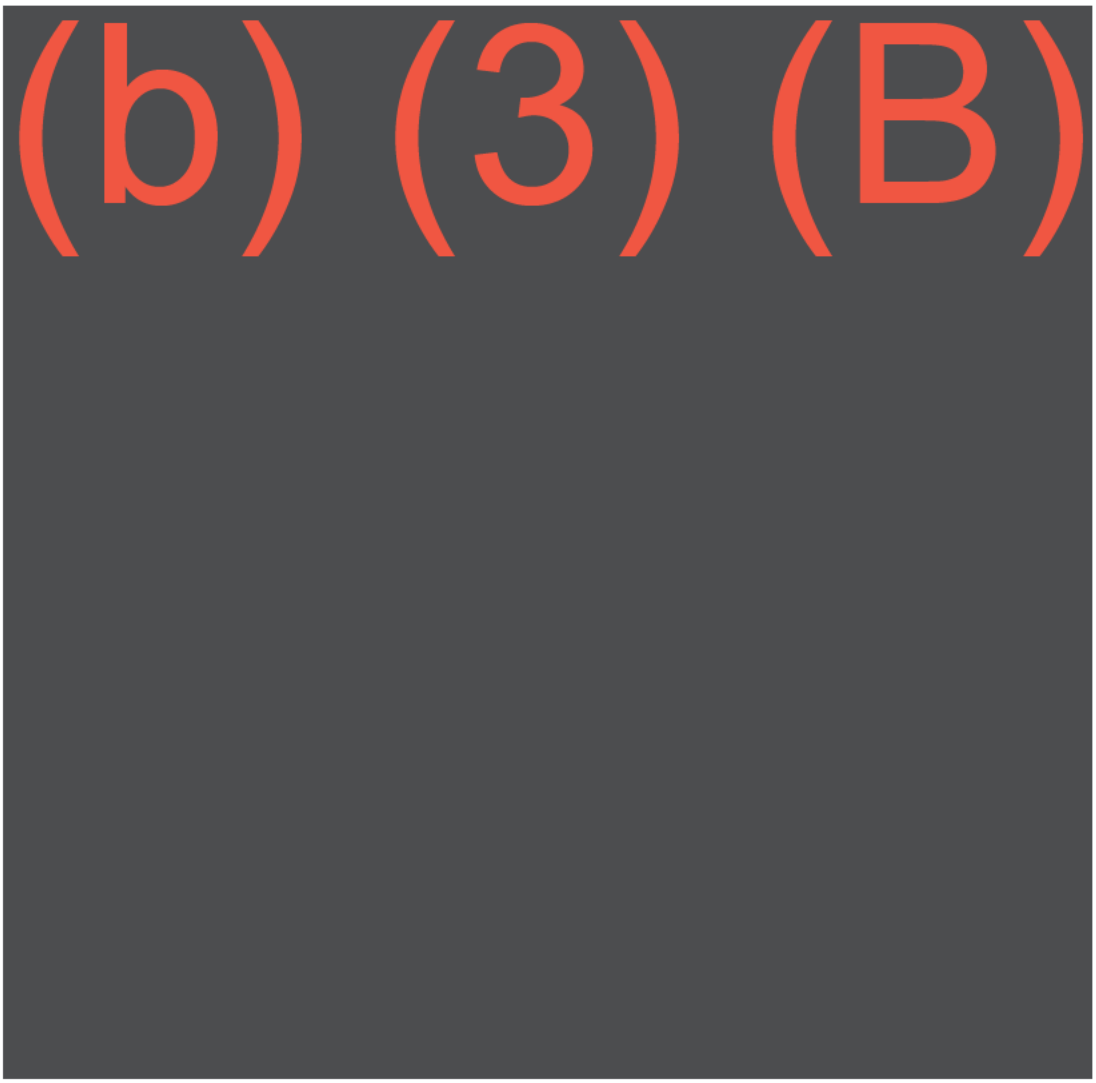
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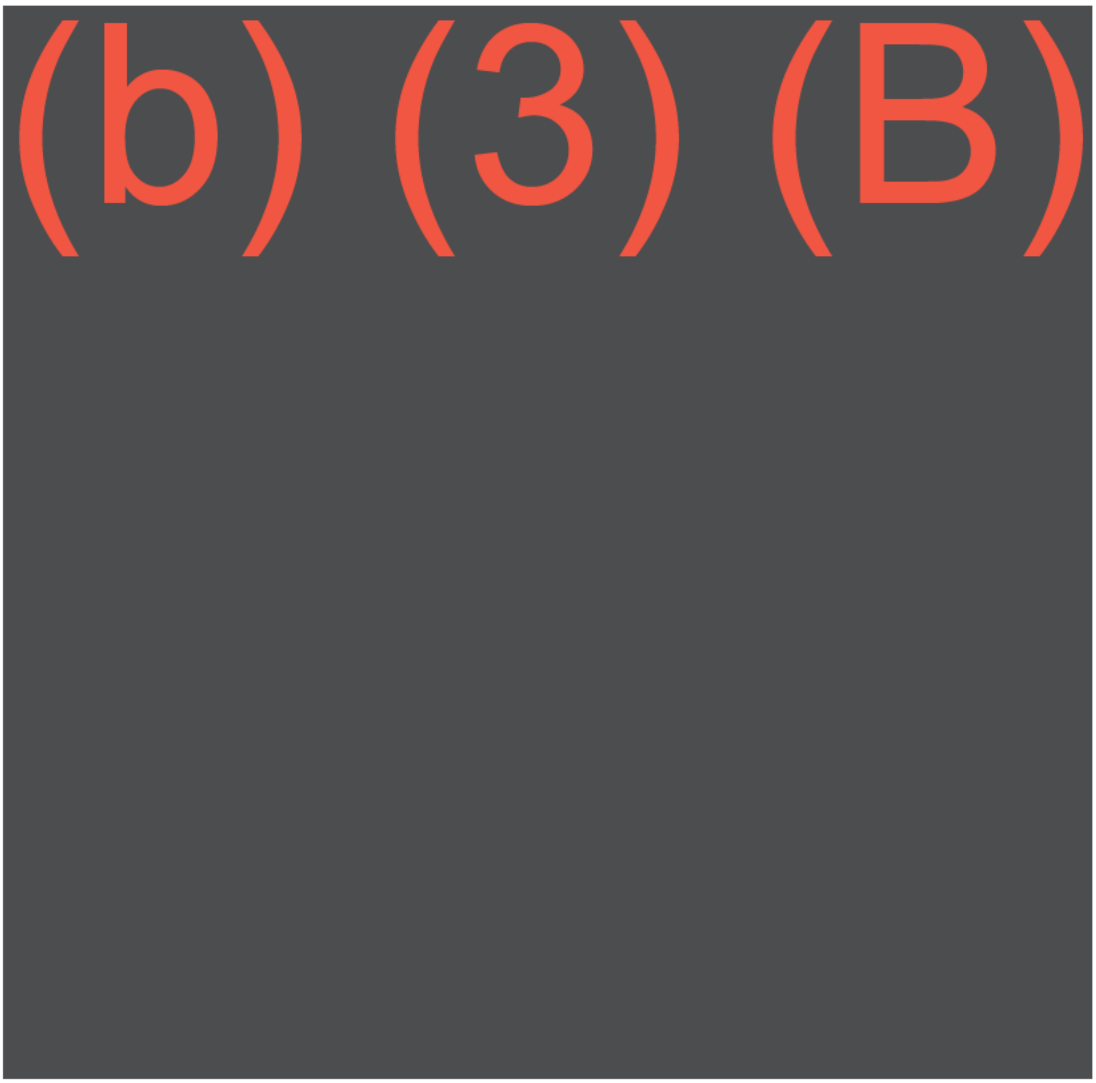
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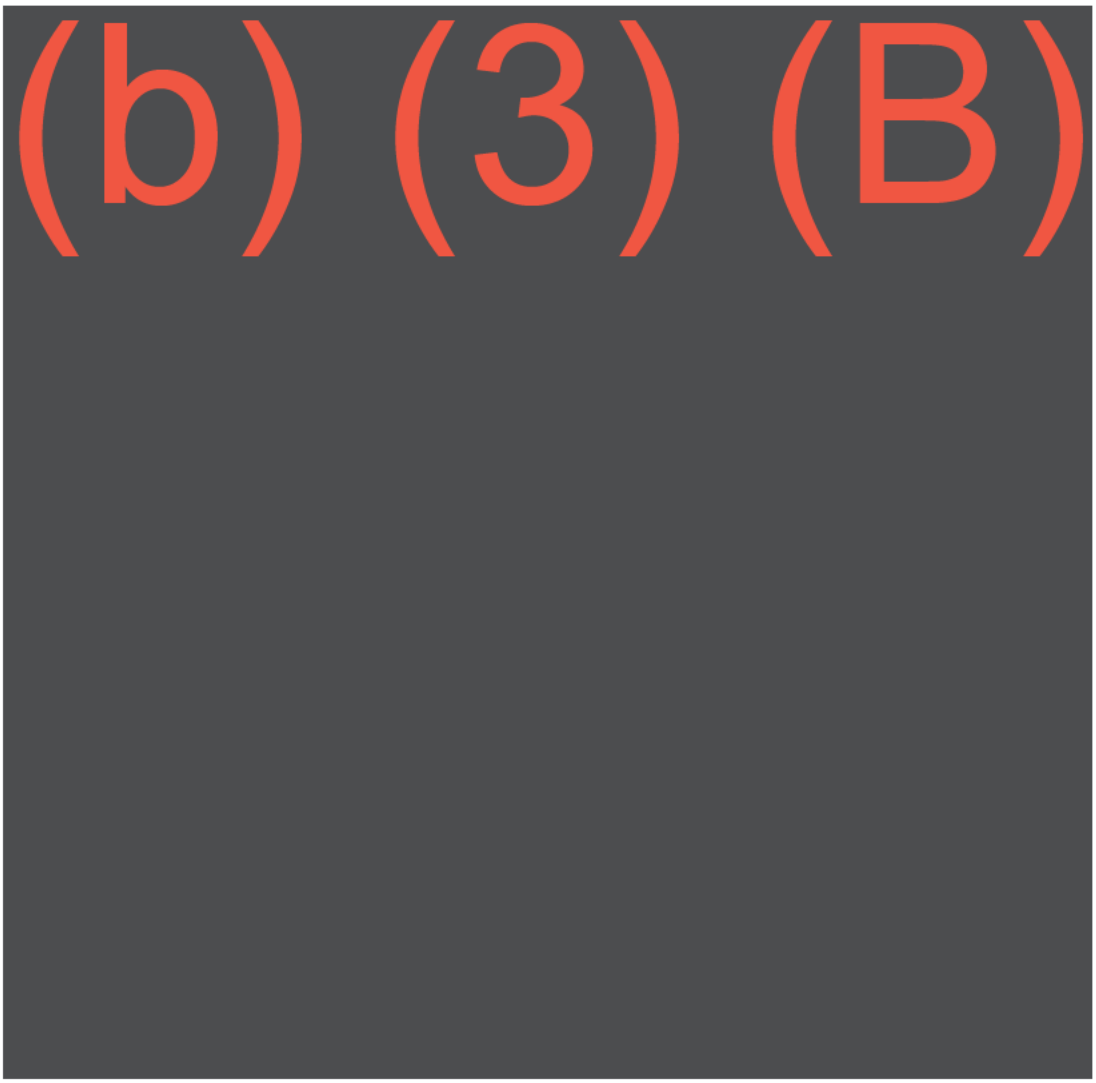
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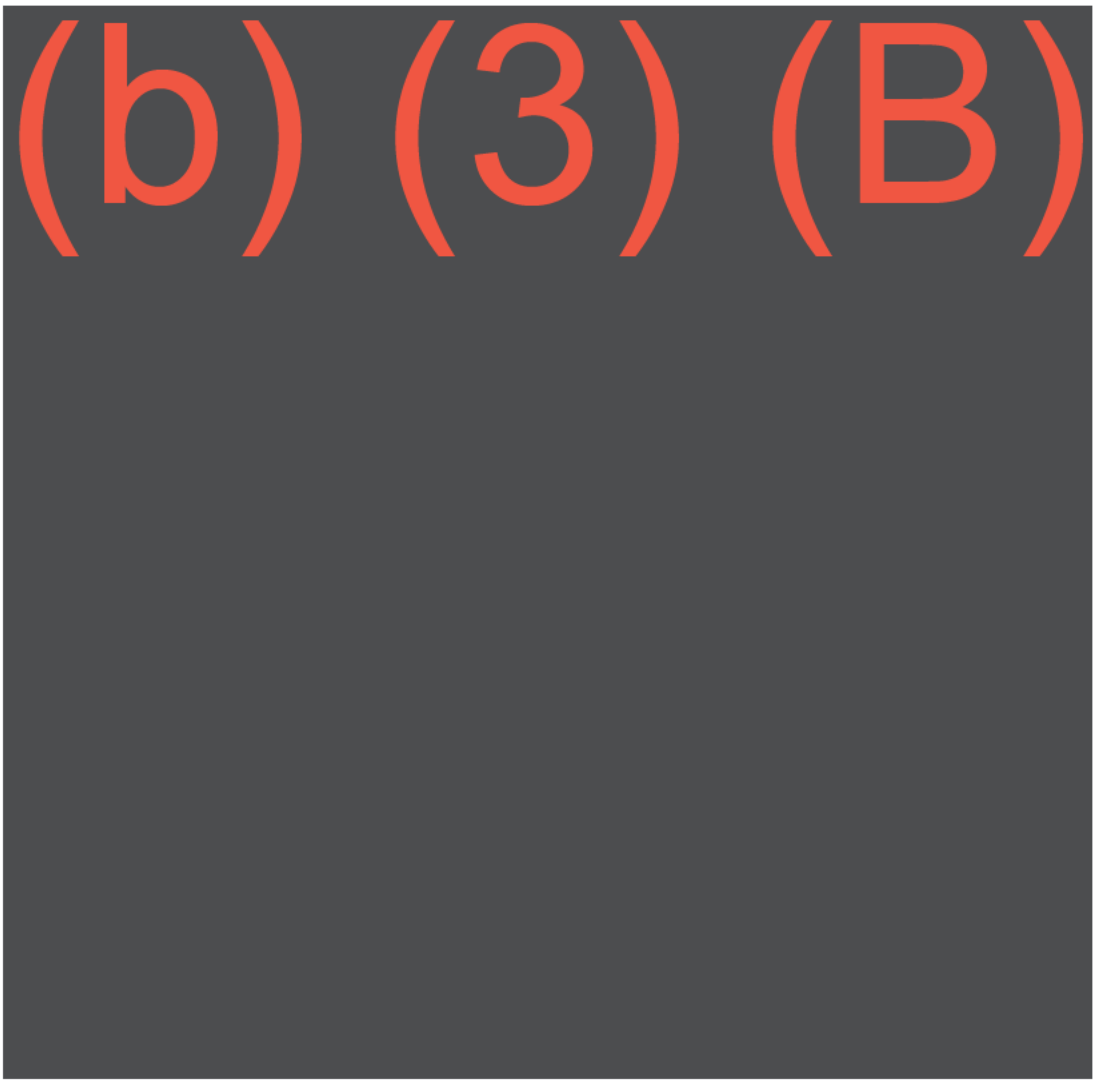
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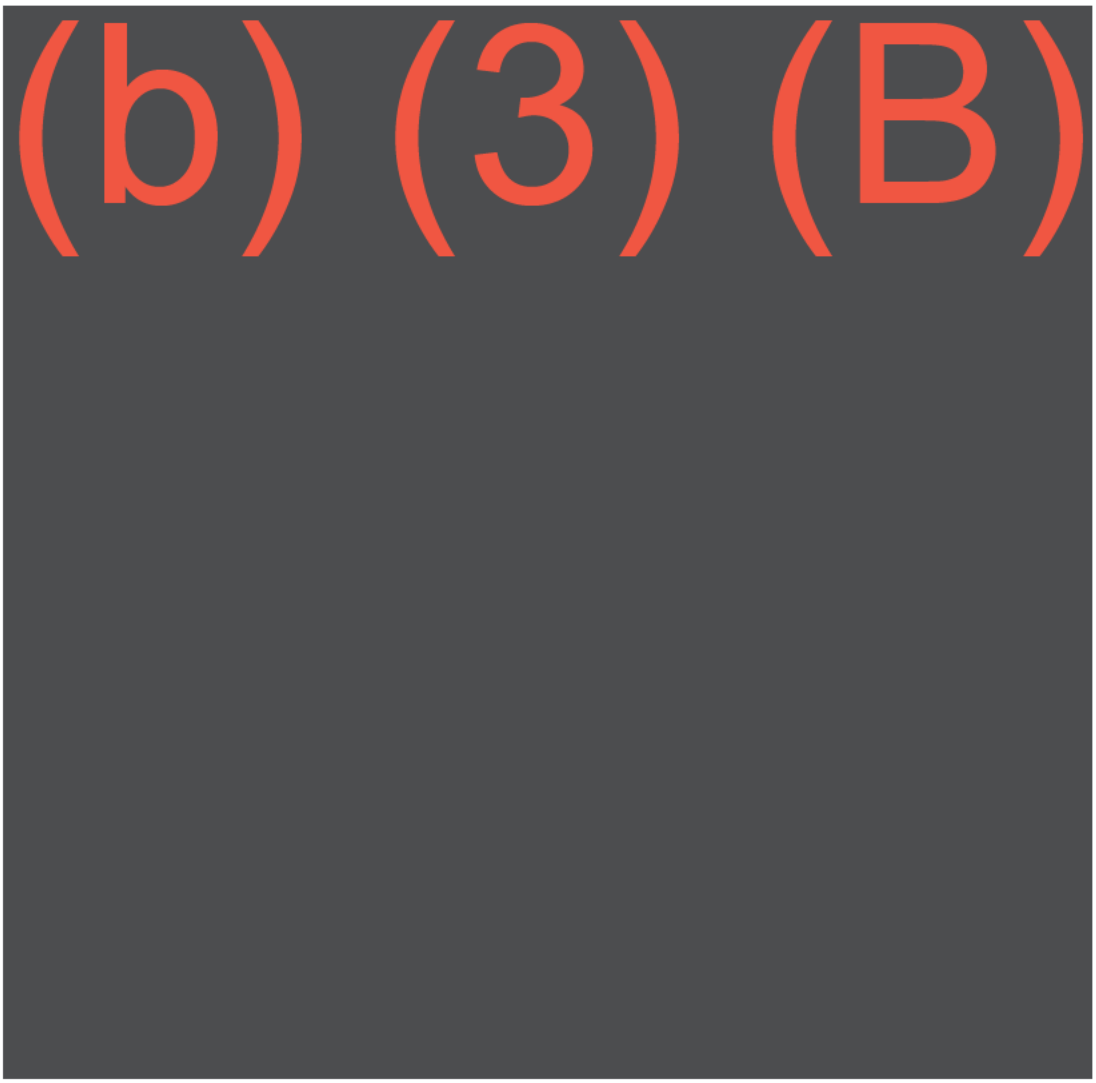
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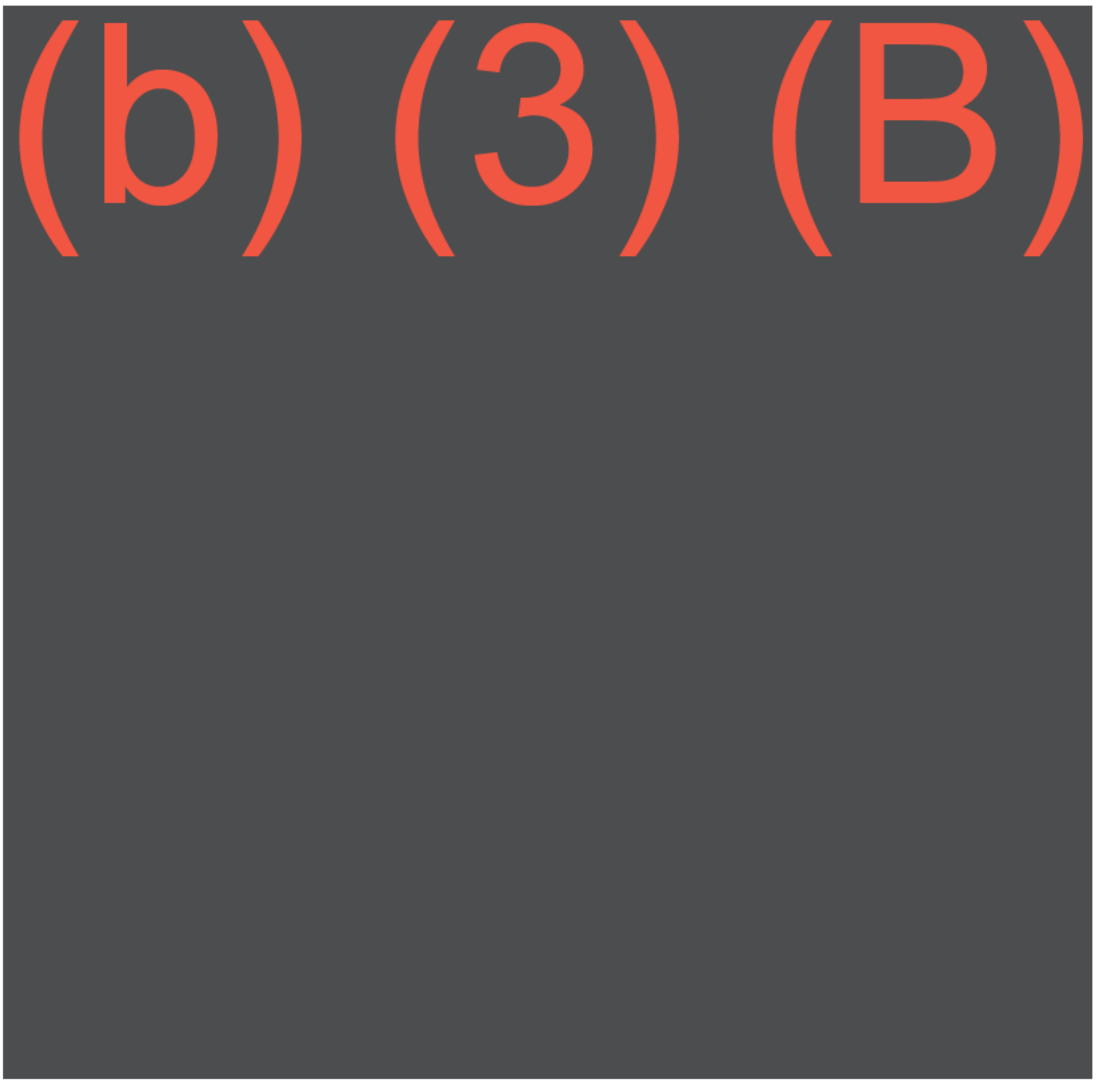
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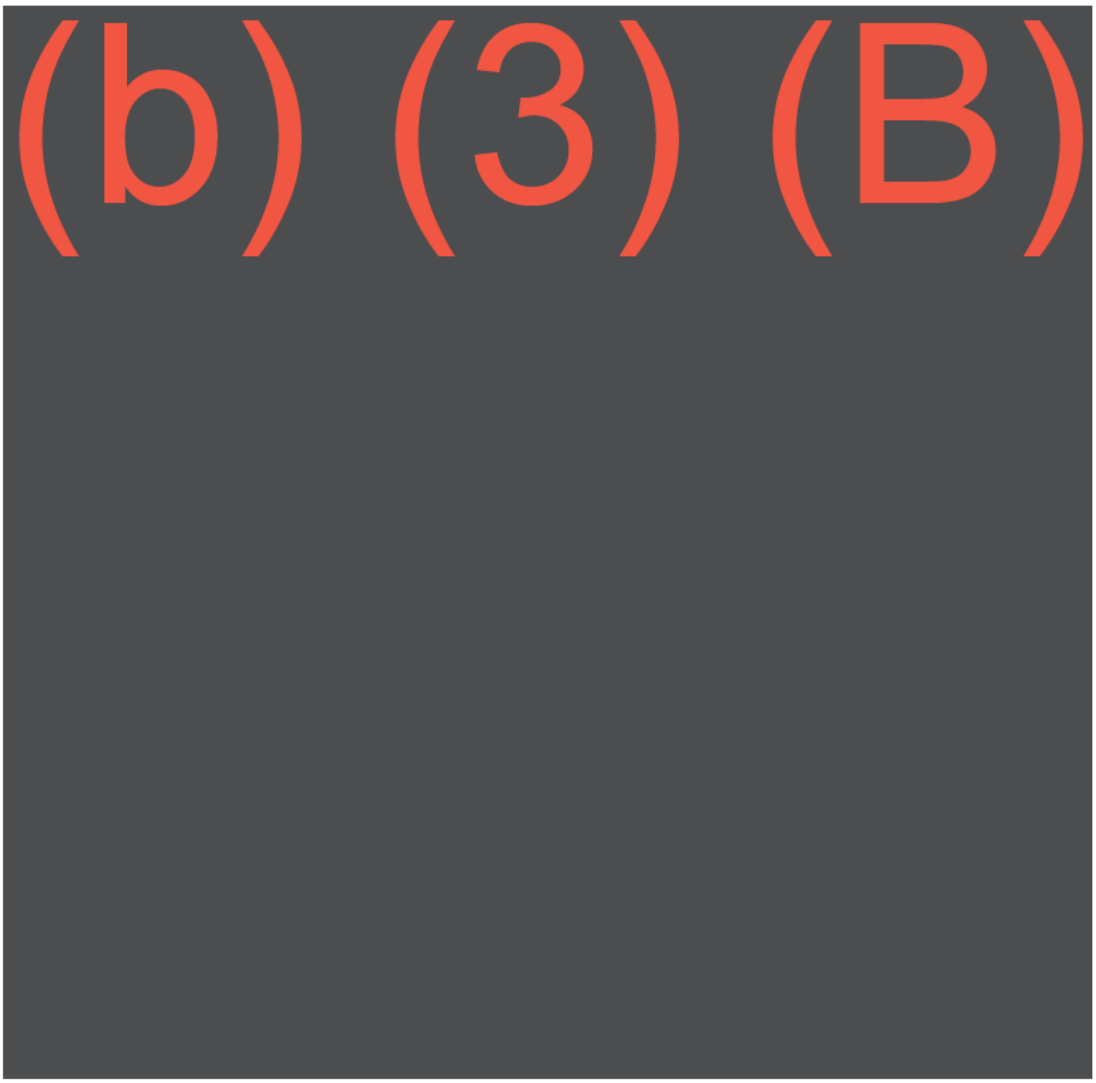
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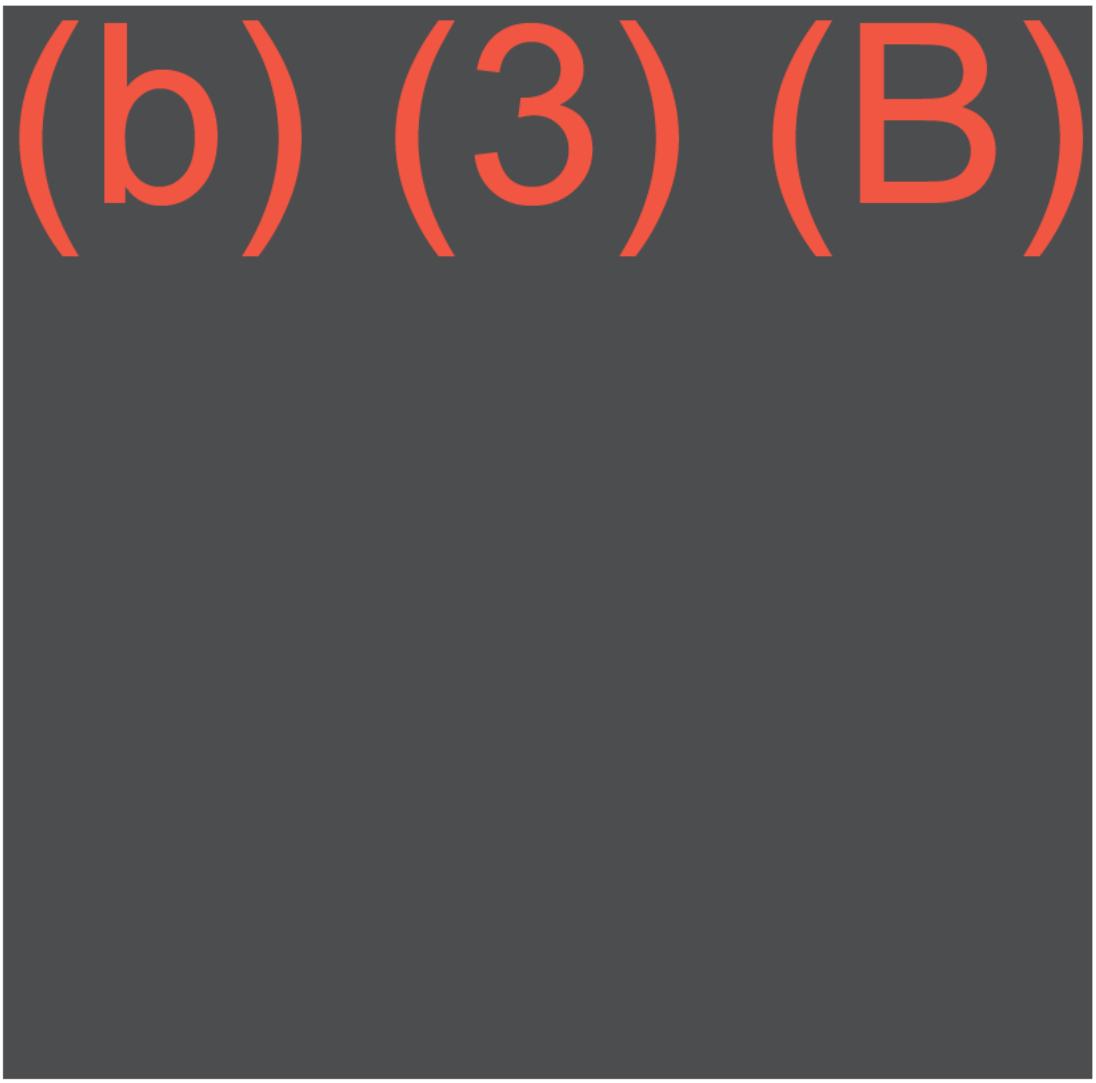
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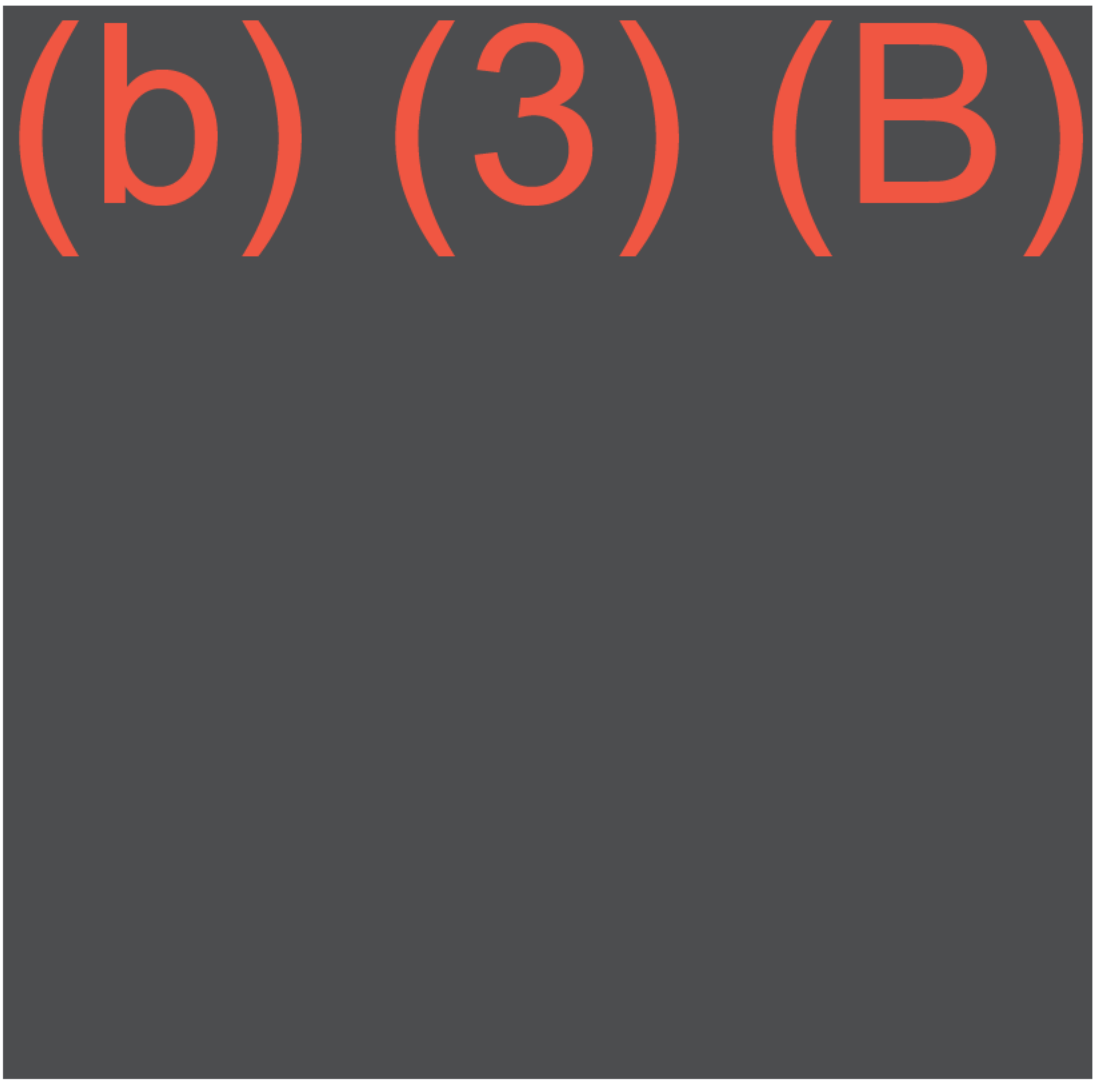
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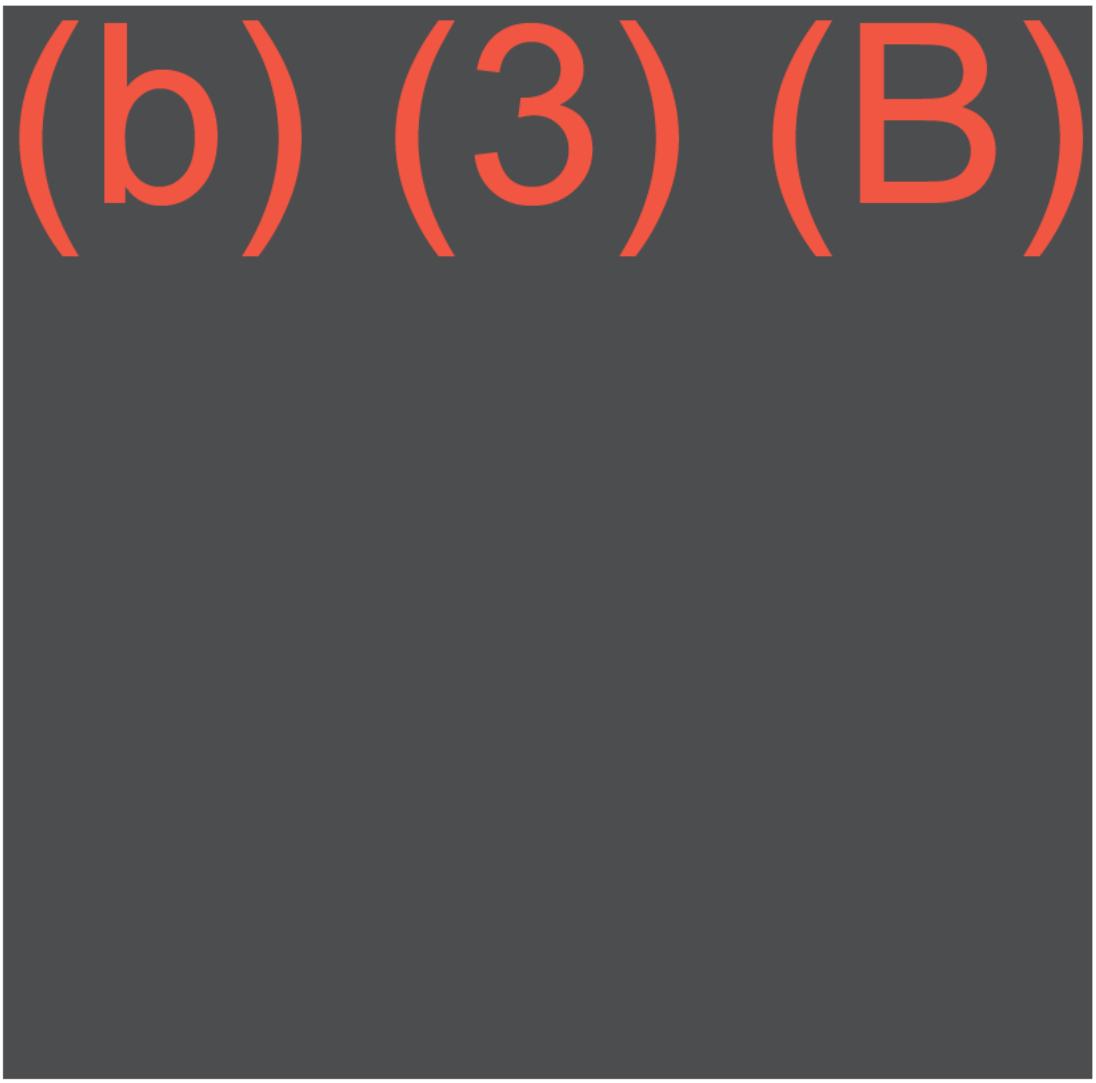
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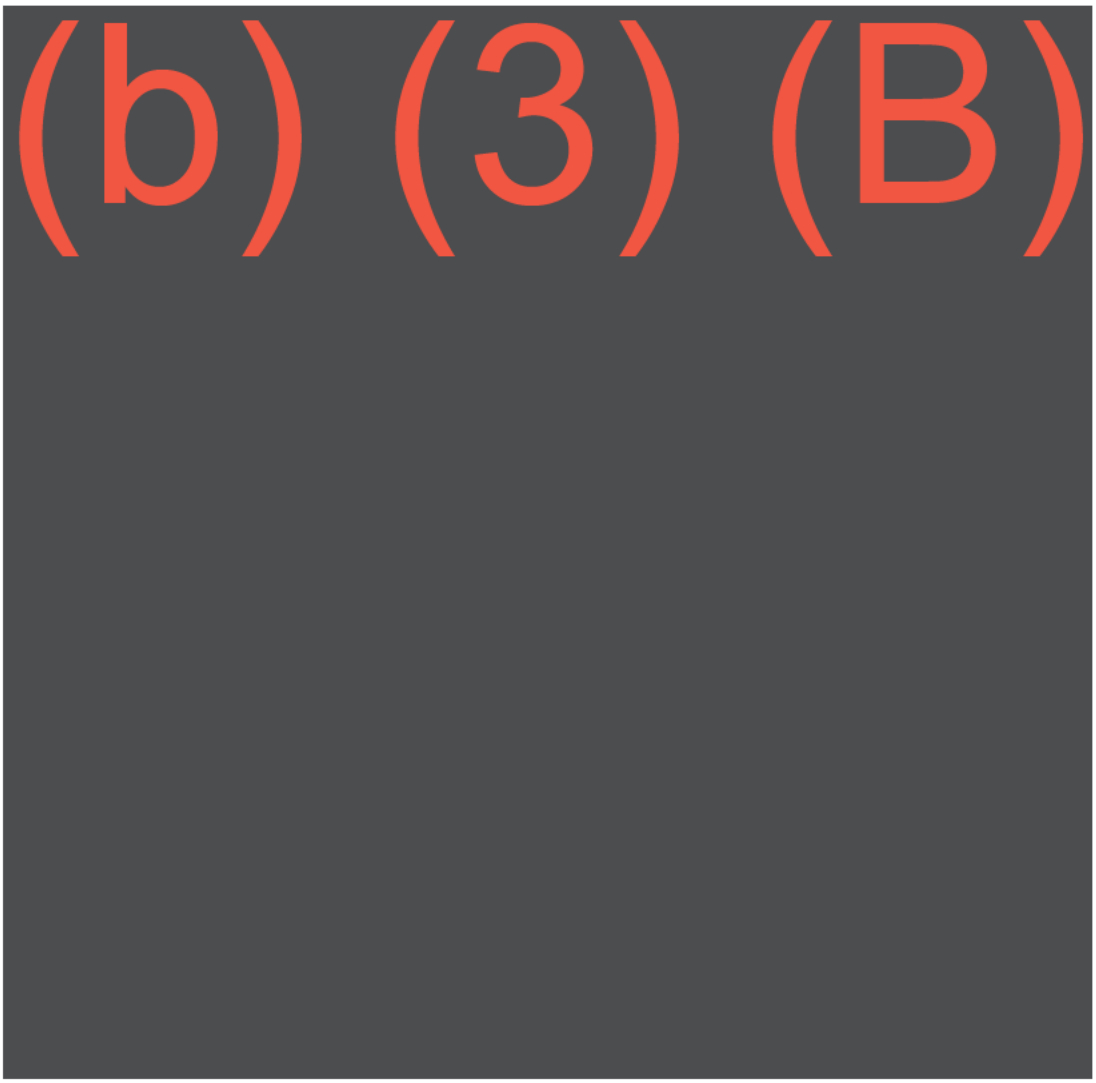
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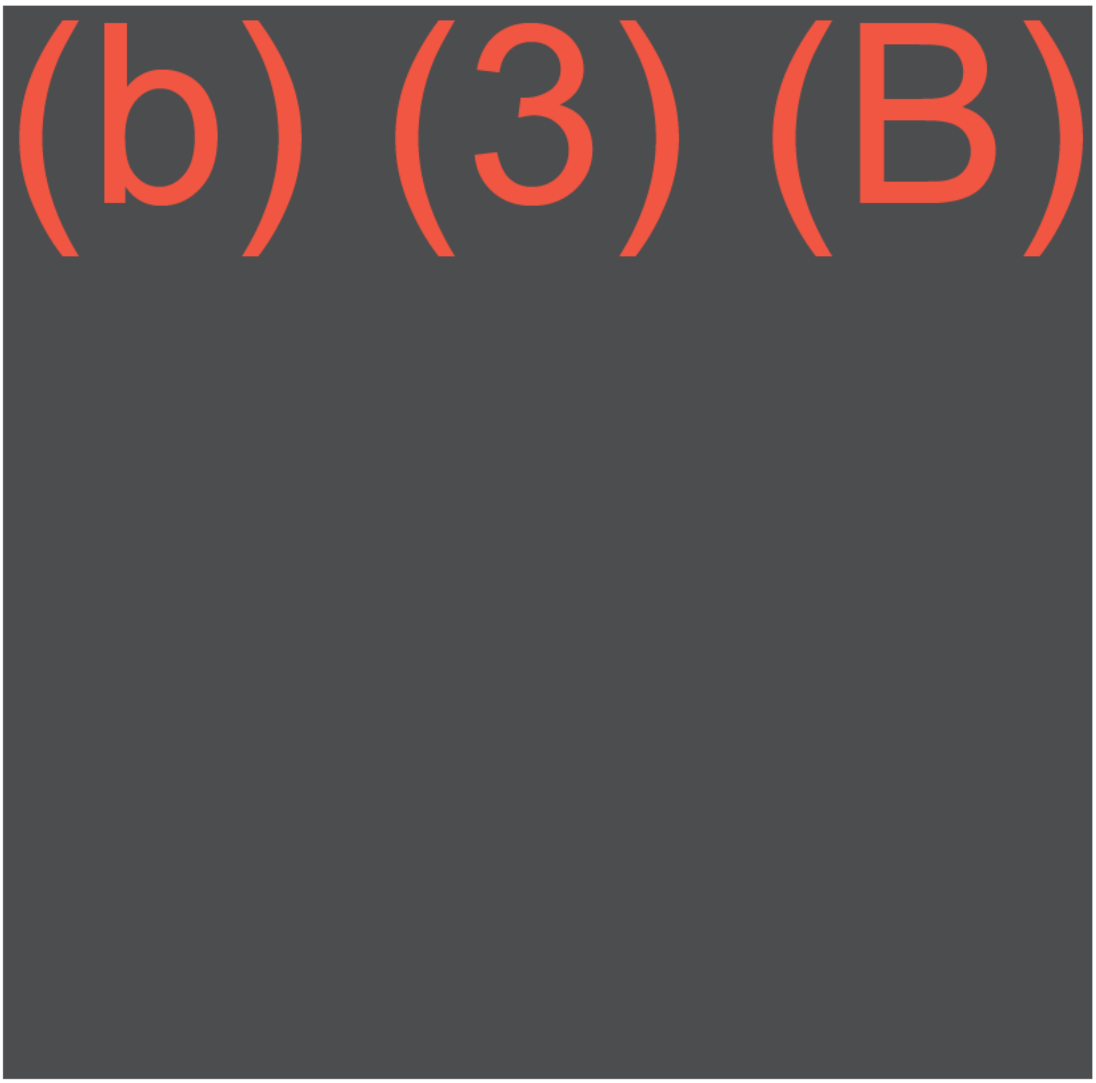
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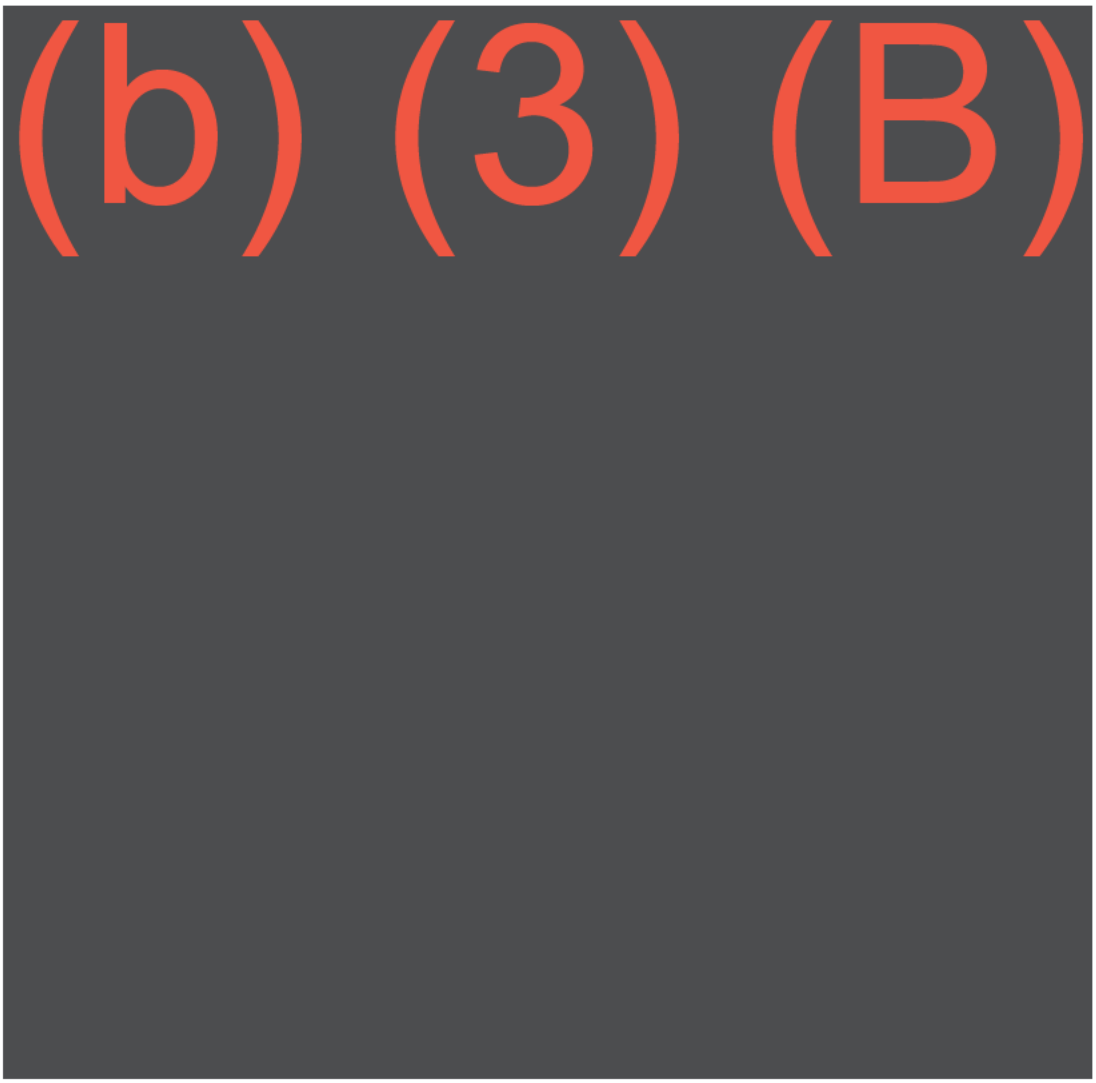
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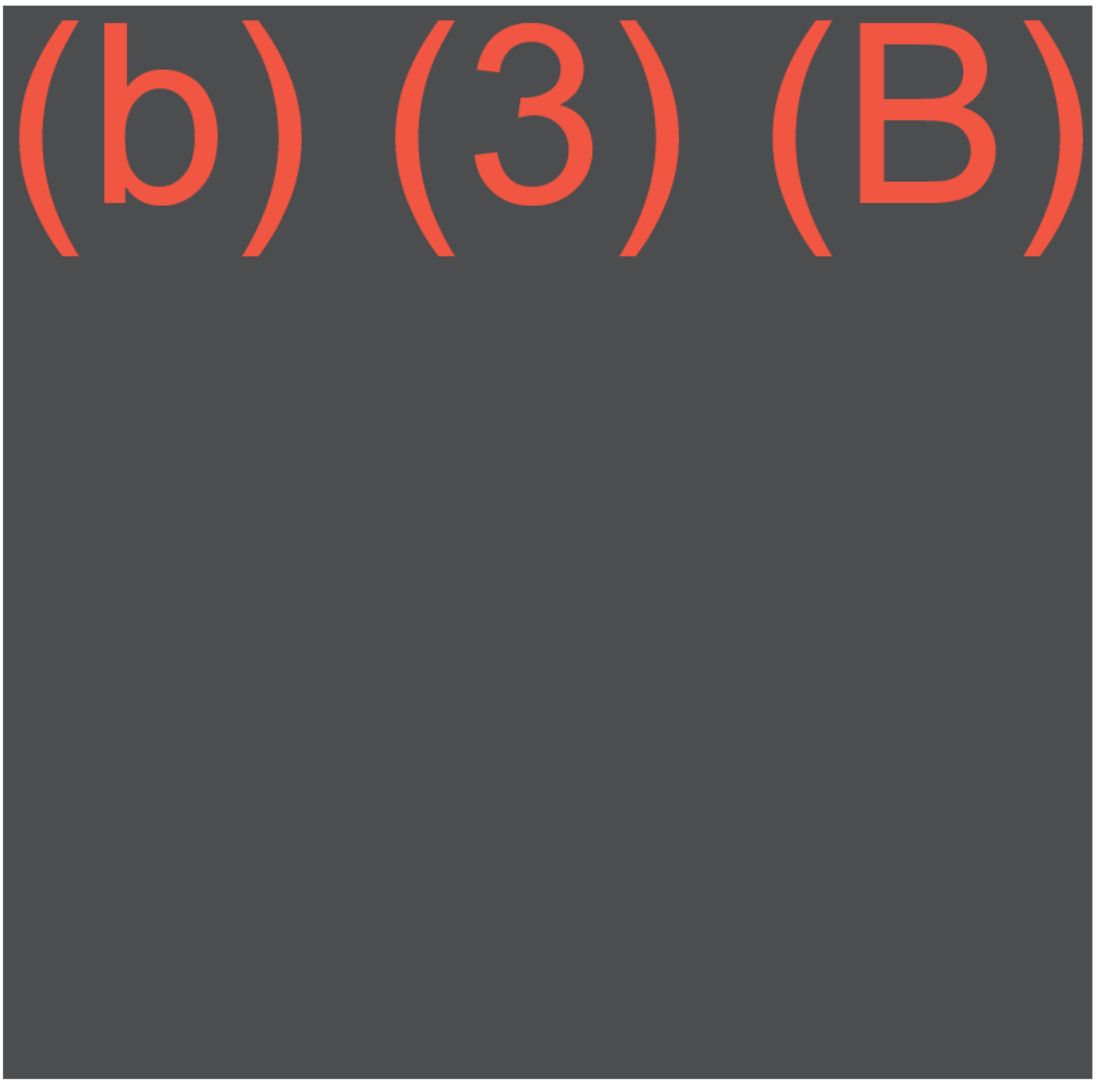
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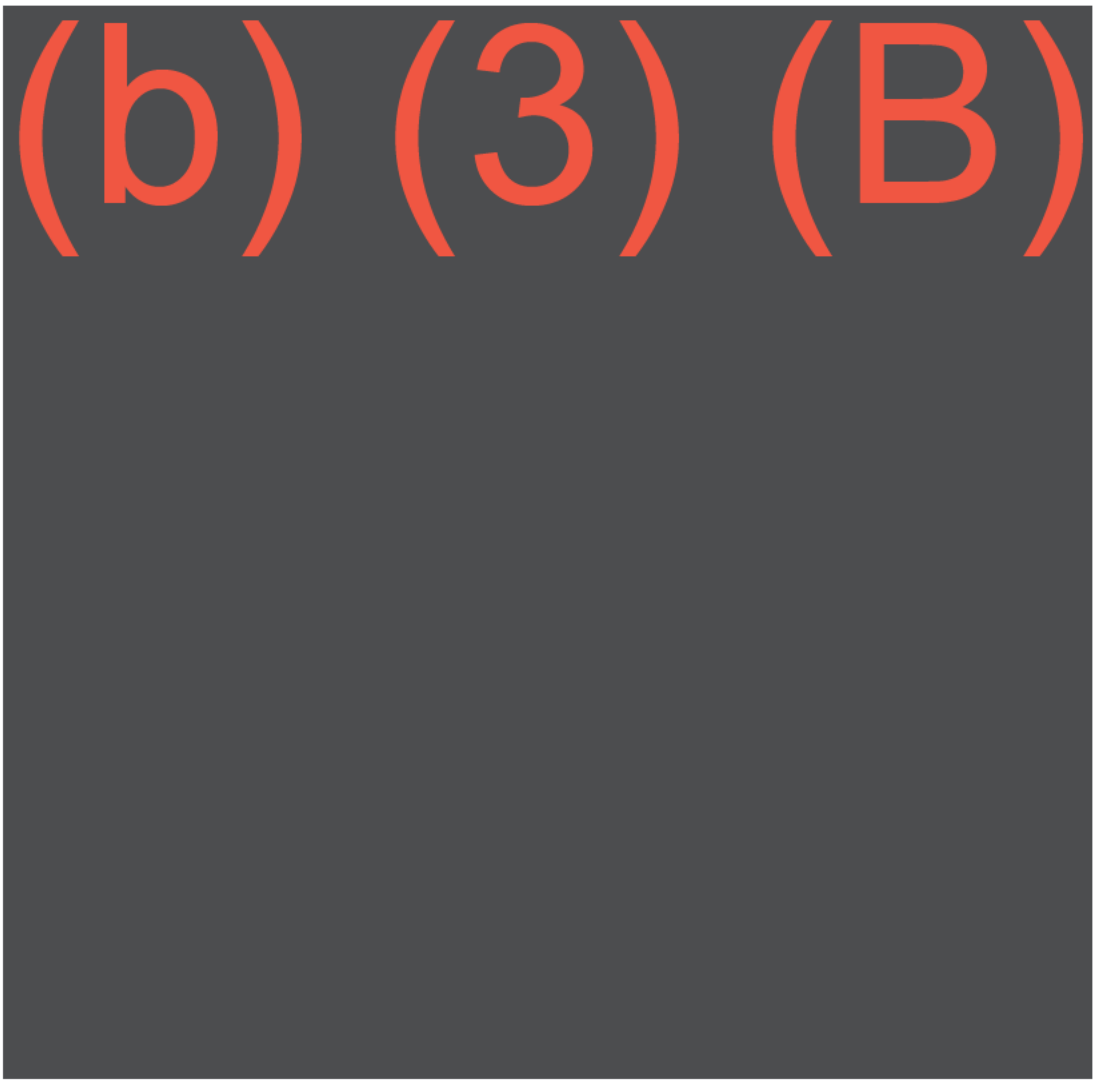
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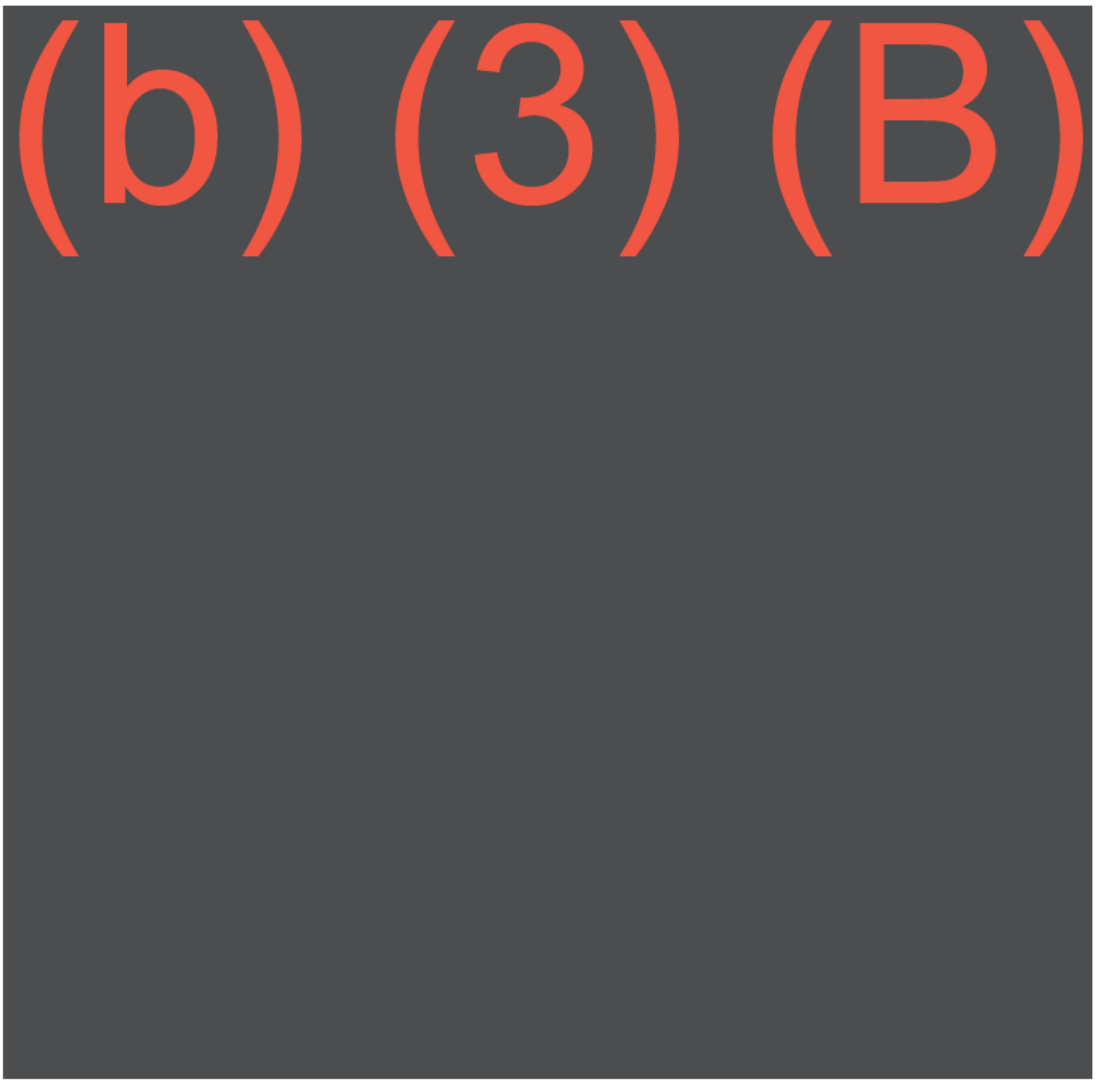
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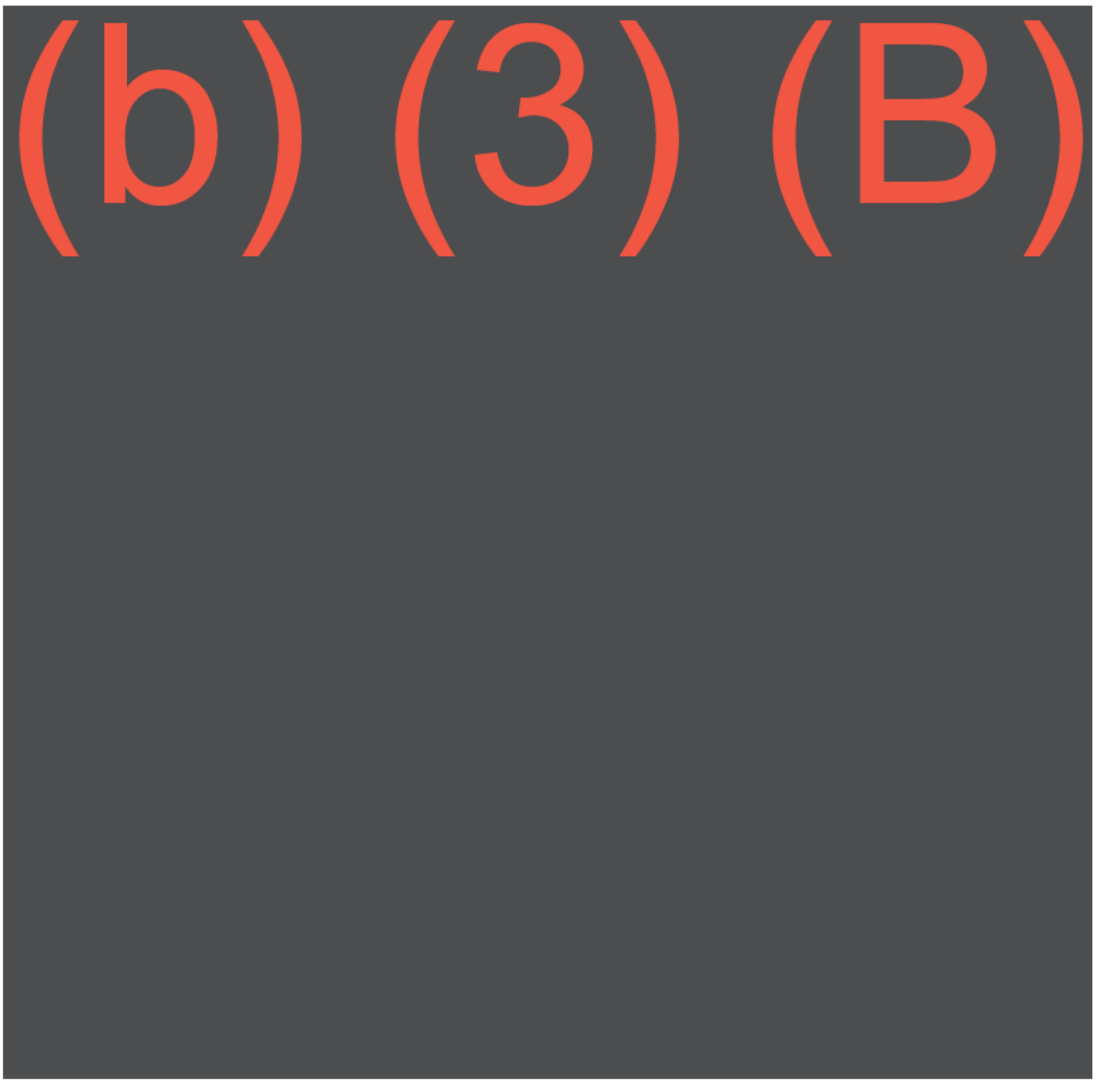
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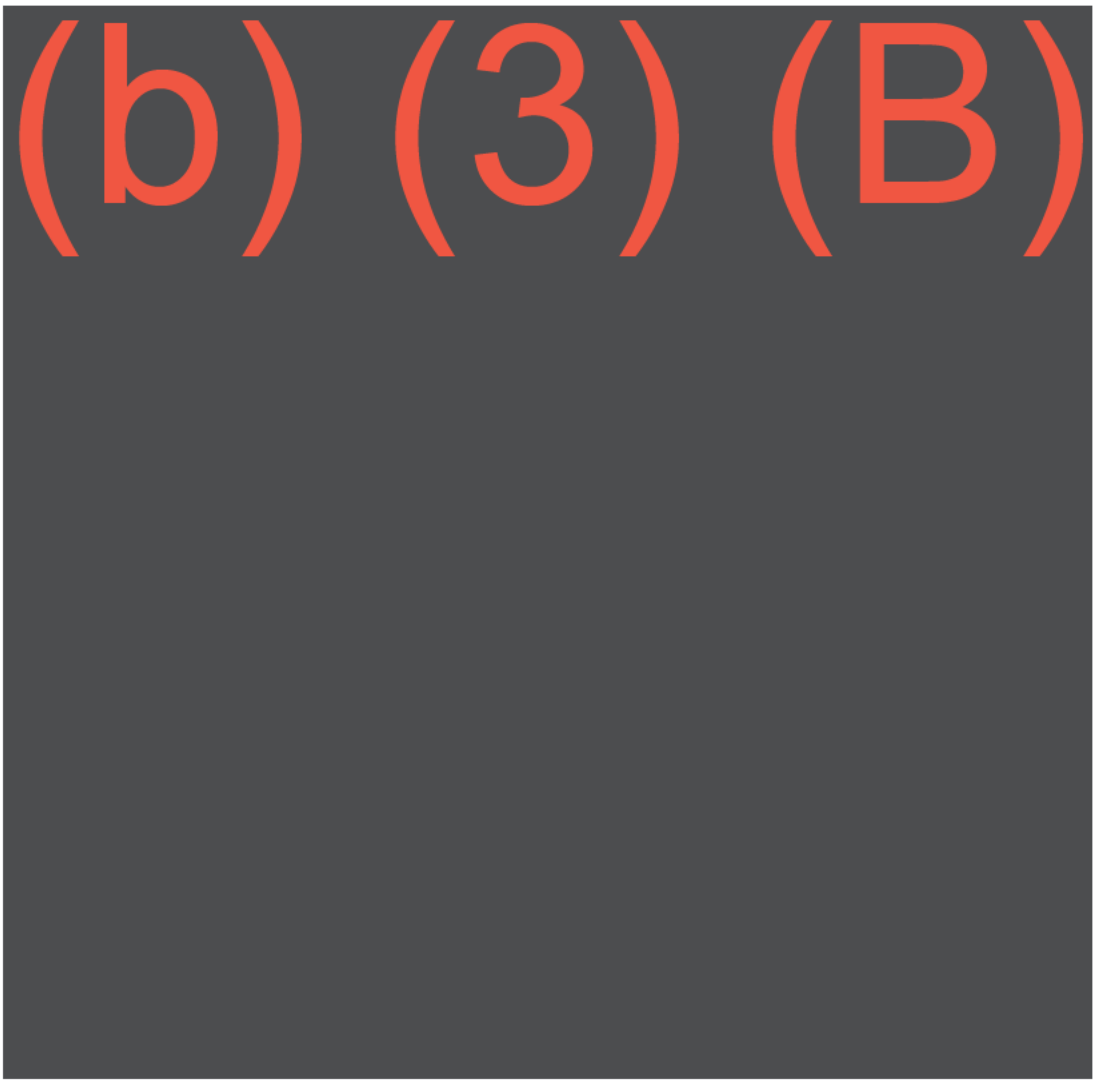
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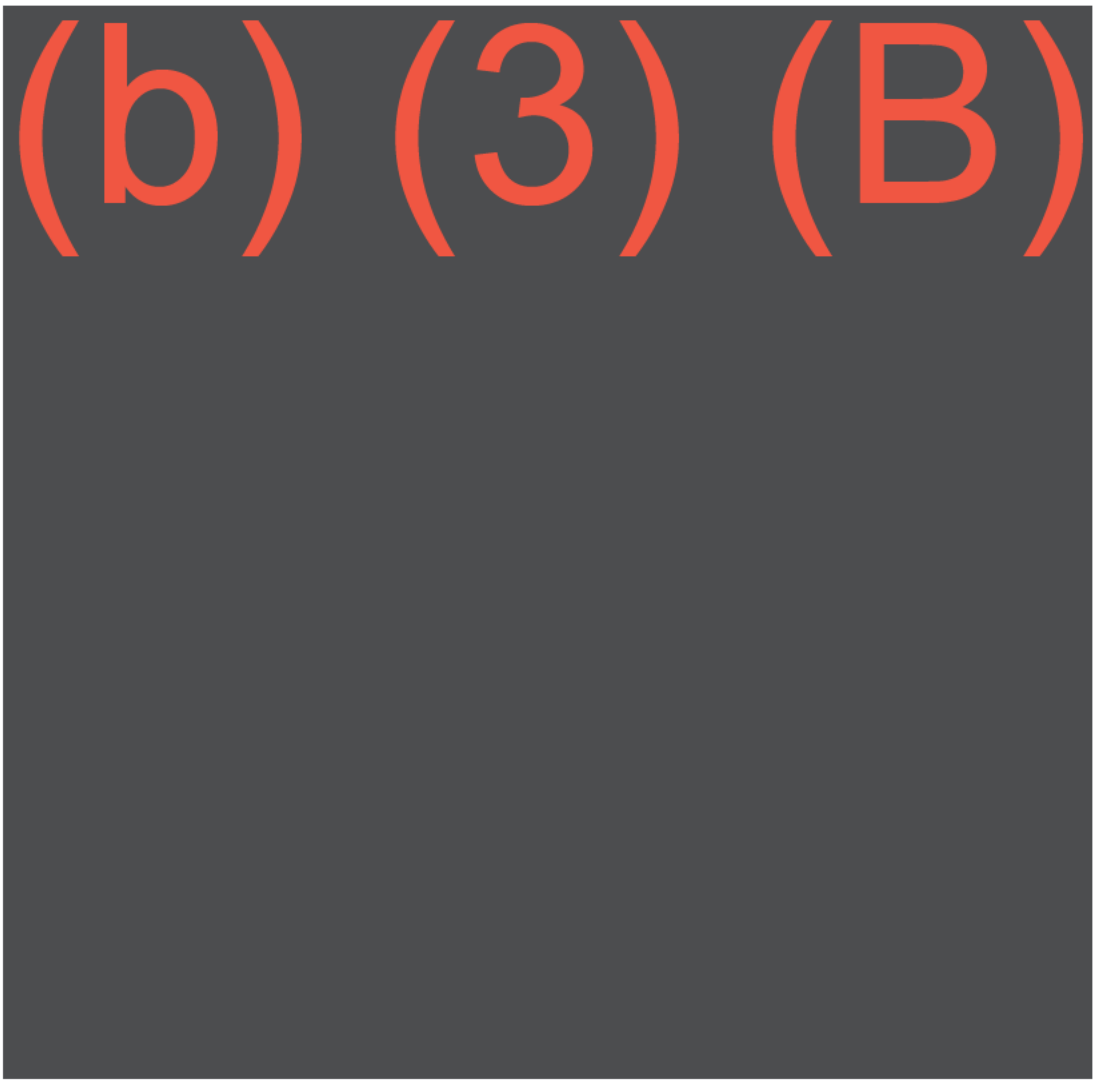
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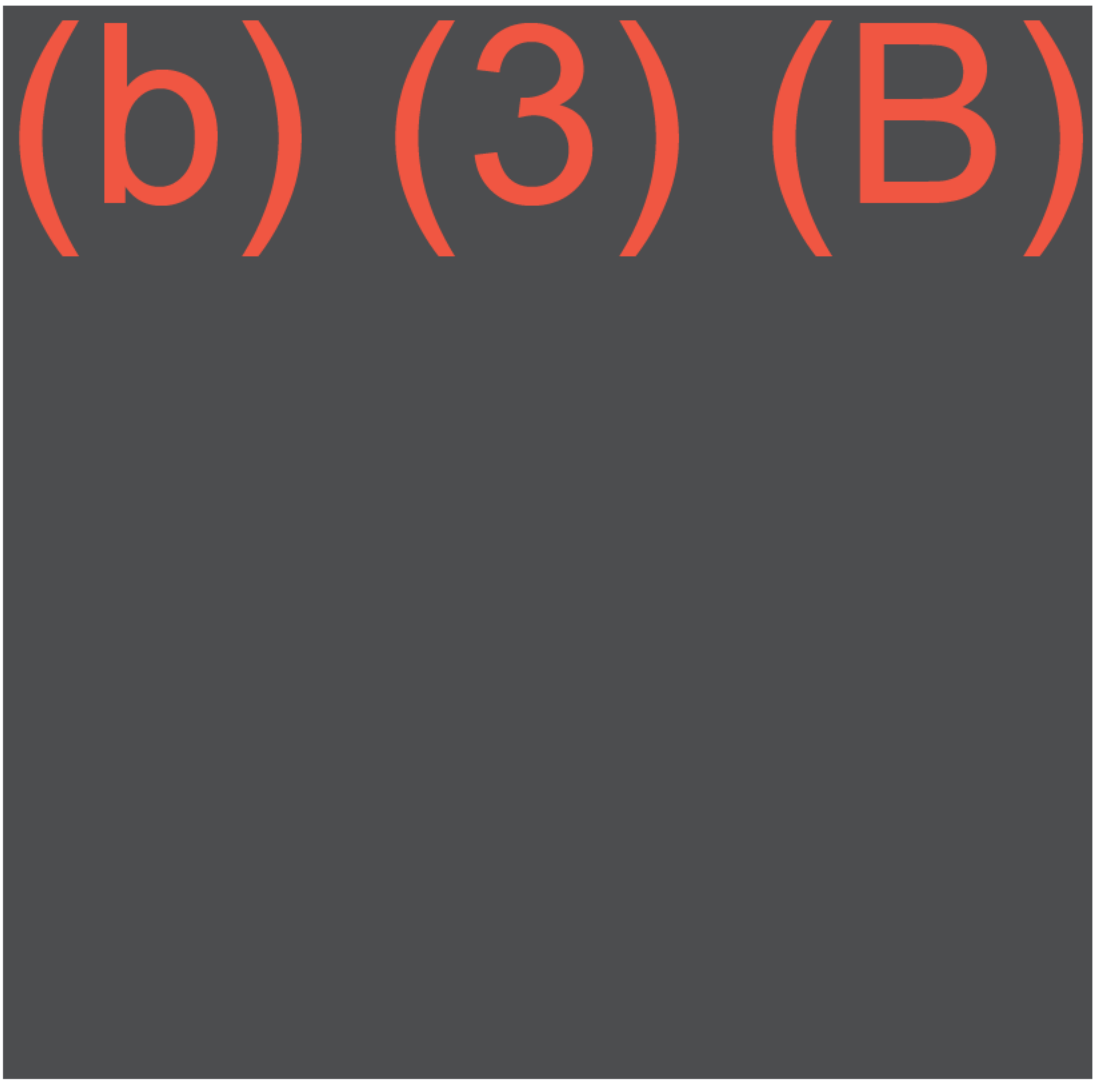
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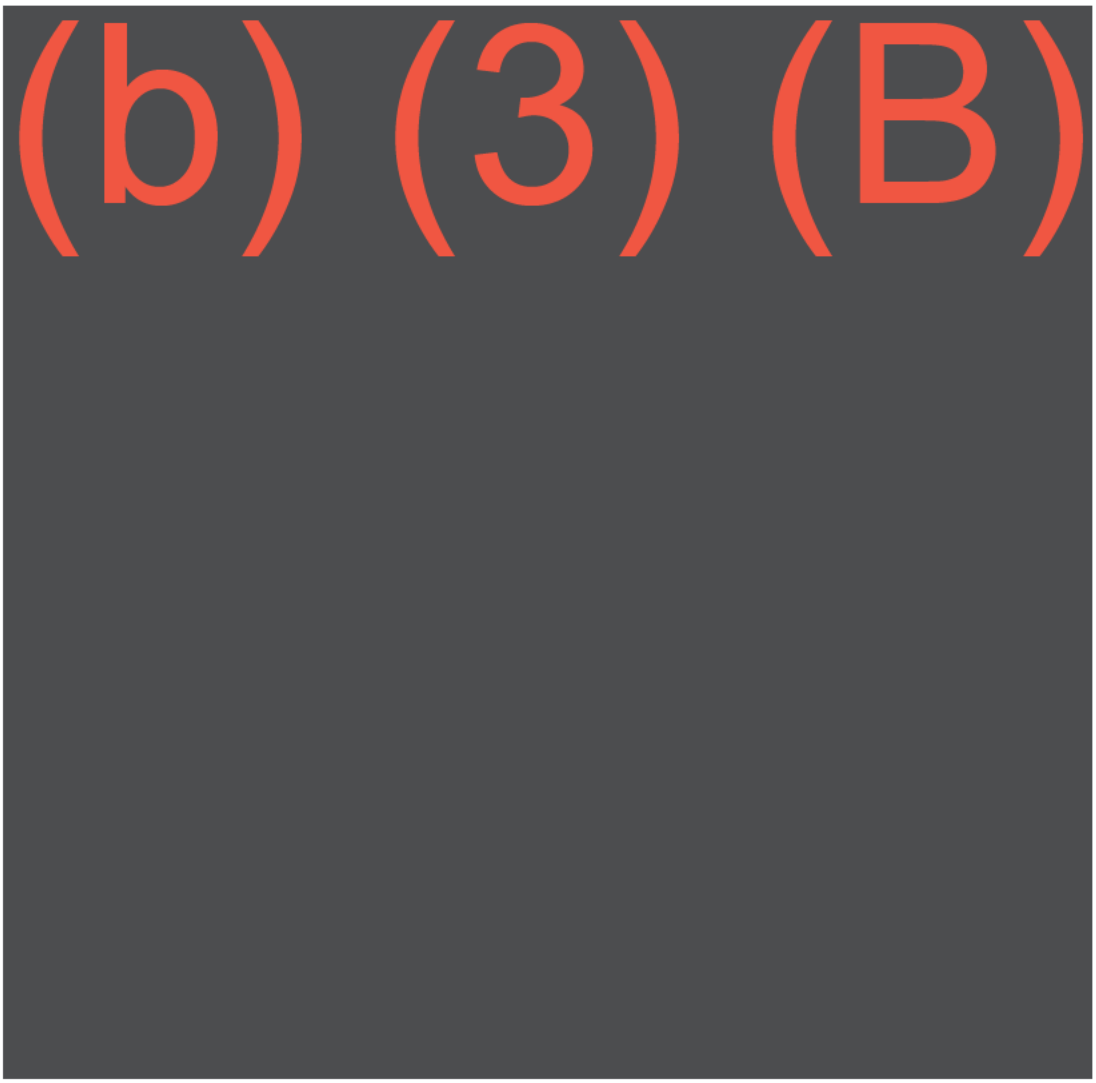
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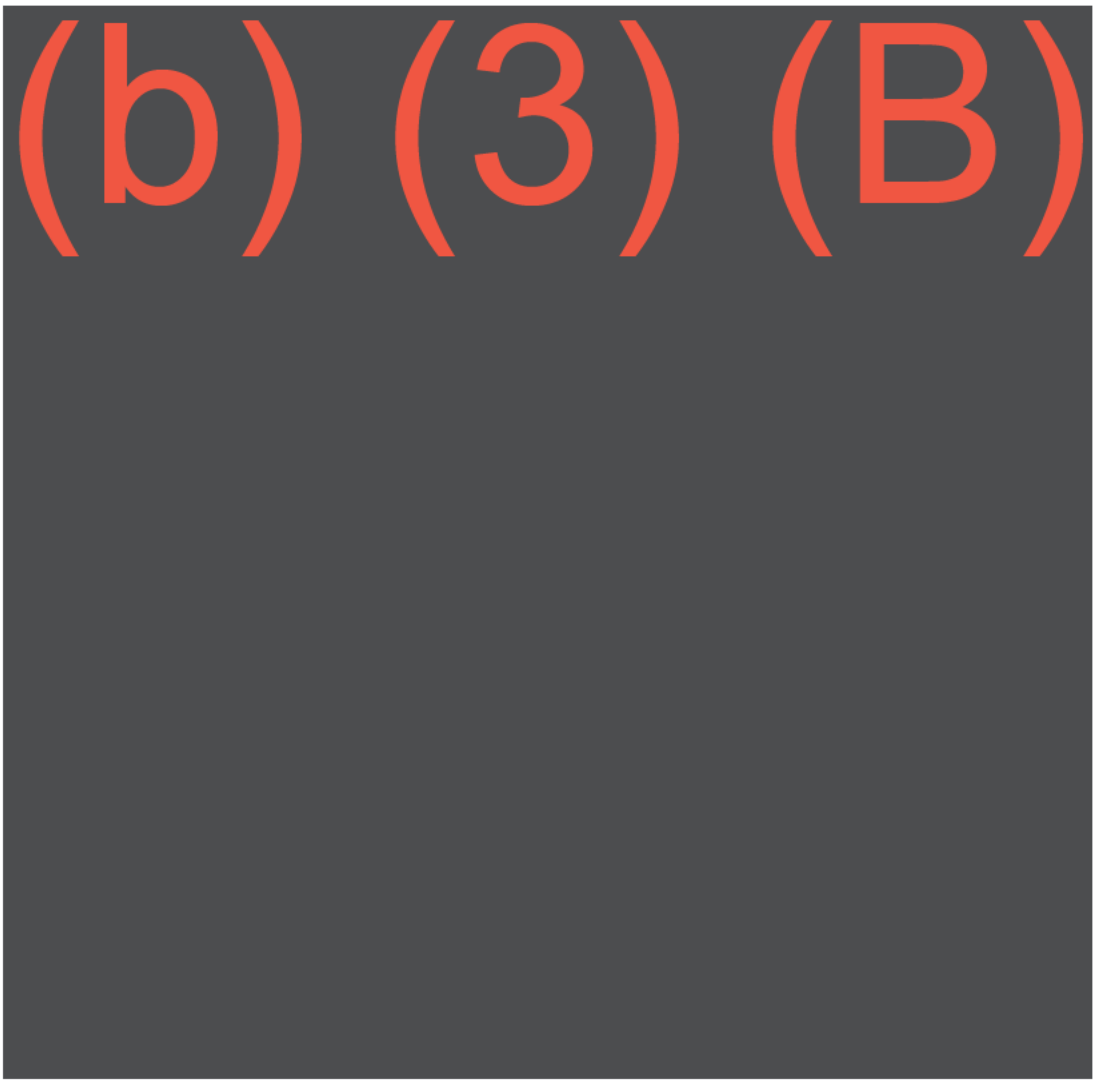
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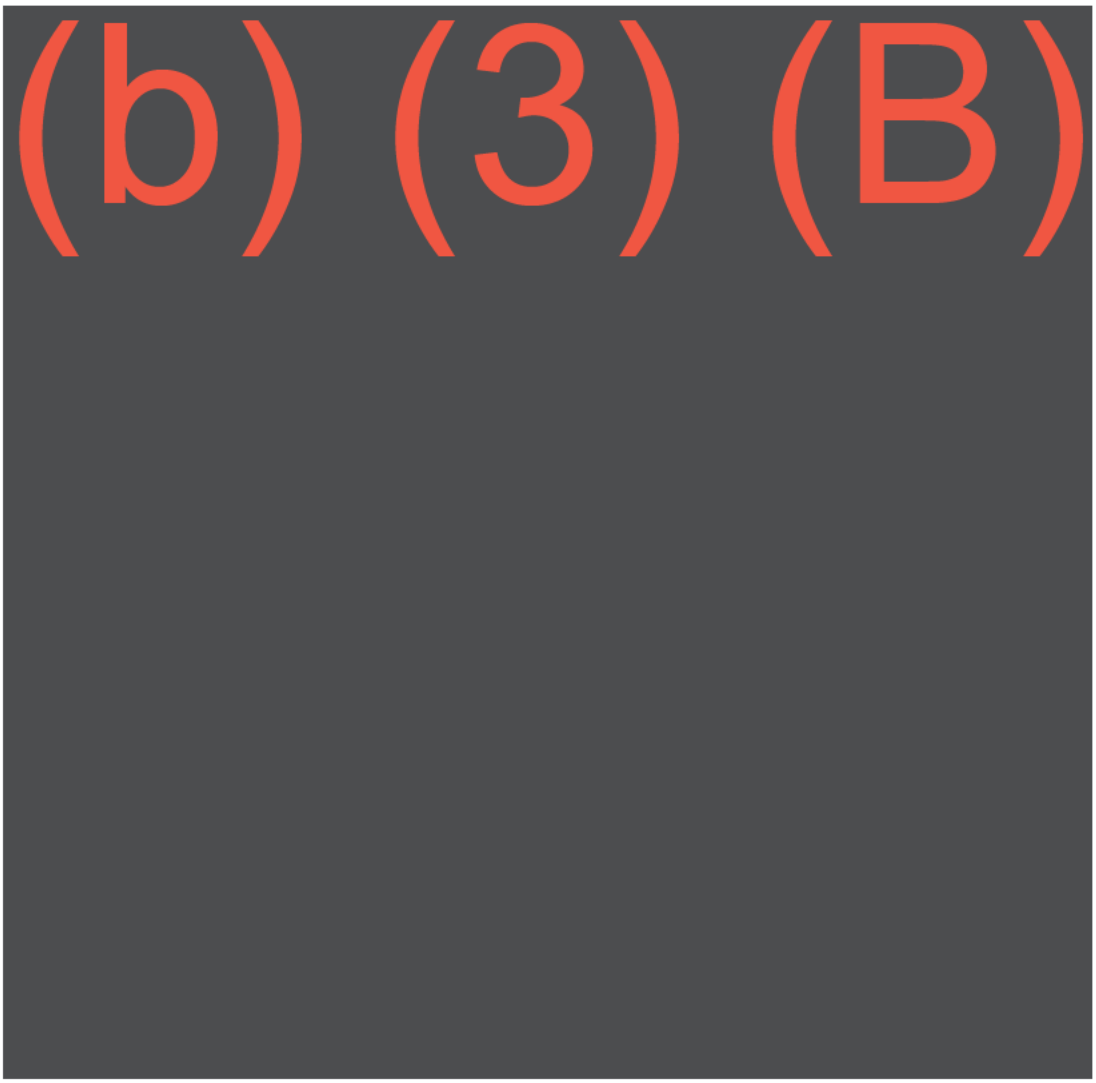
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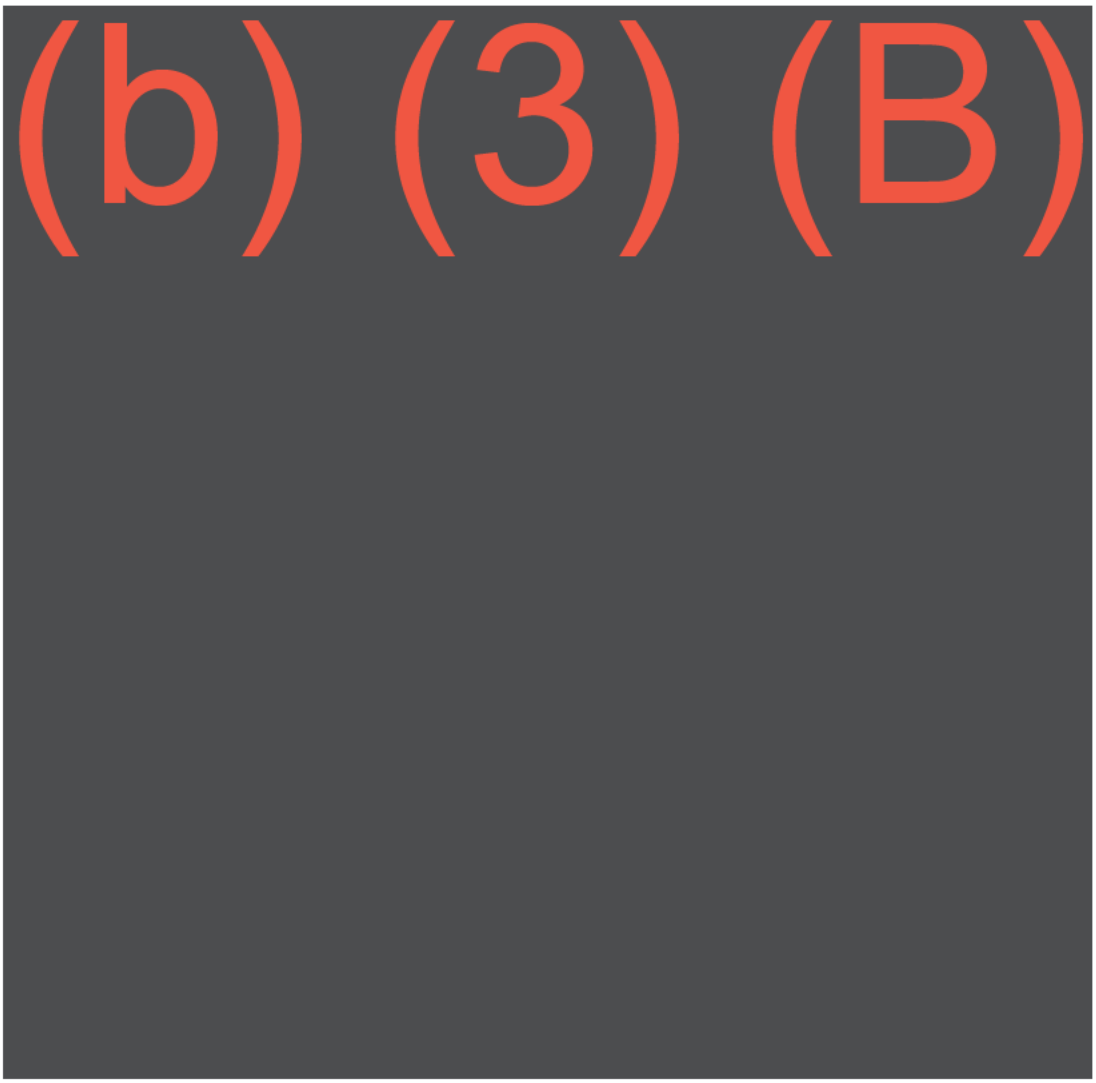
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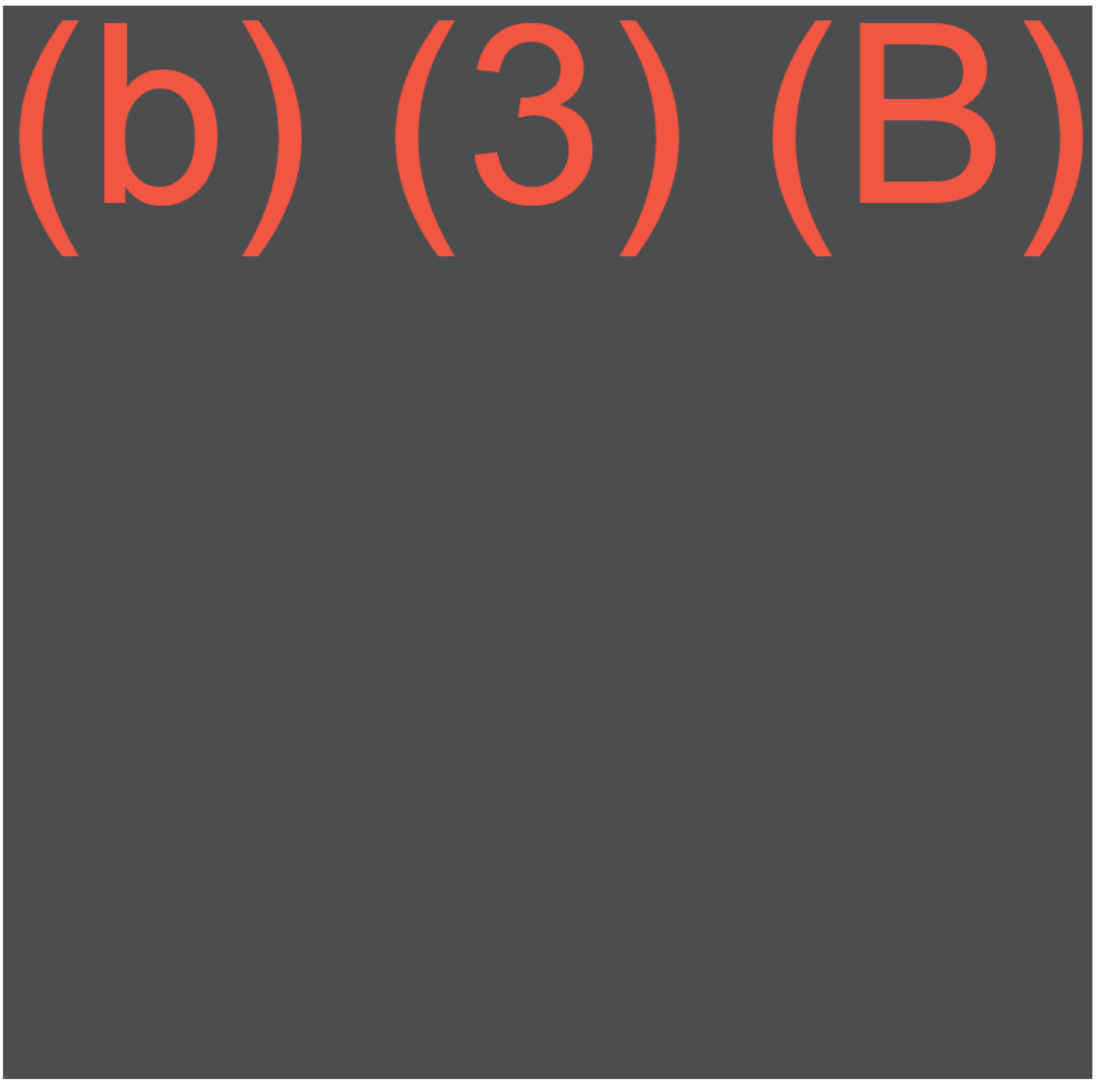
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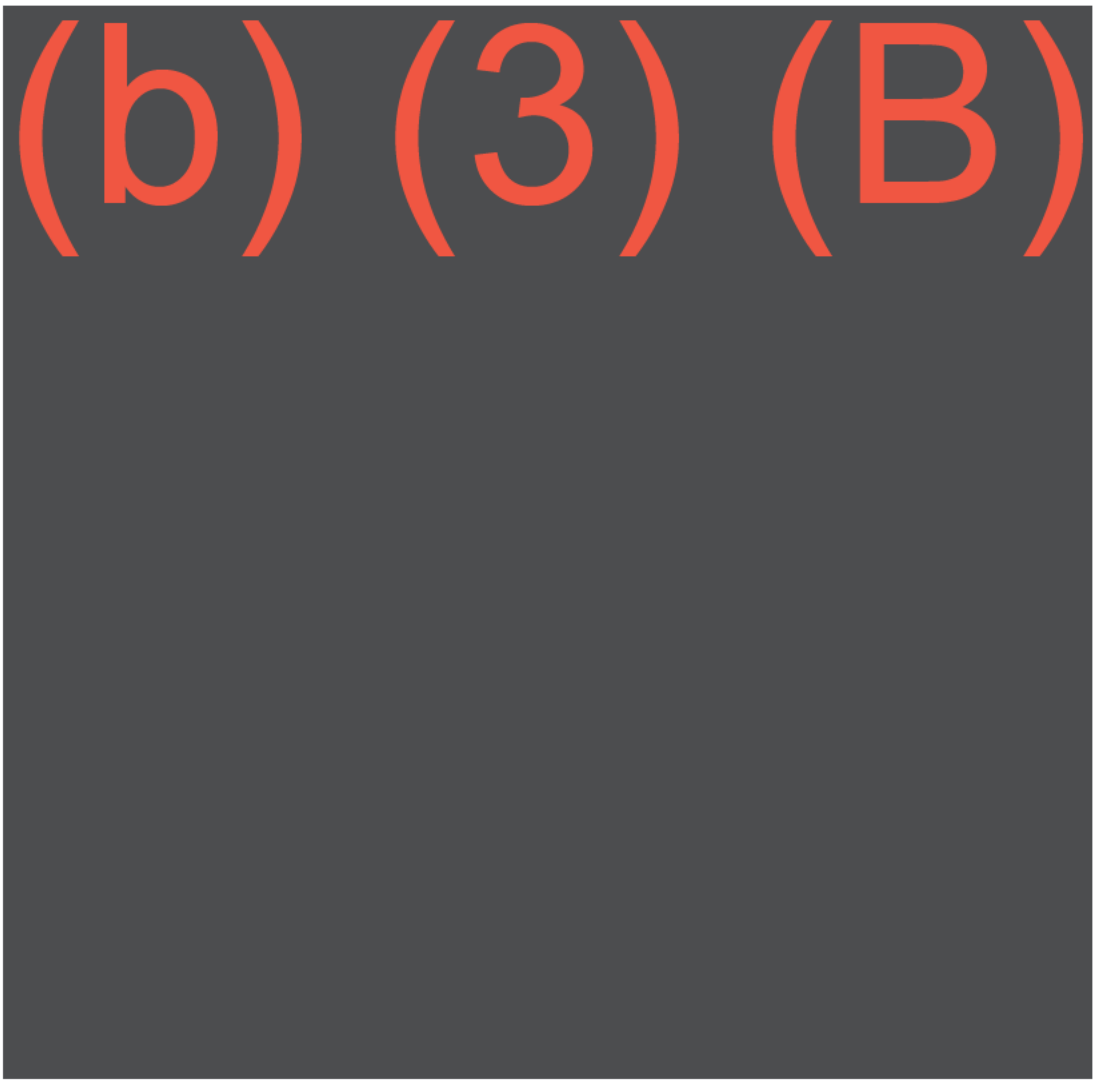
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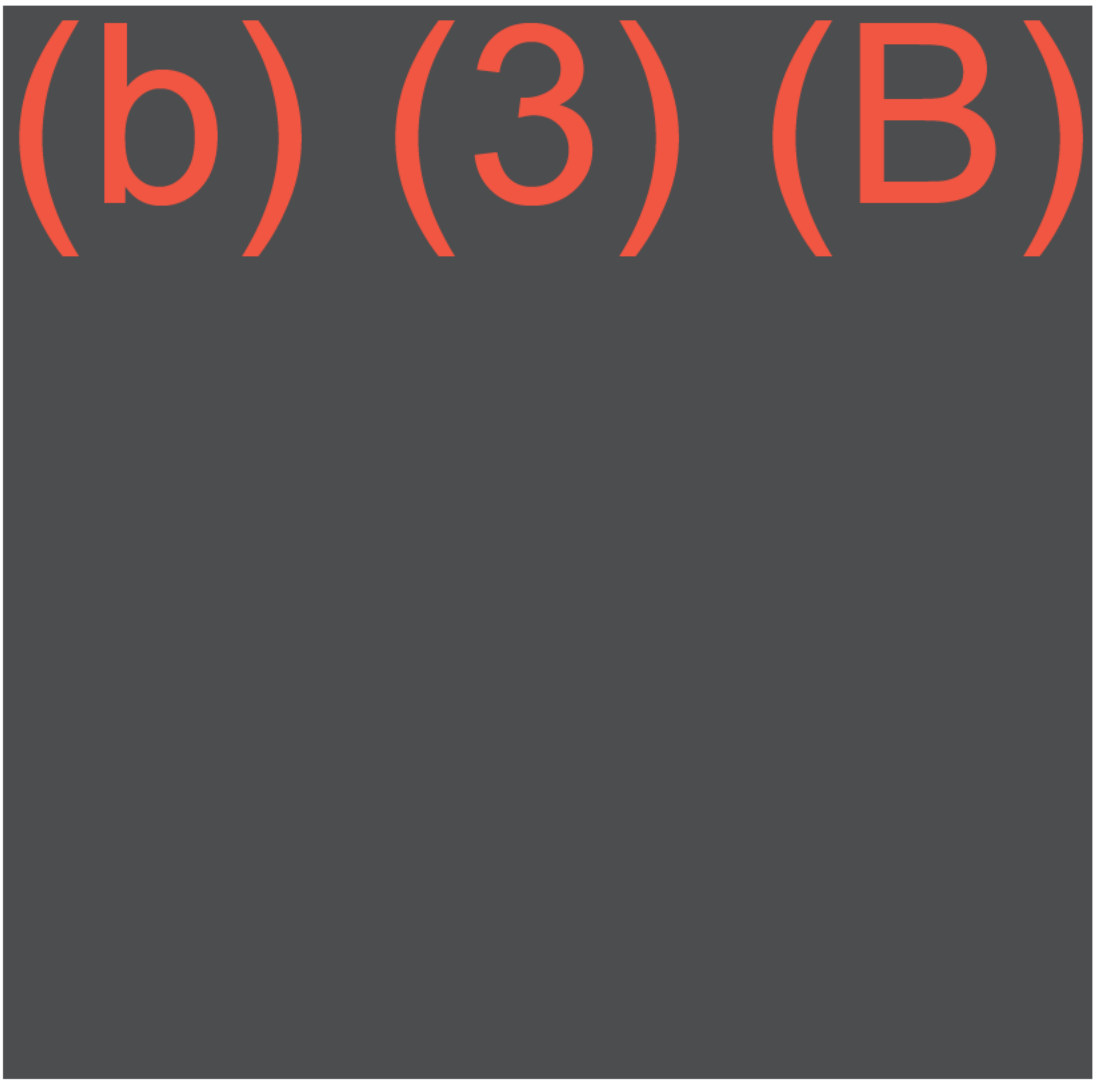
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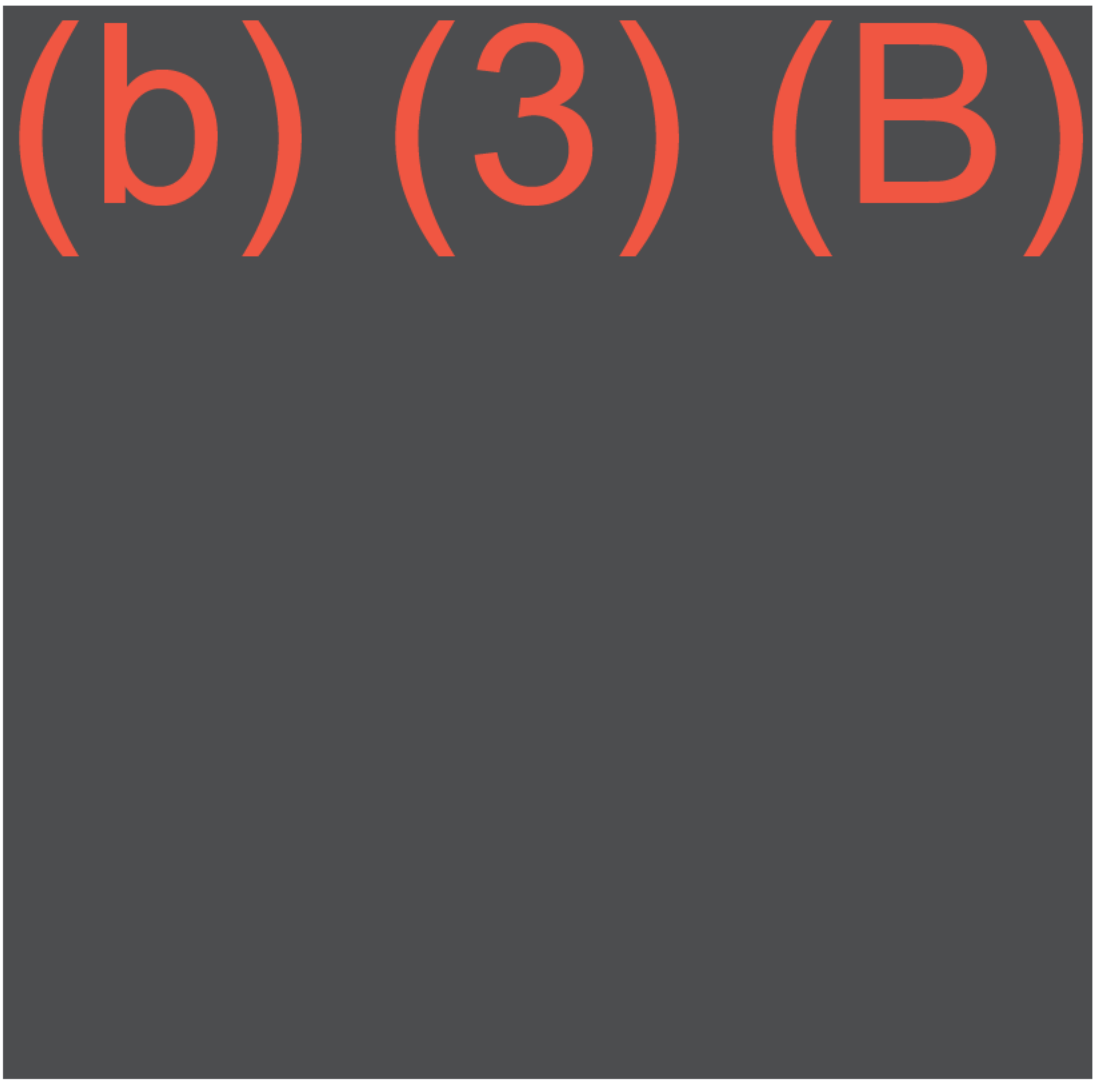
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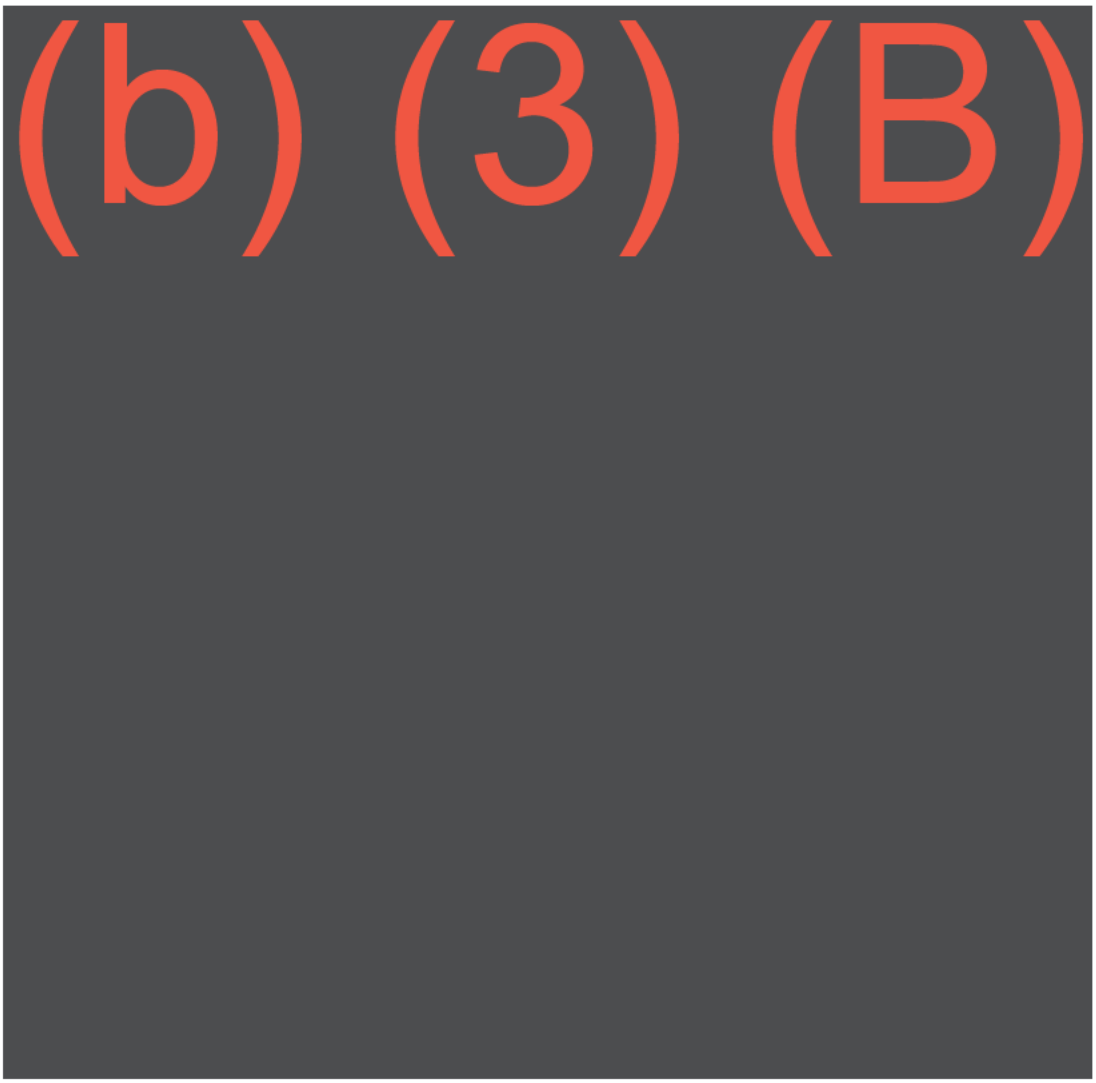
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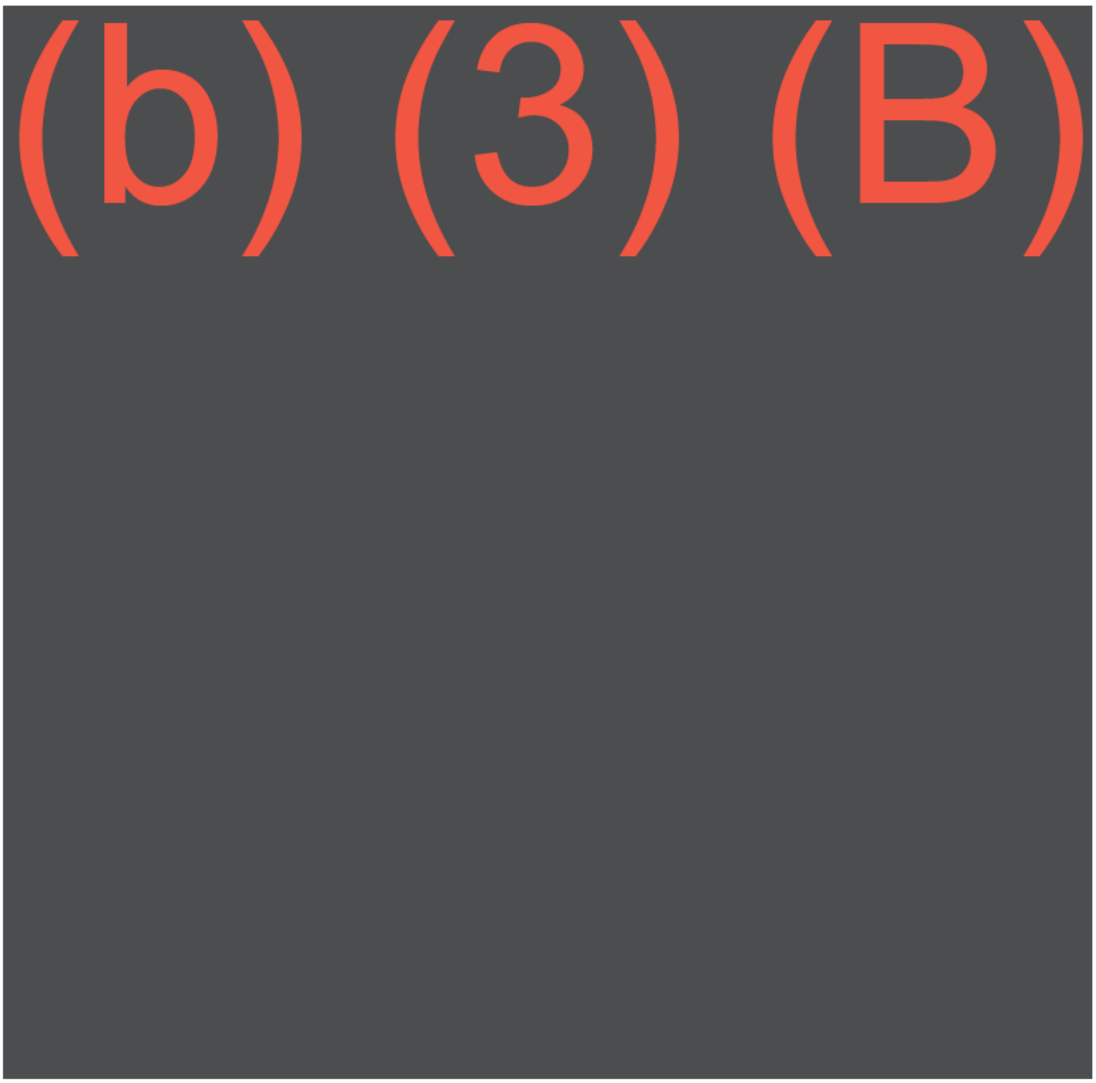
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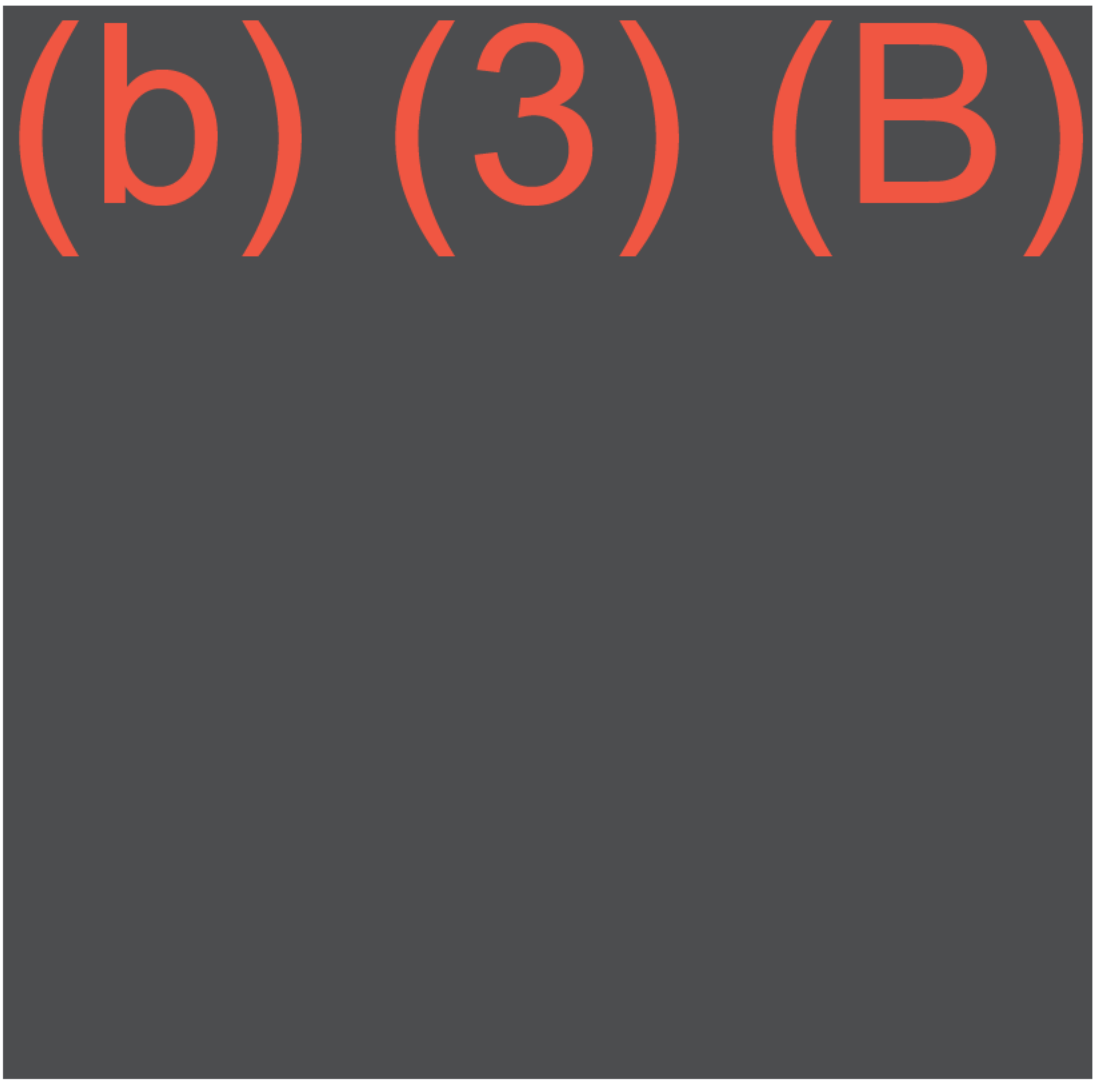
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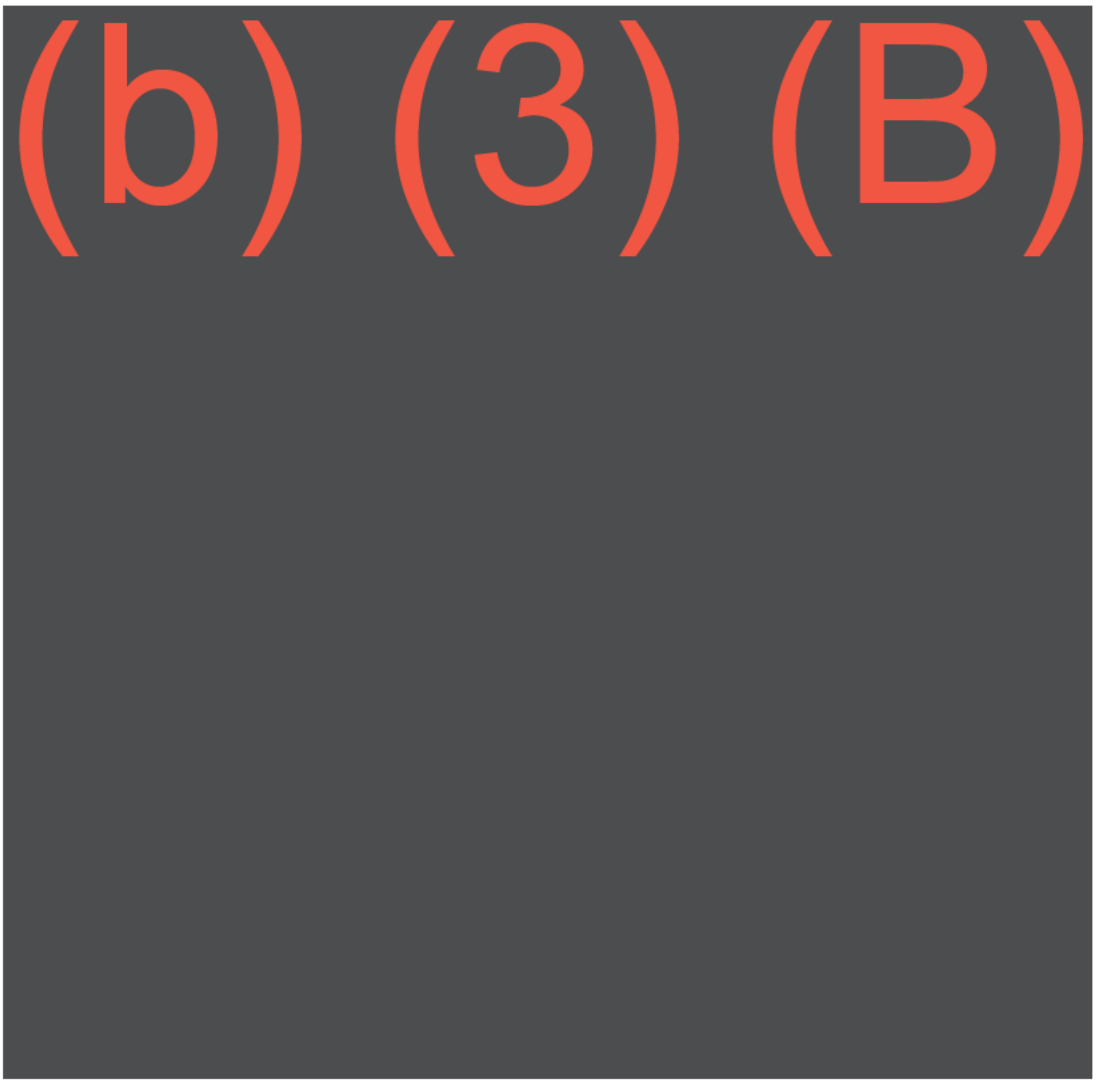
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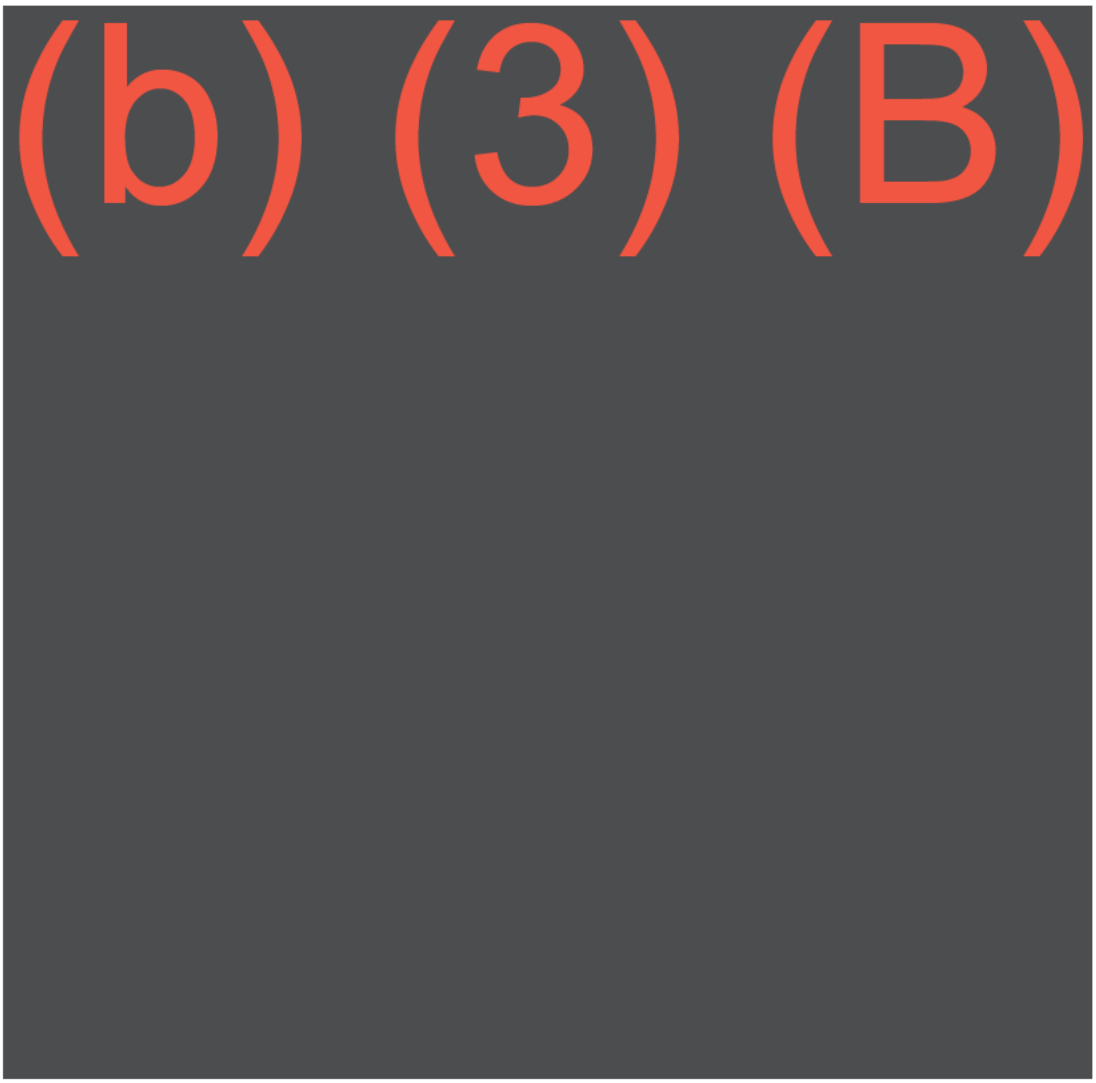
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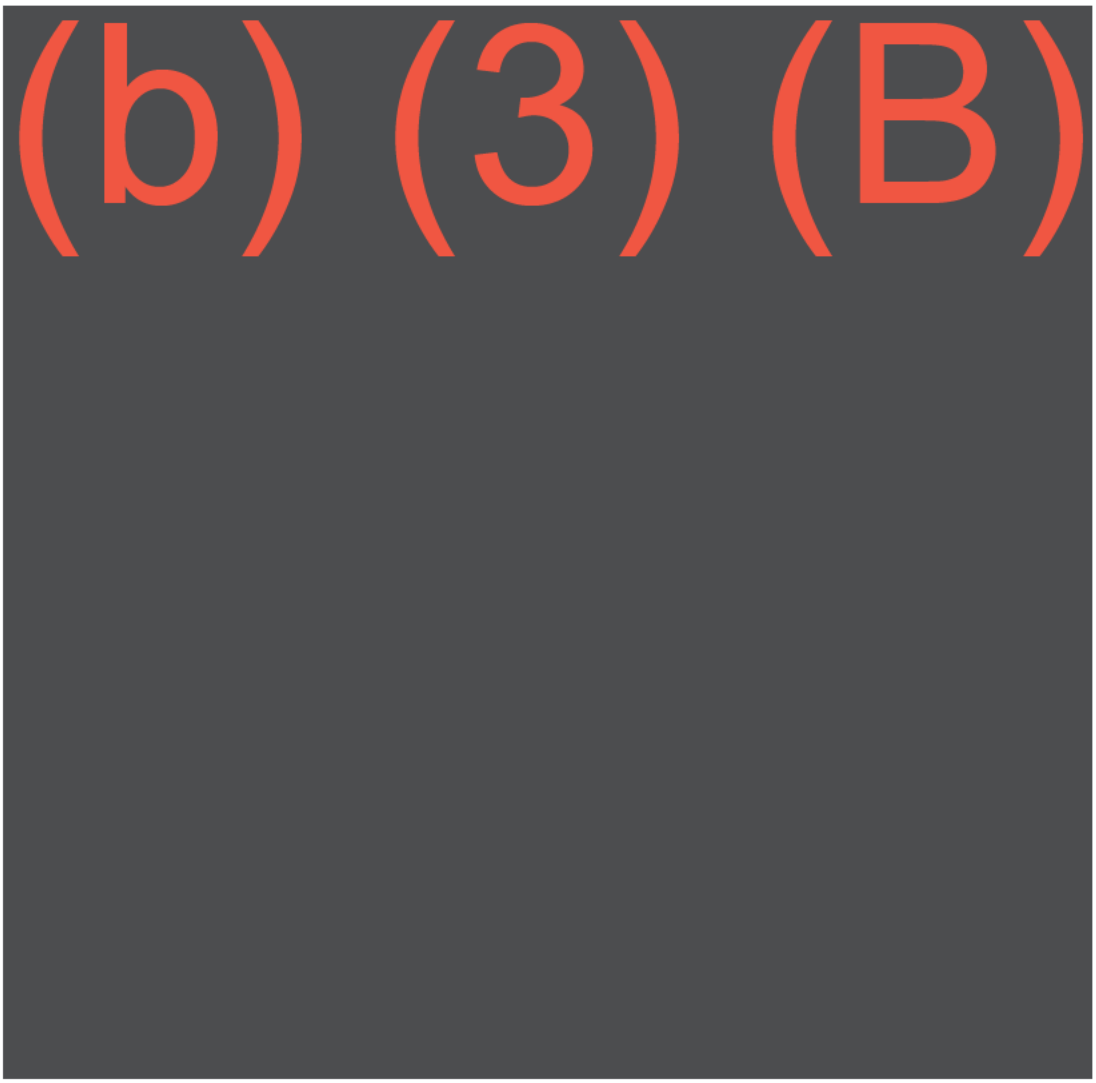
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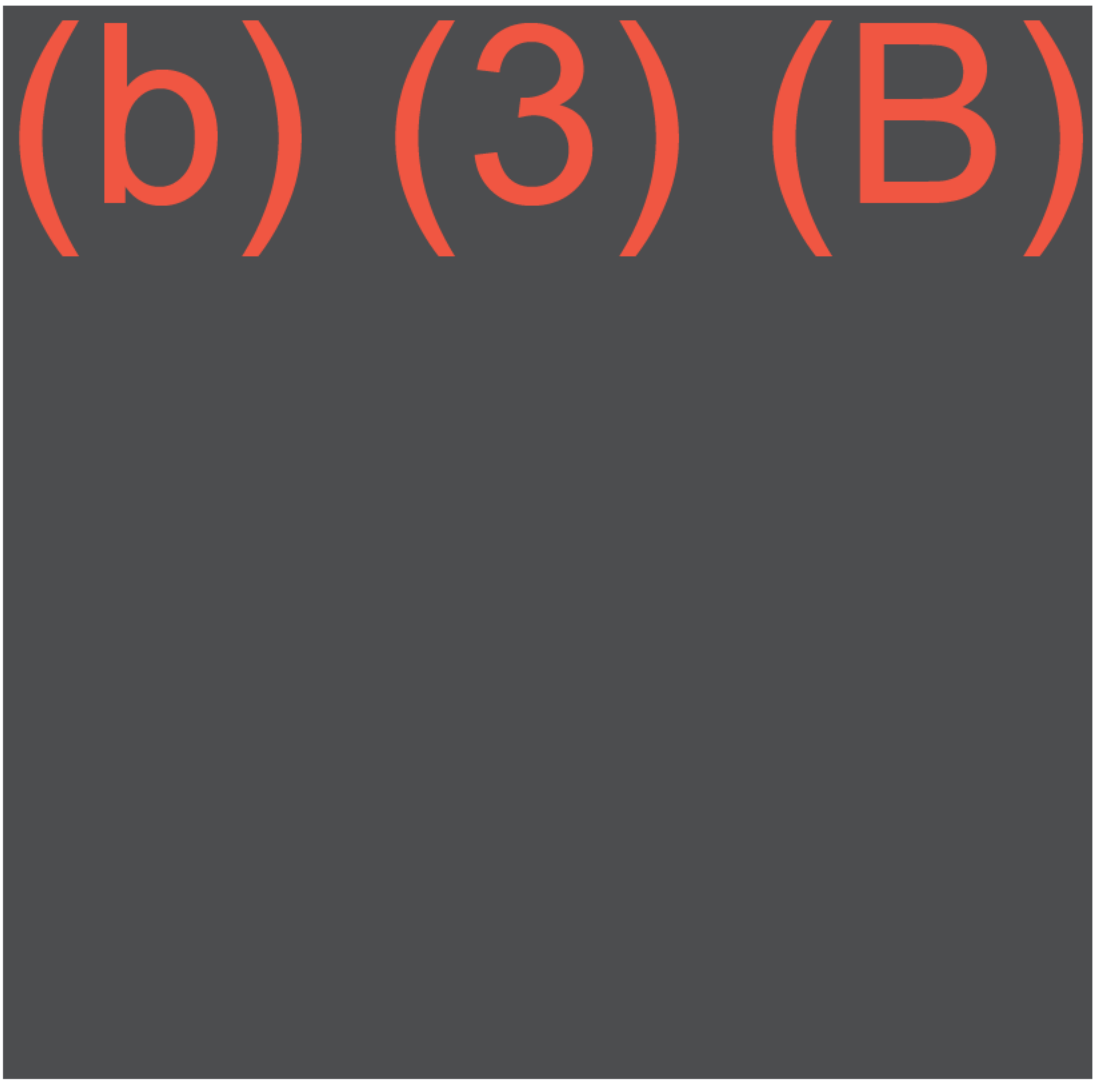
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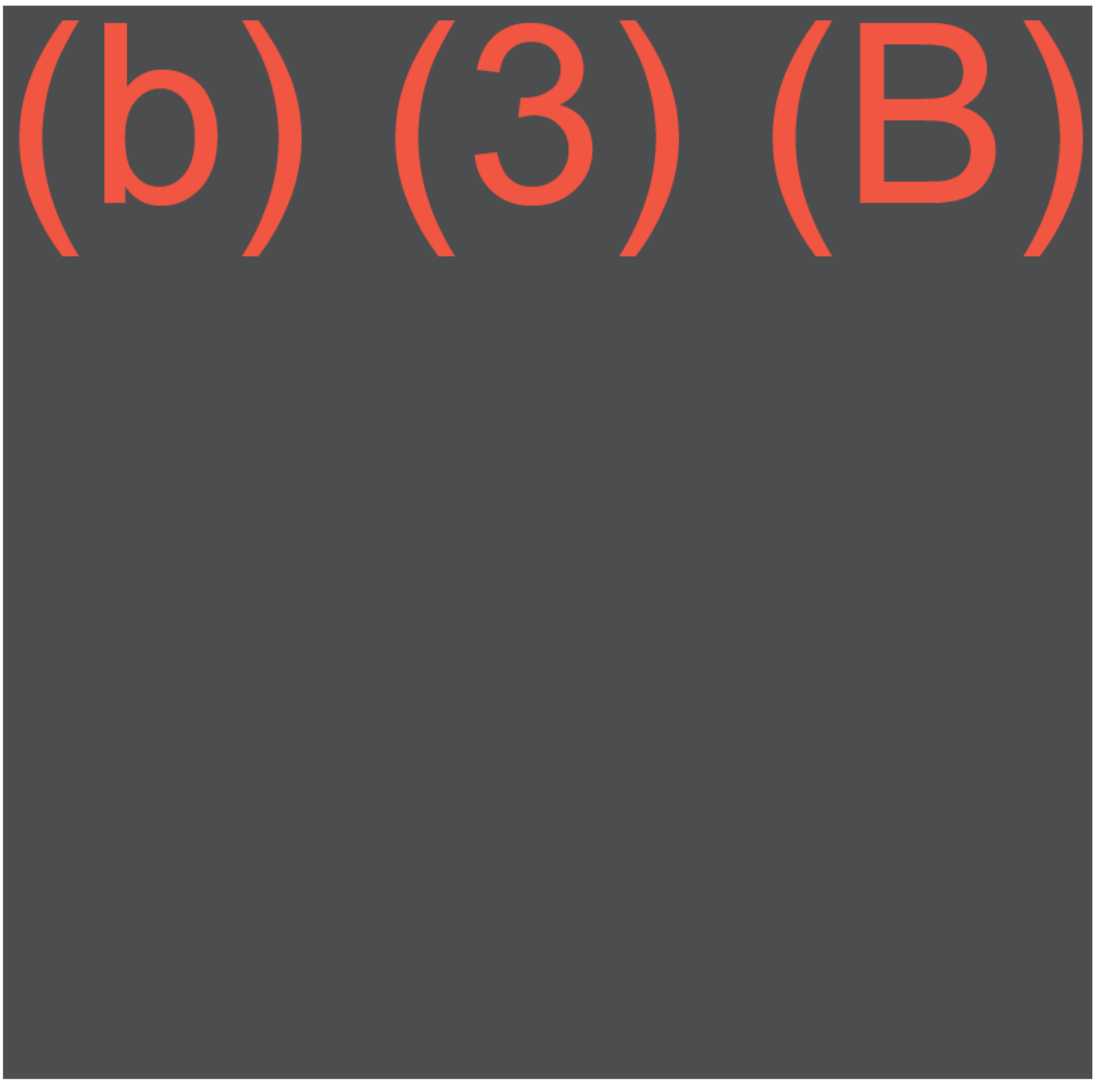
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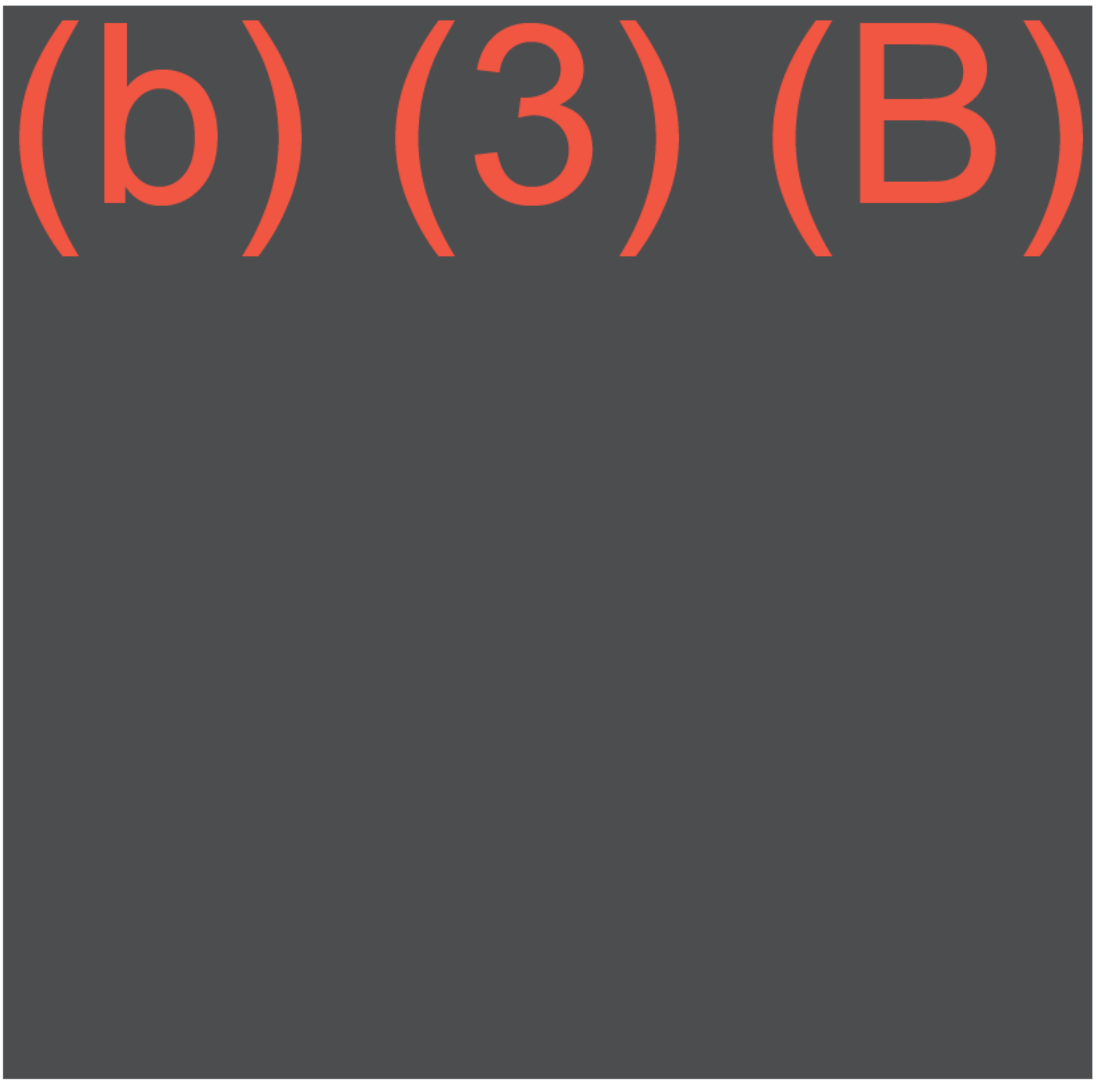
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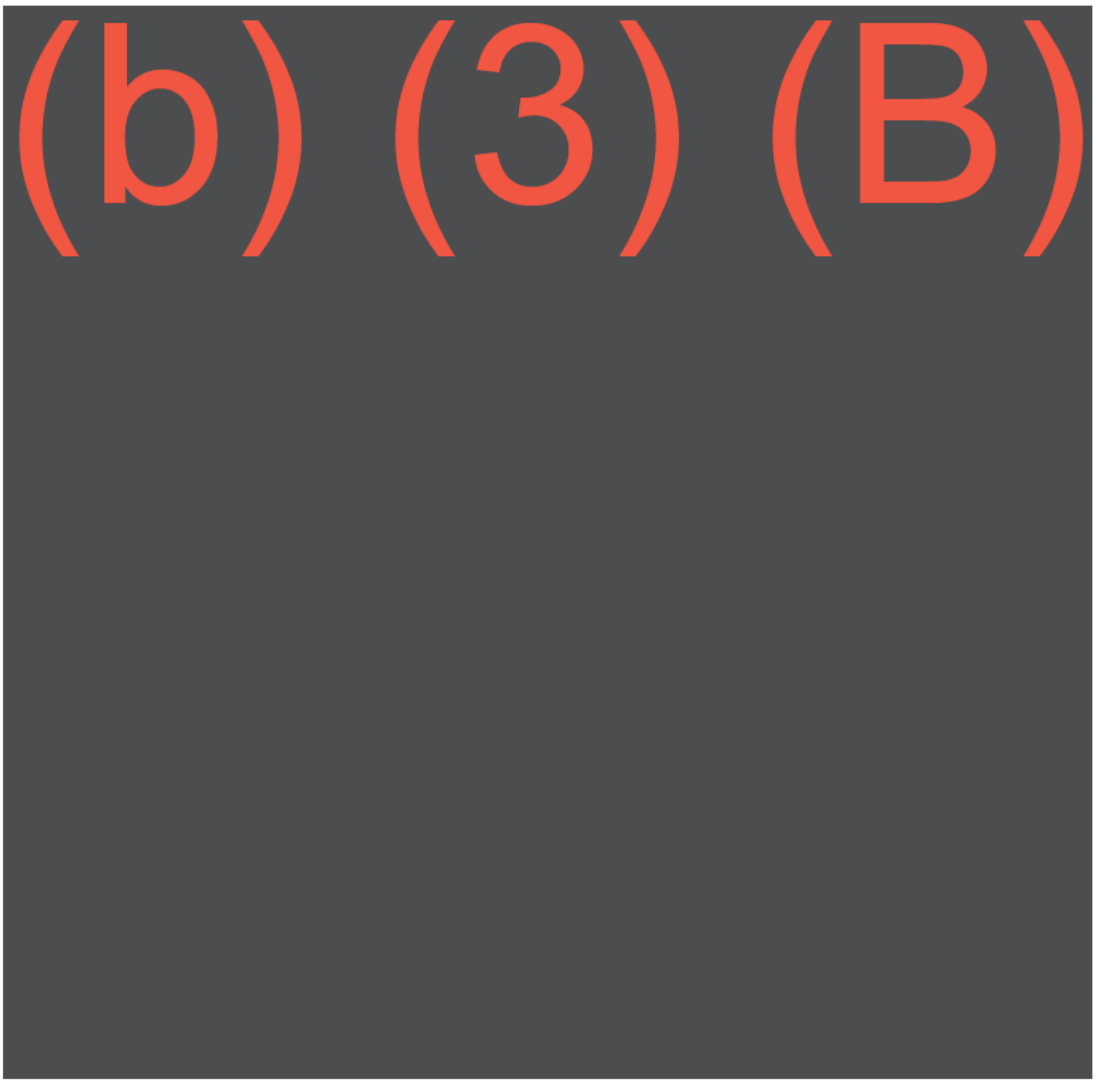
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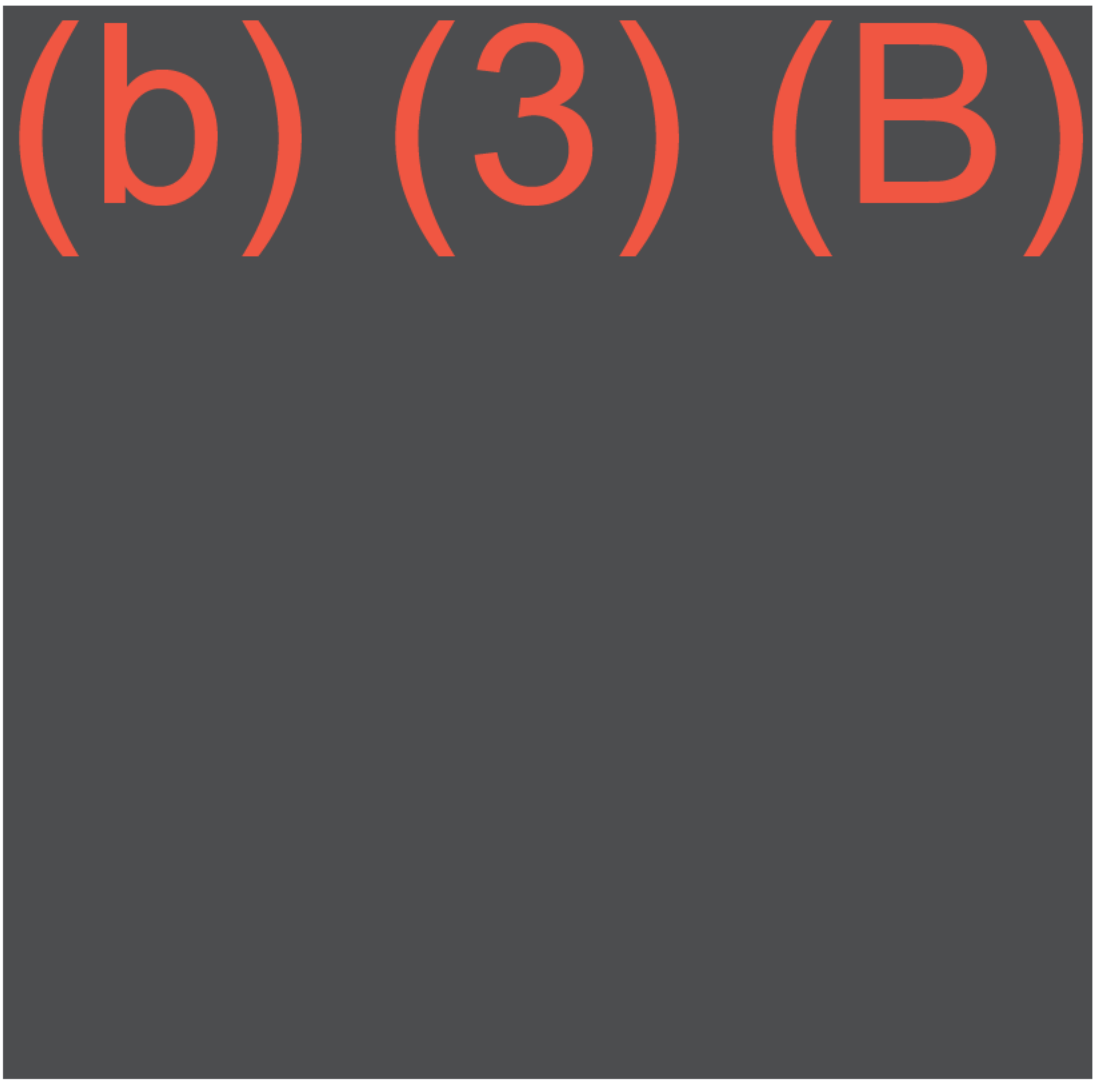
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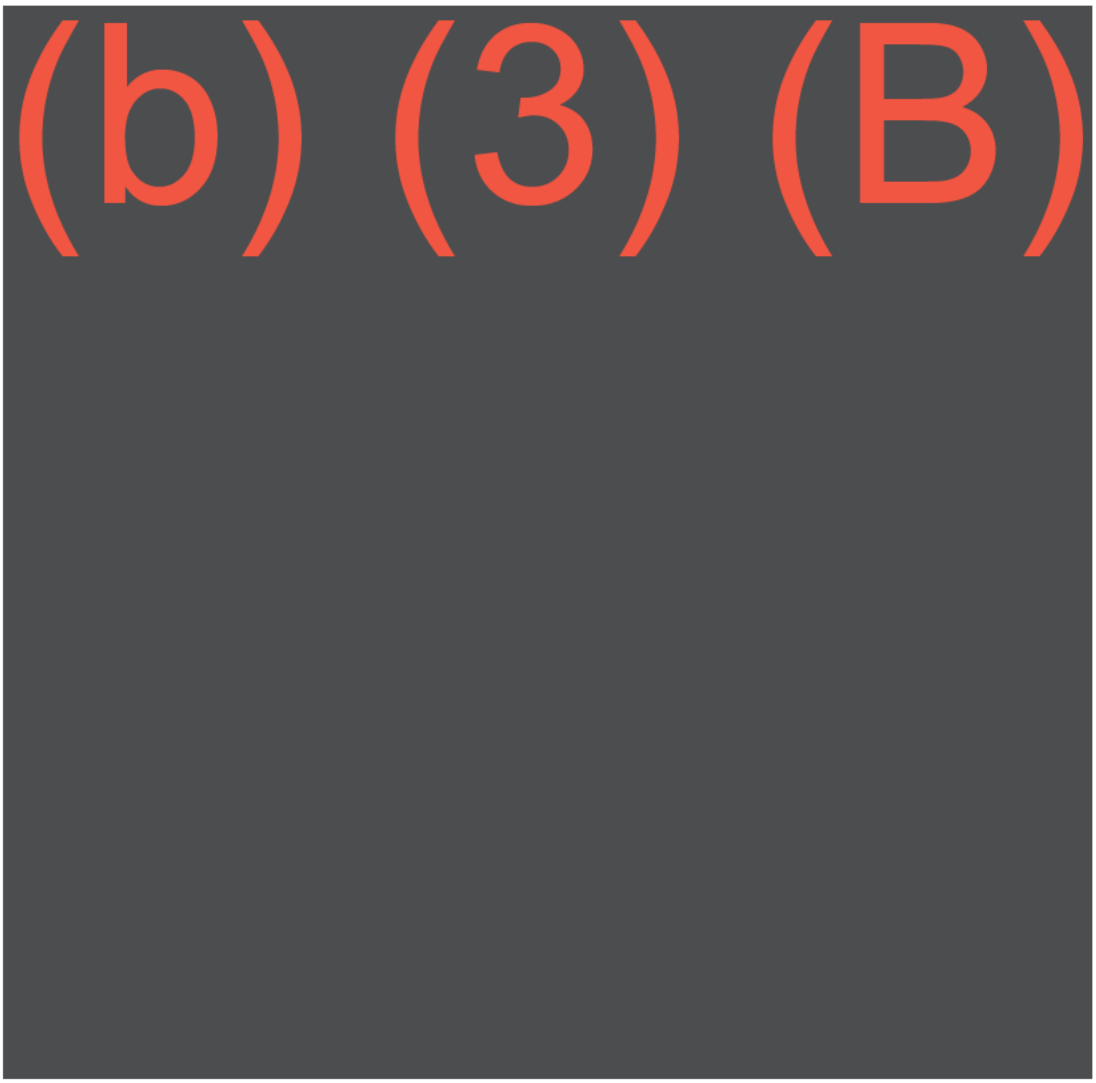
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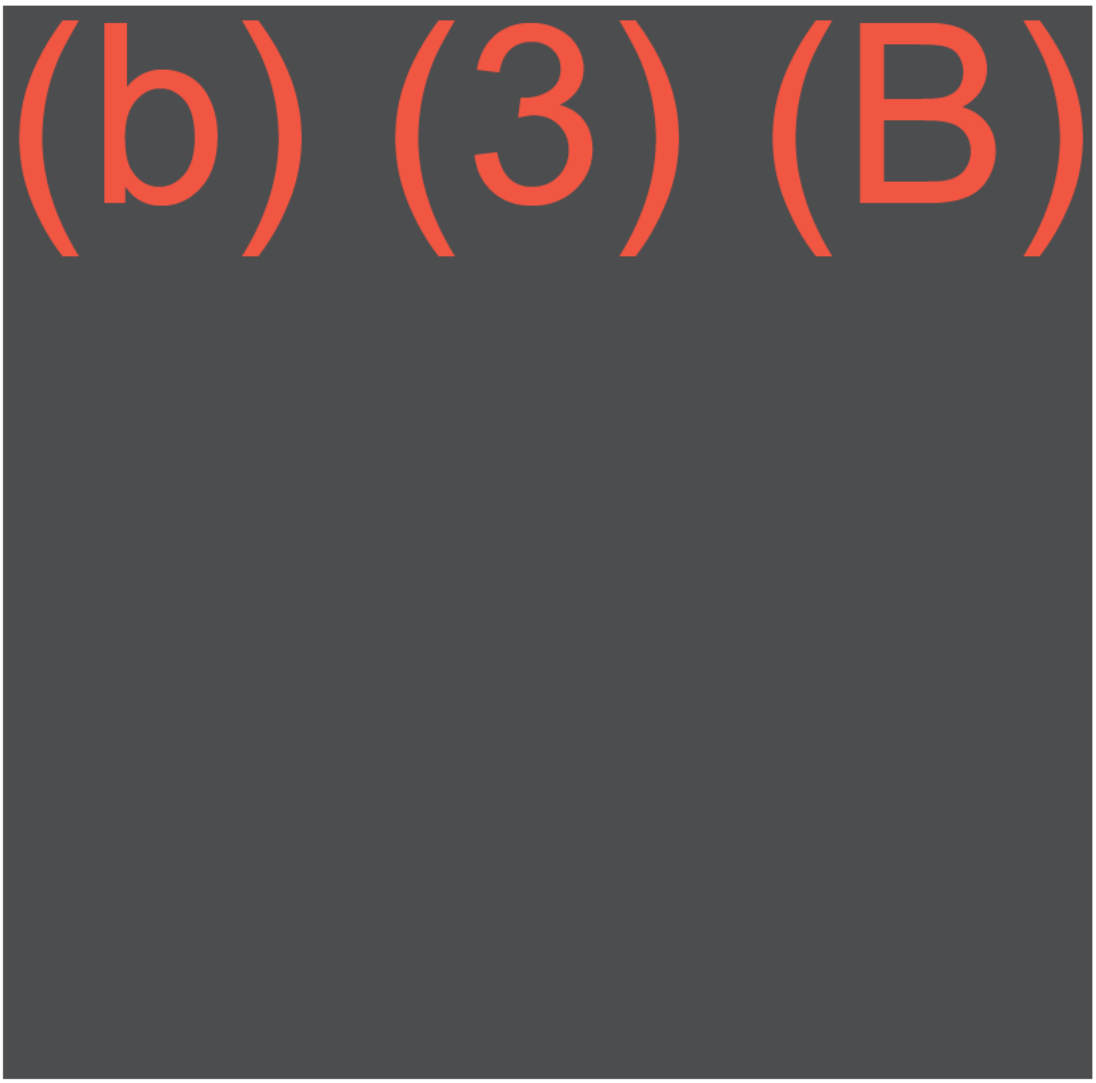
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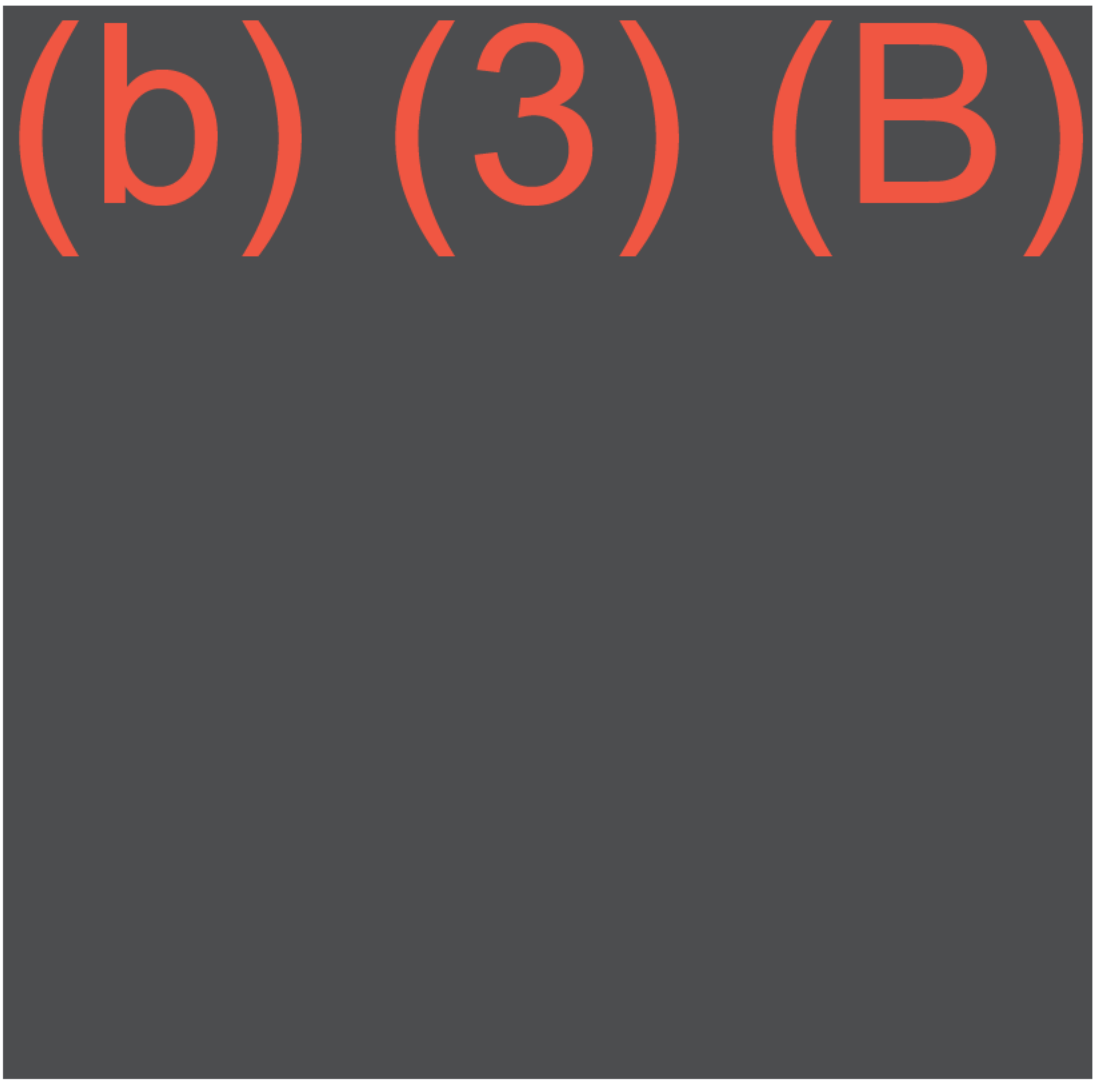
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Attachment 6:
(b) (3) (B) Water Meter Cut Sheet

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Attachment 7:

(b) (3) (B) [redacted] Differential Pressure Transmitter Operating Instructions

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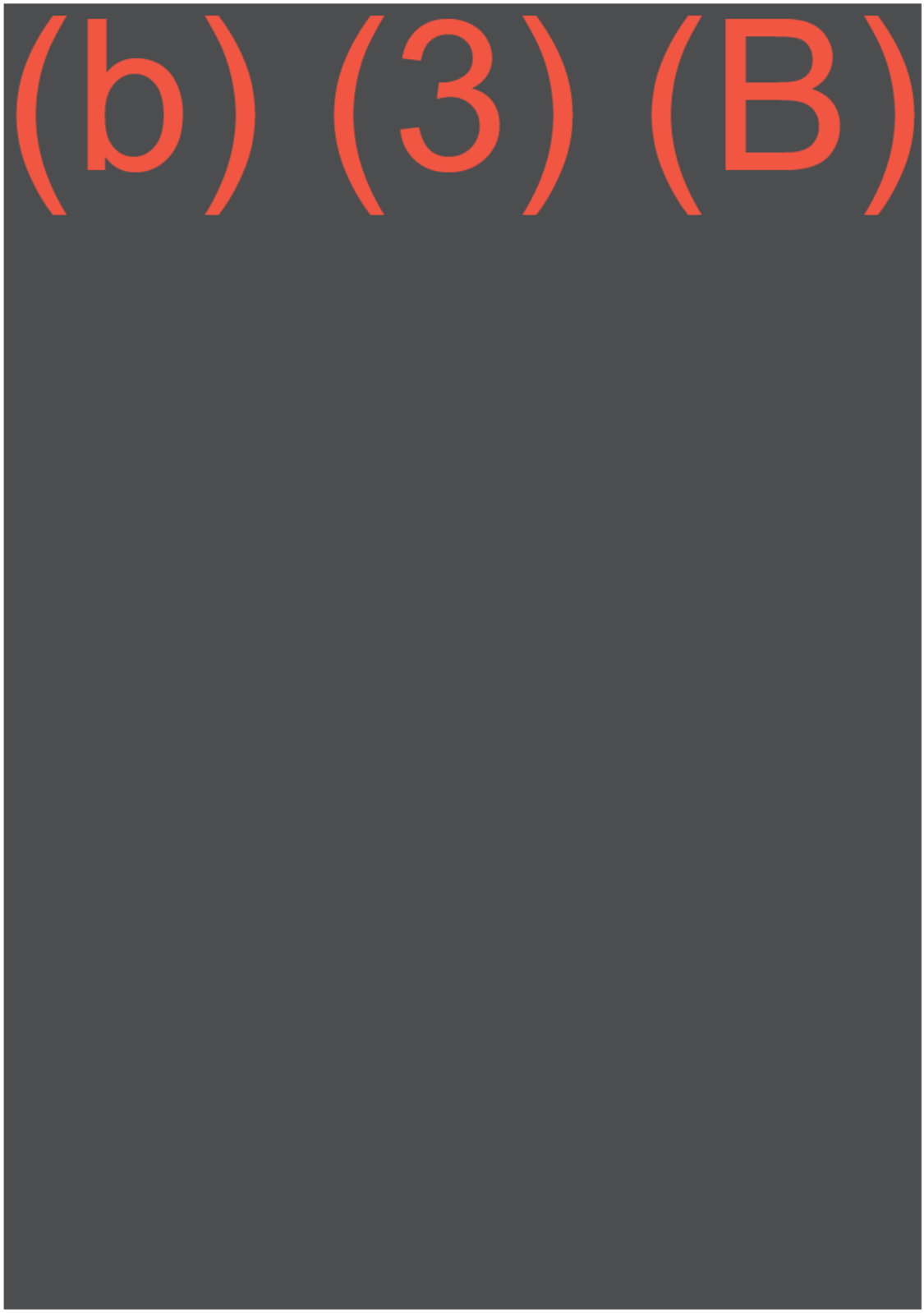
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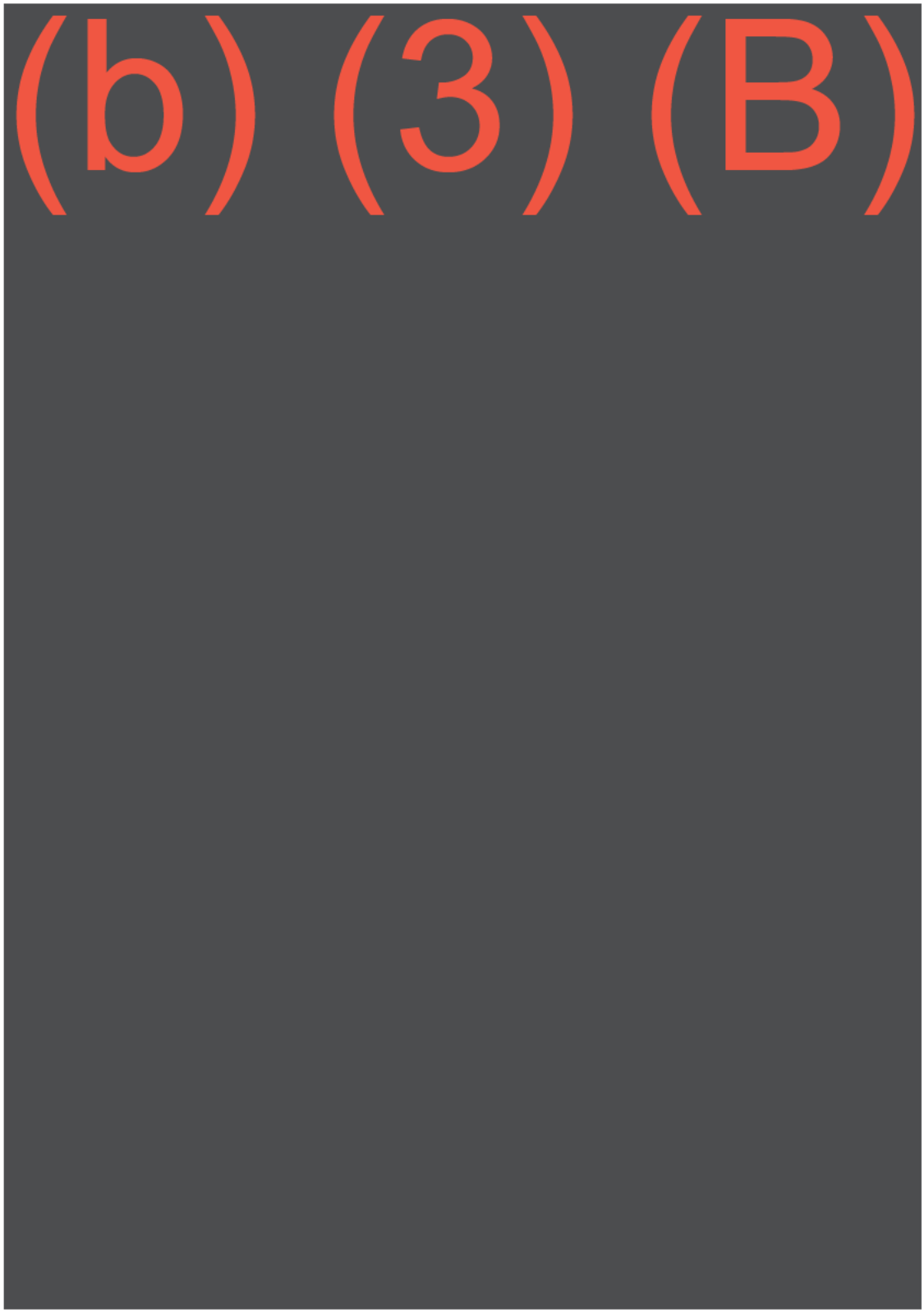
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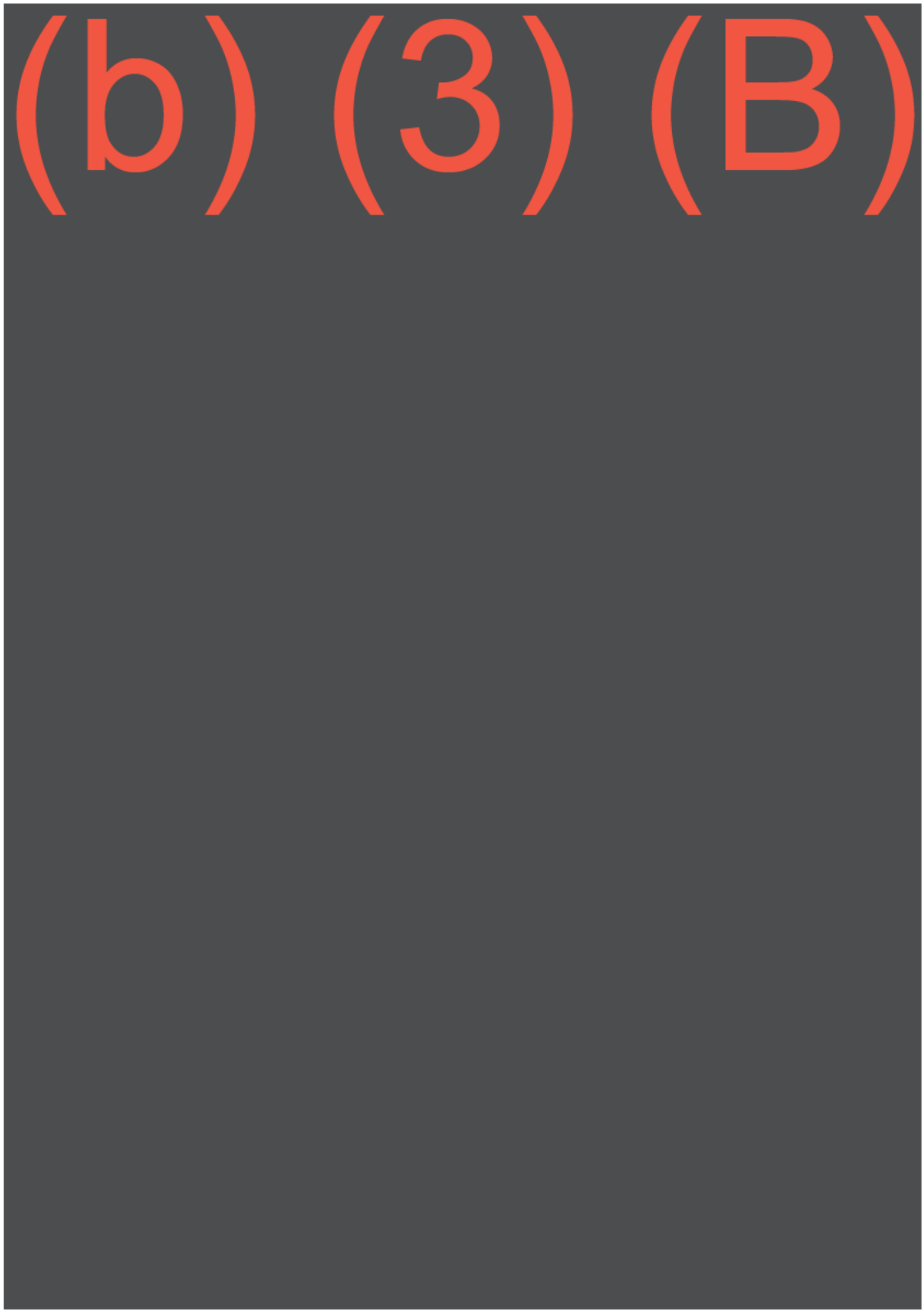
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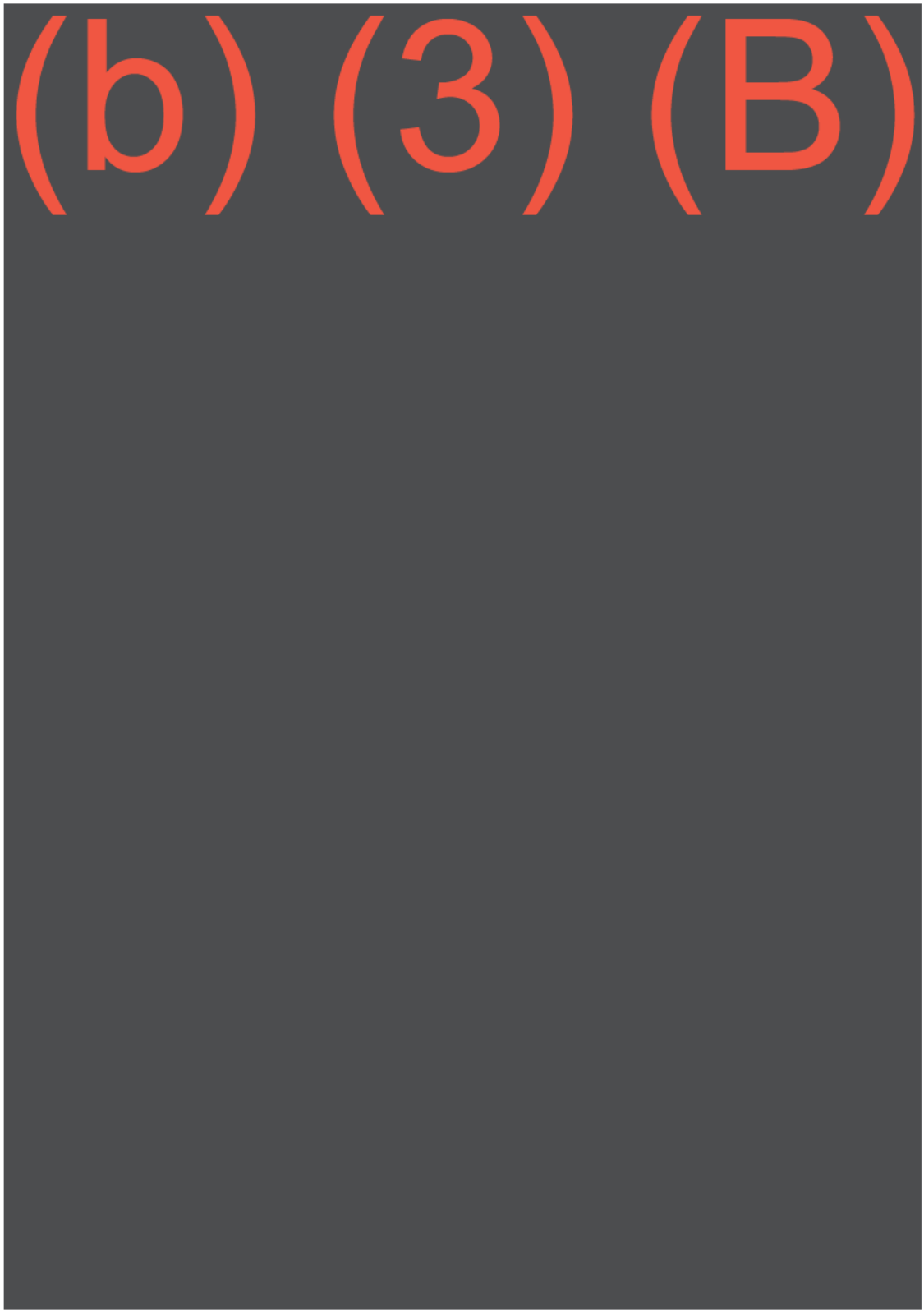
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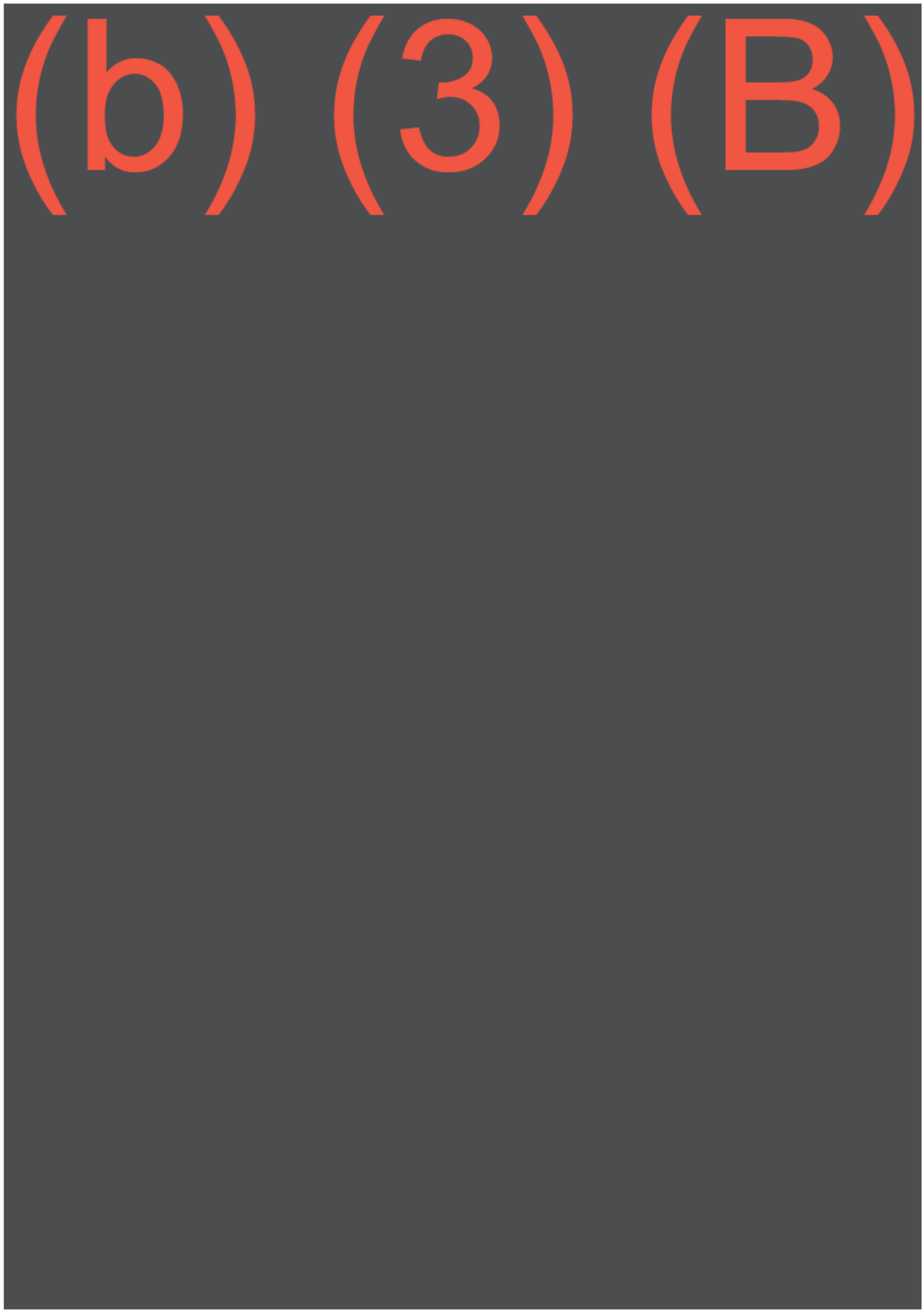
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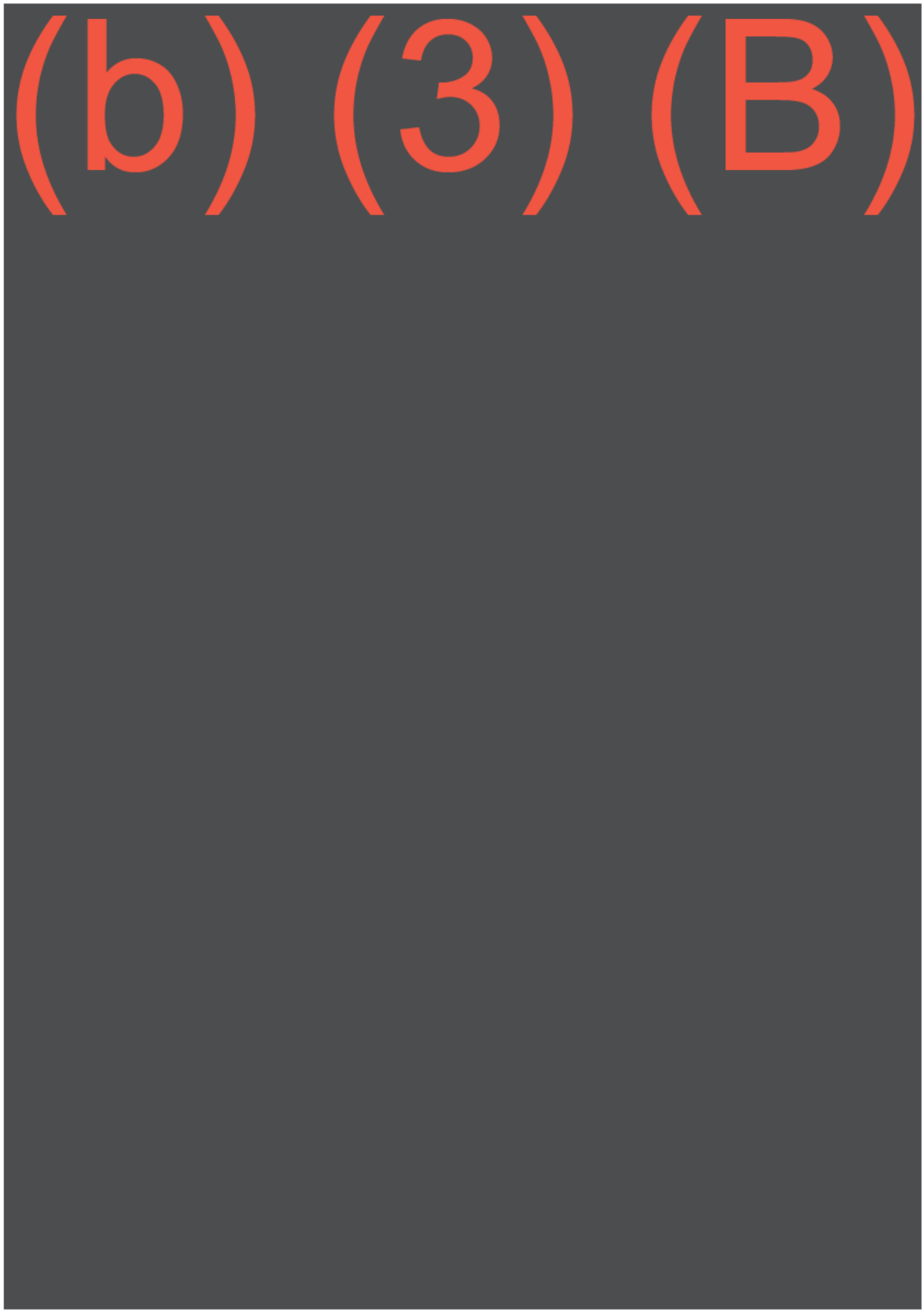
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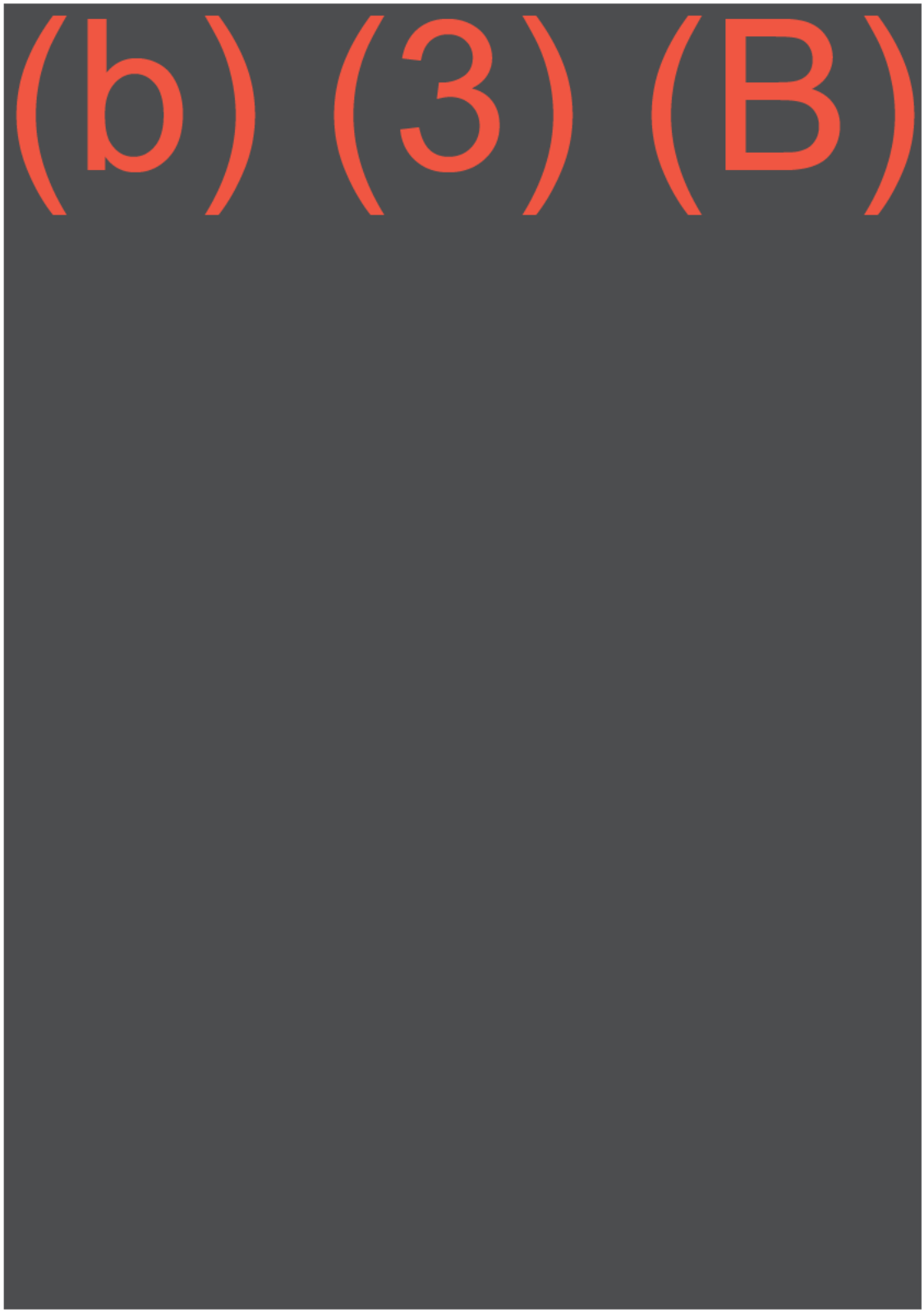
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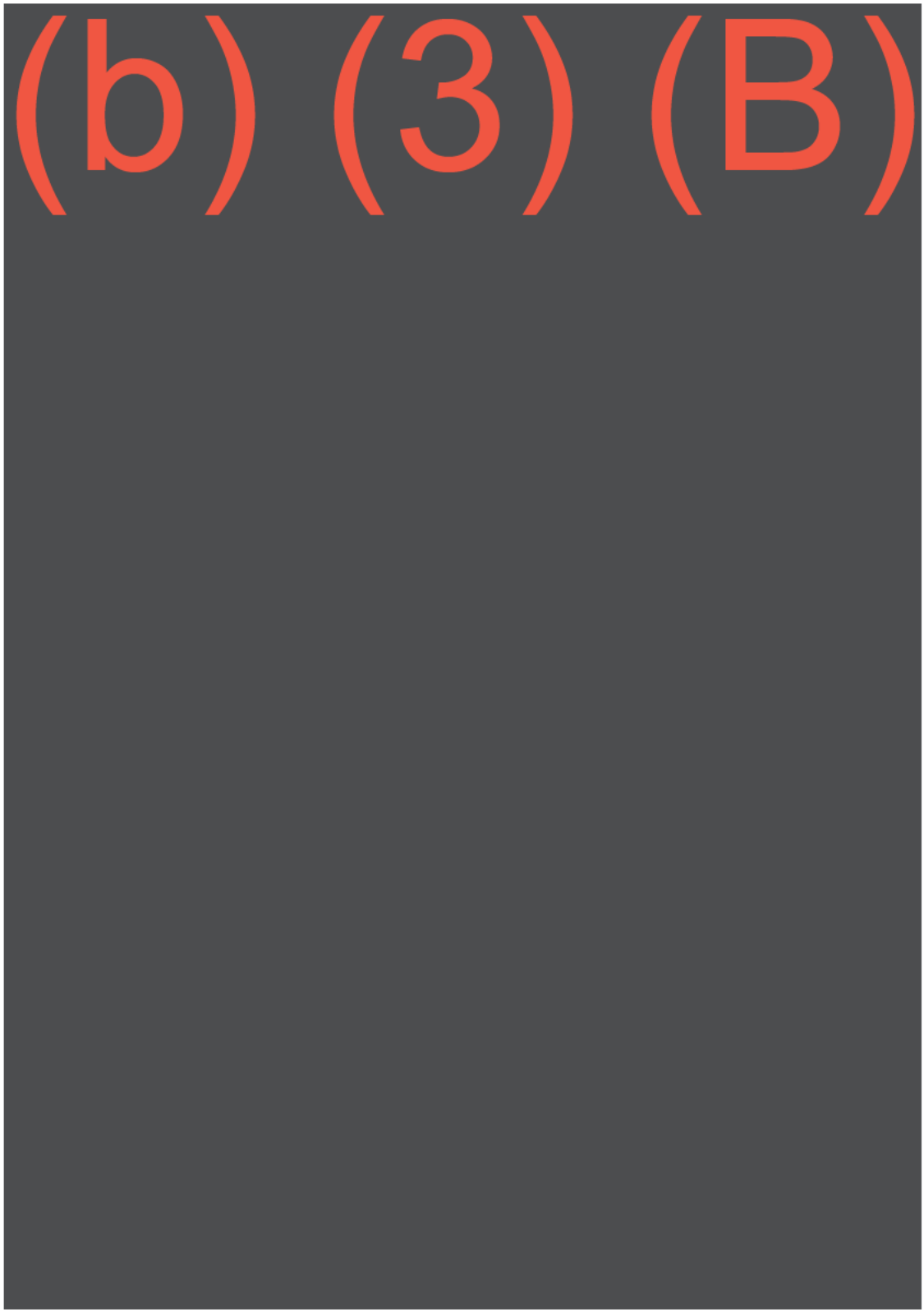
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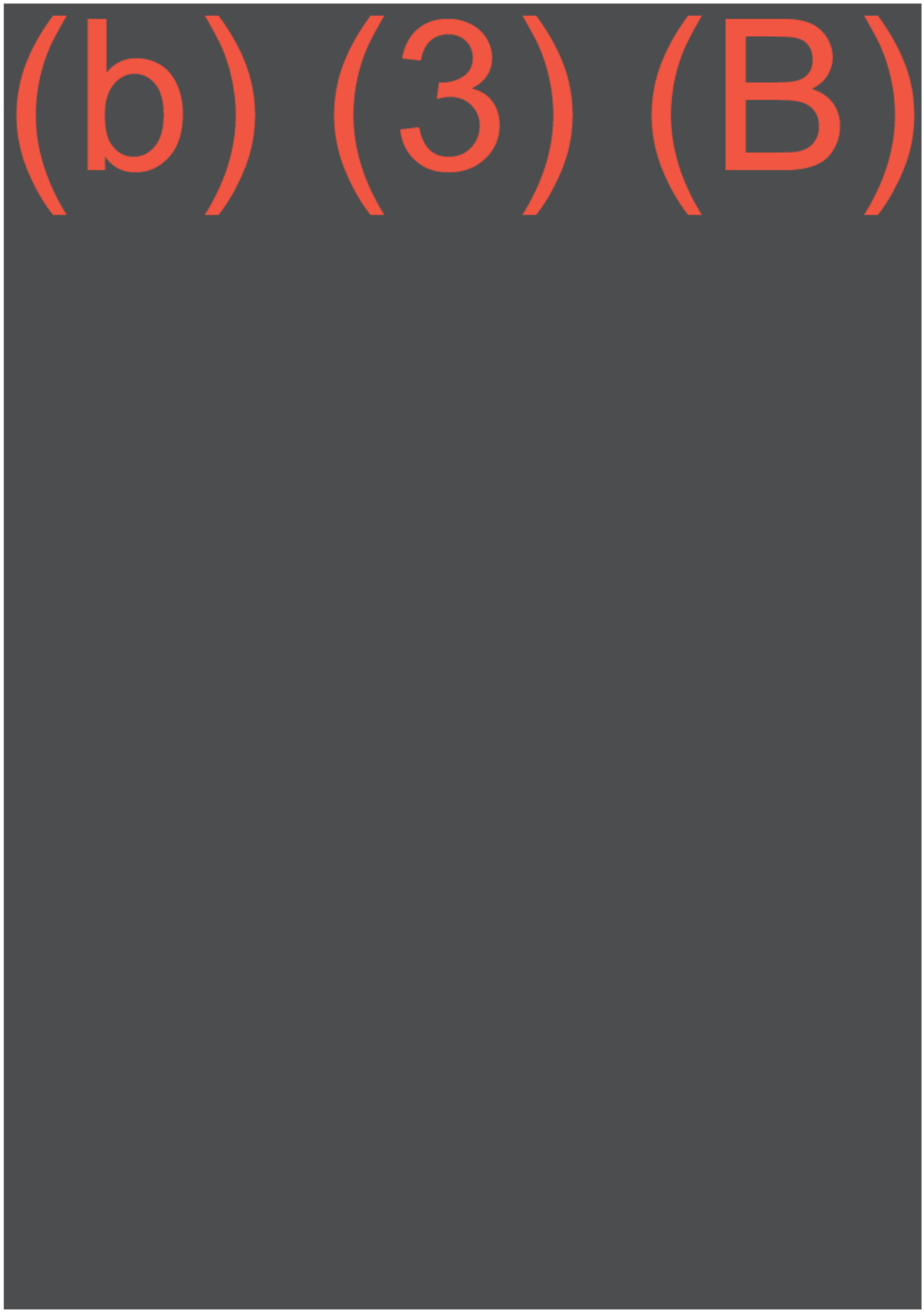
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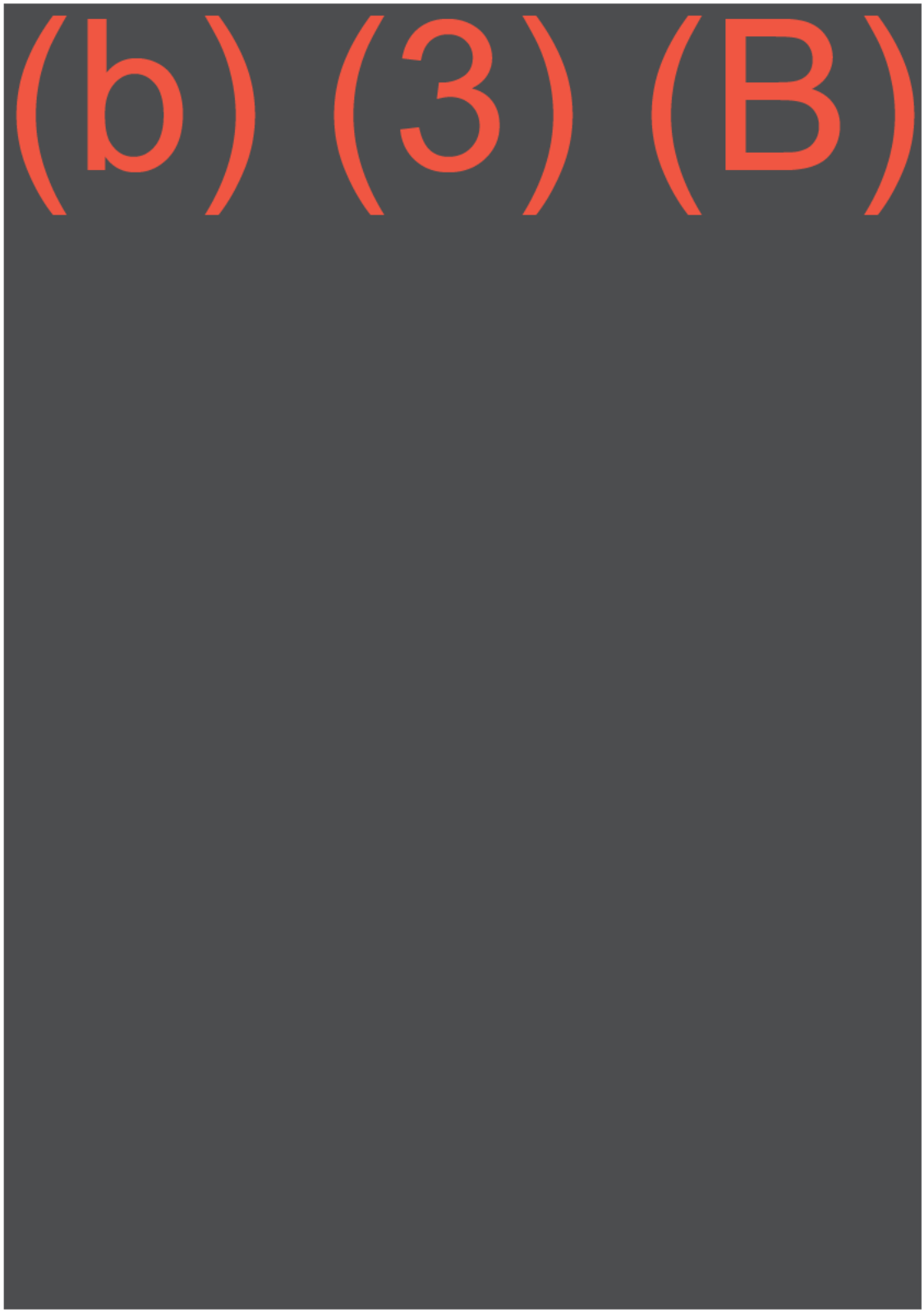
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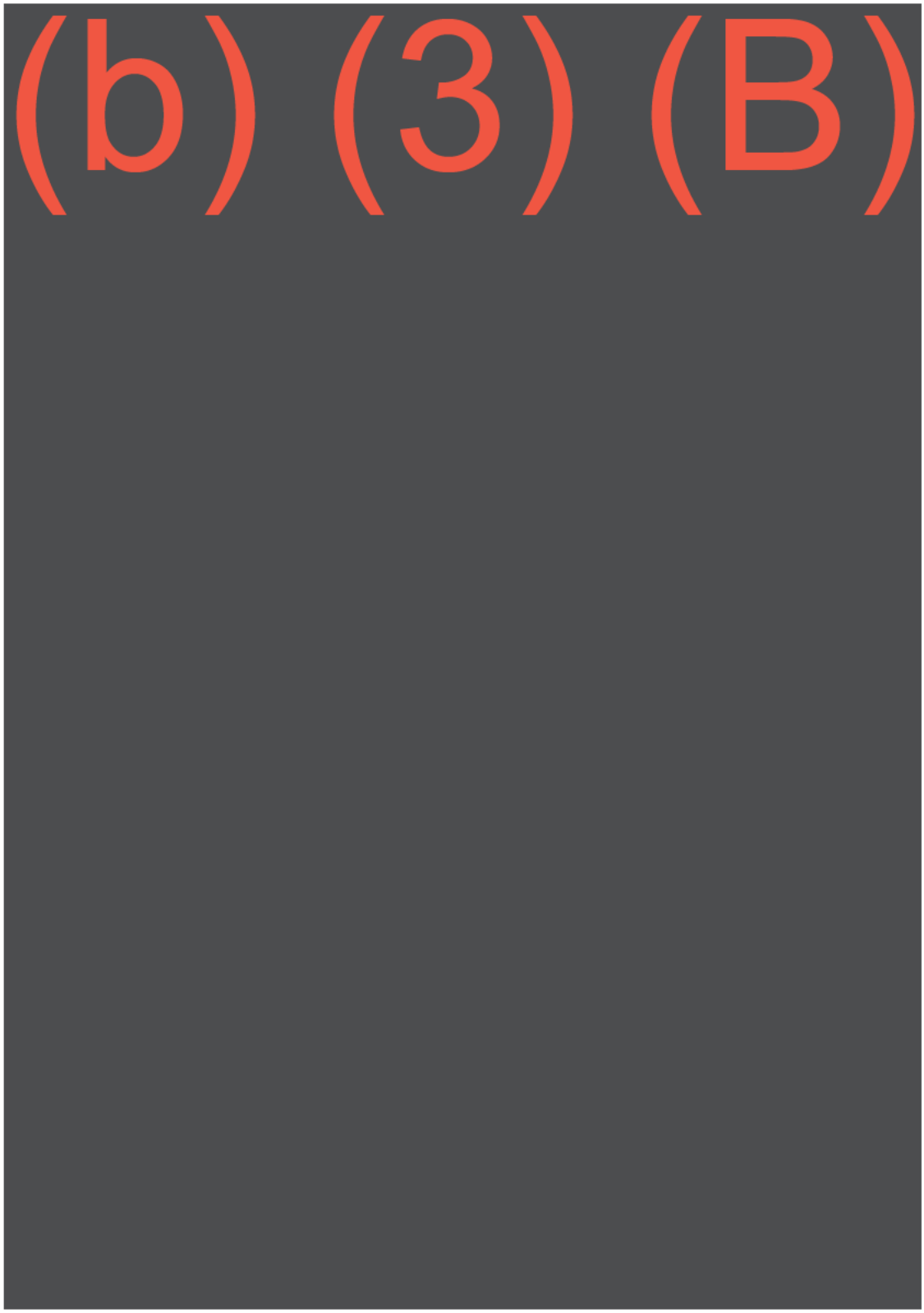
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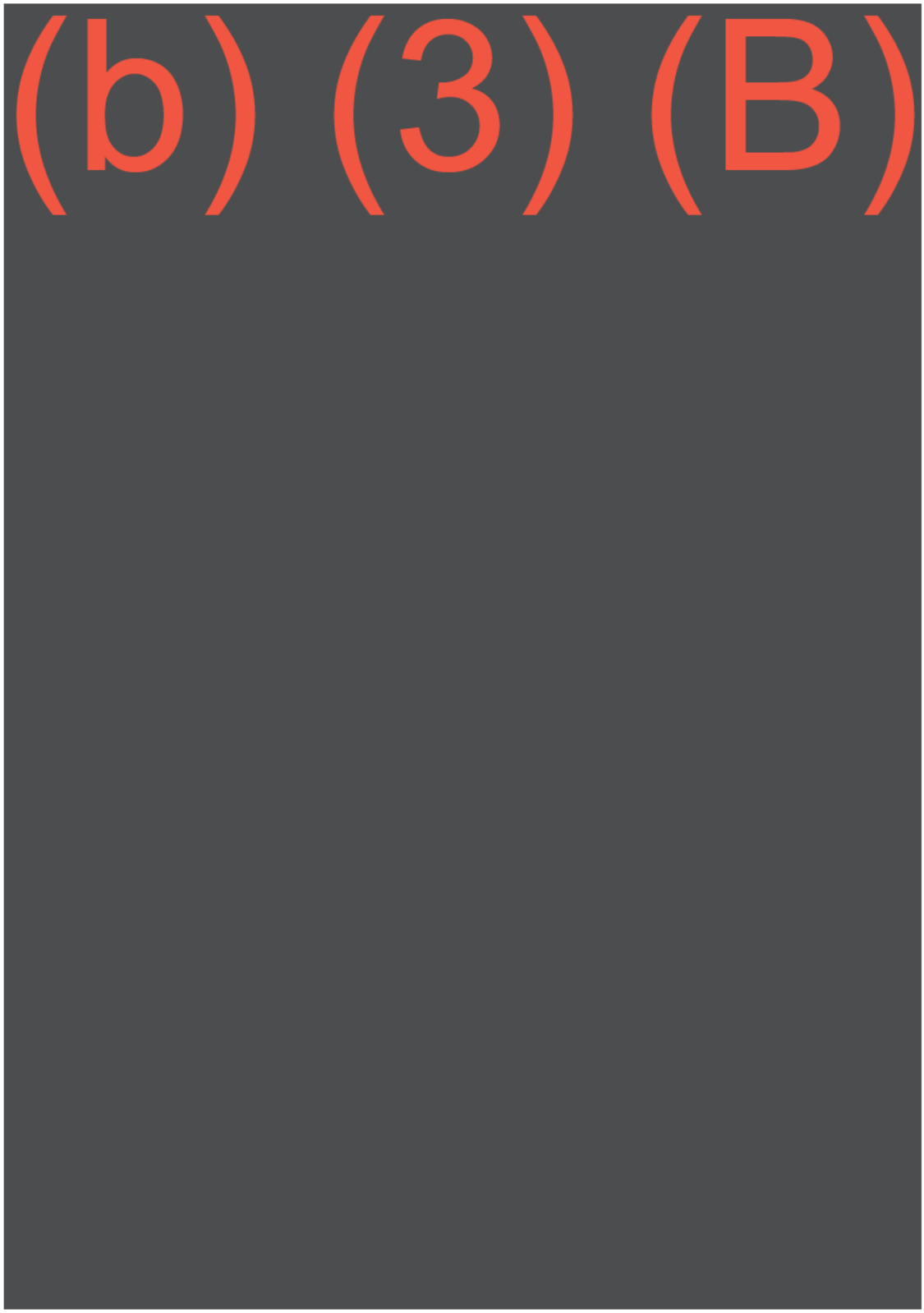
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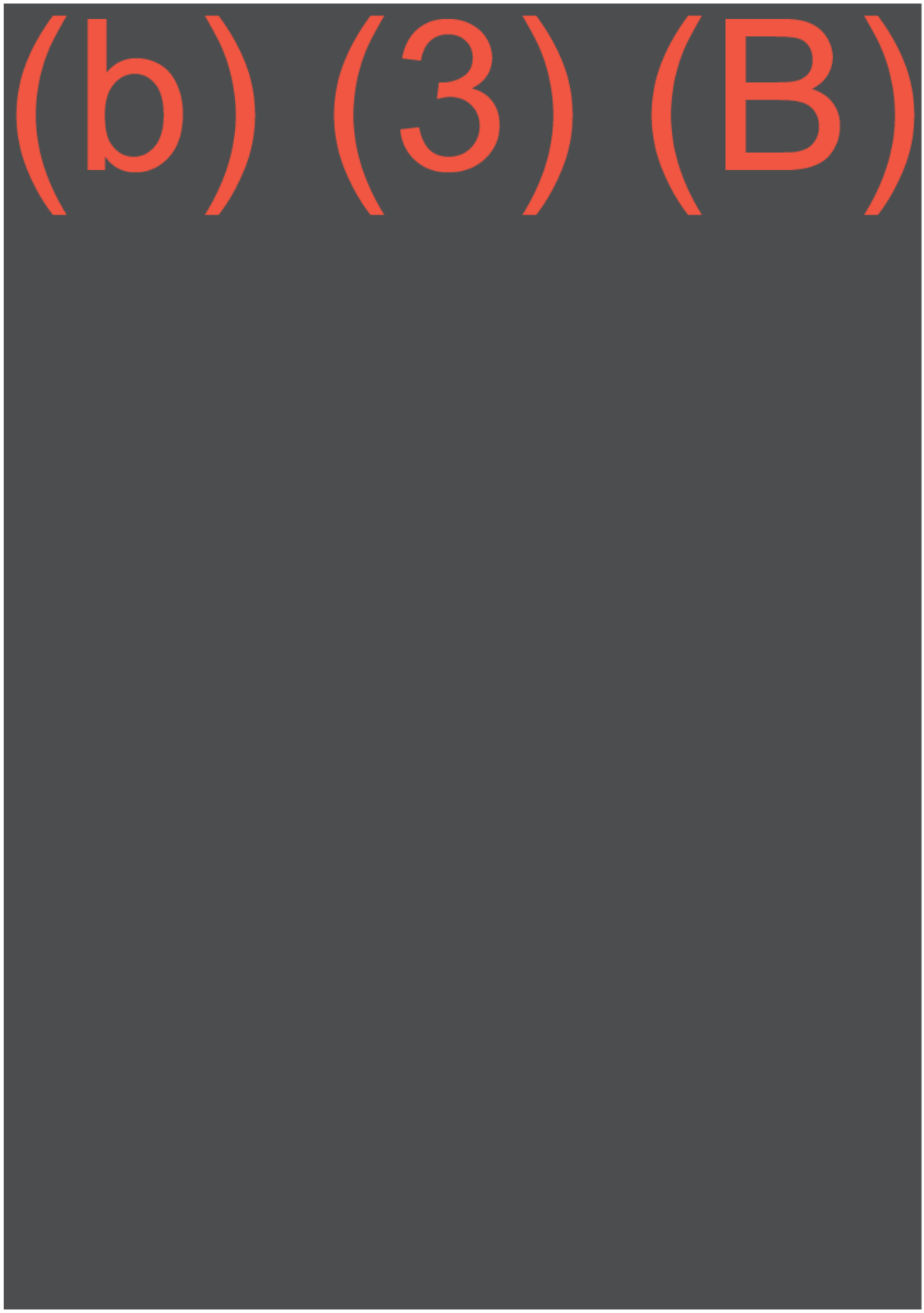
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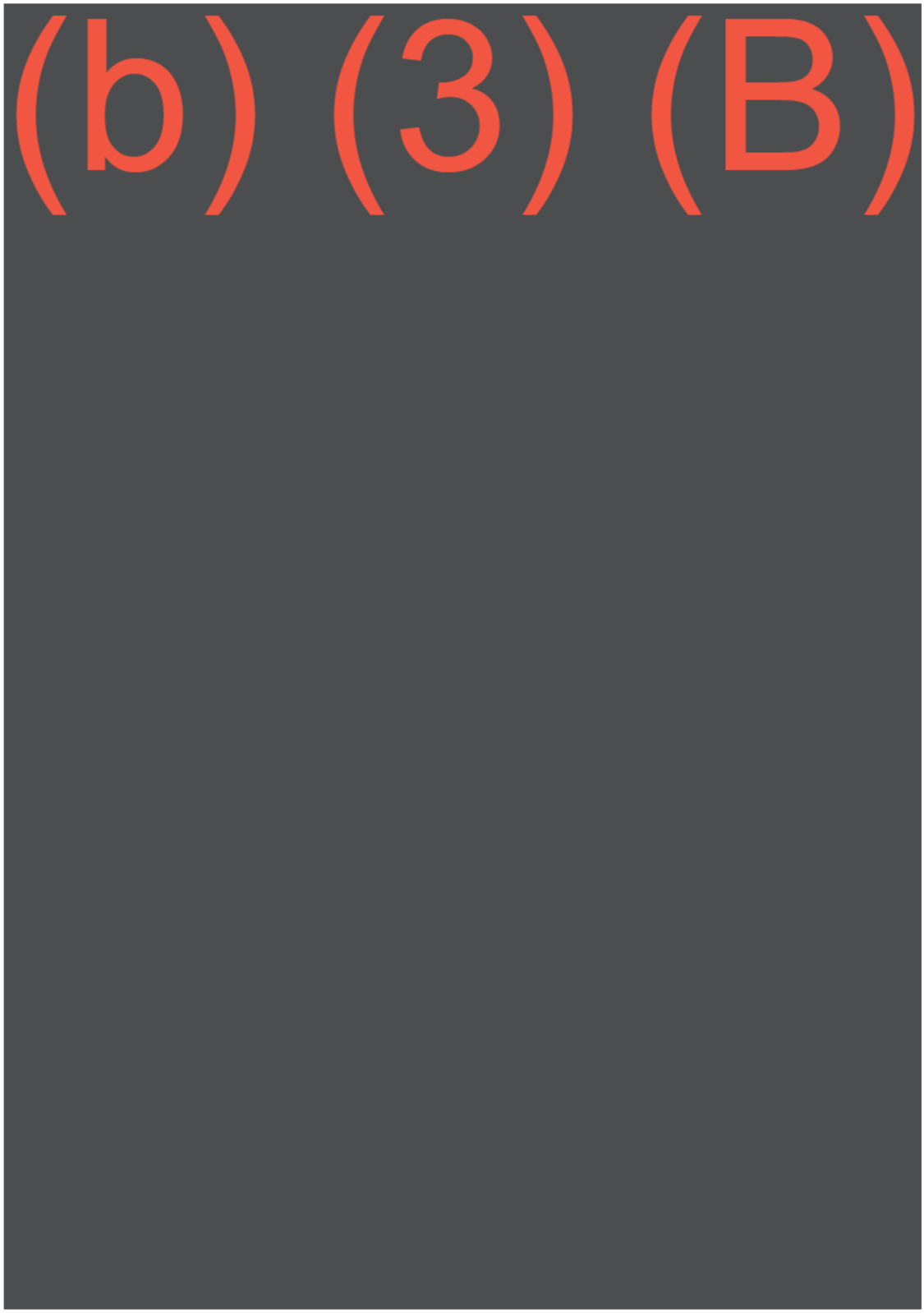
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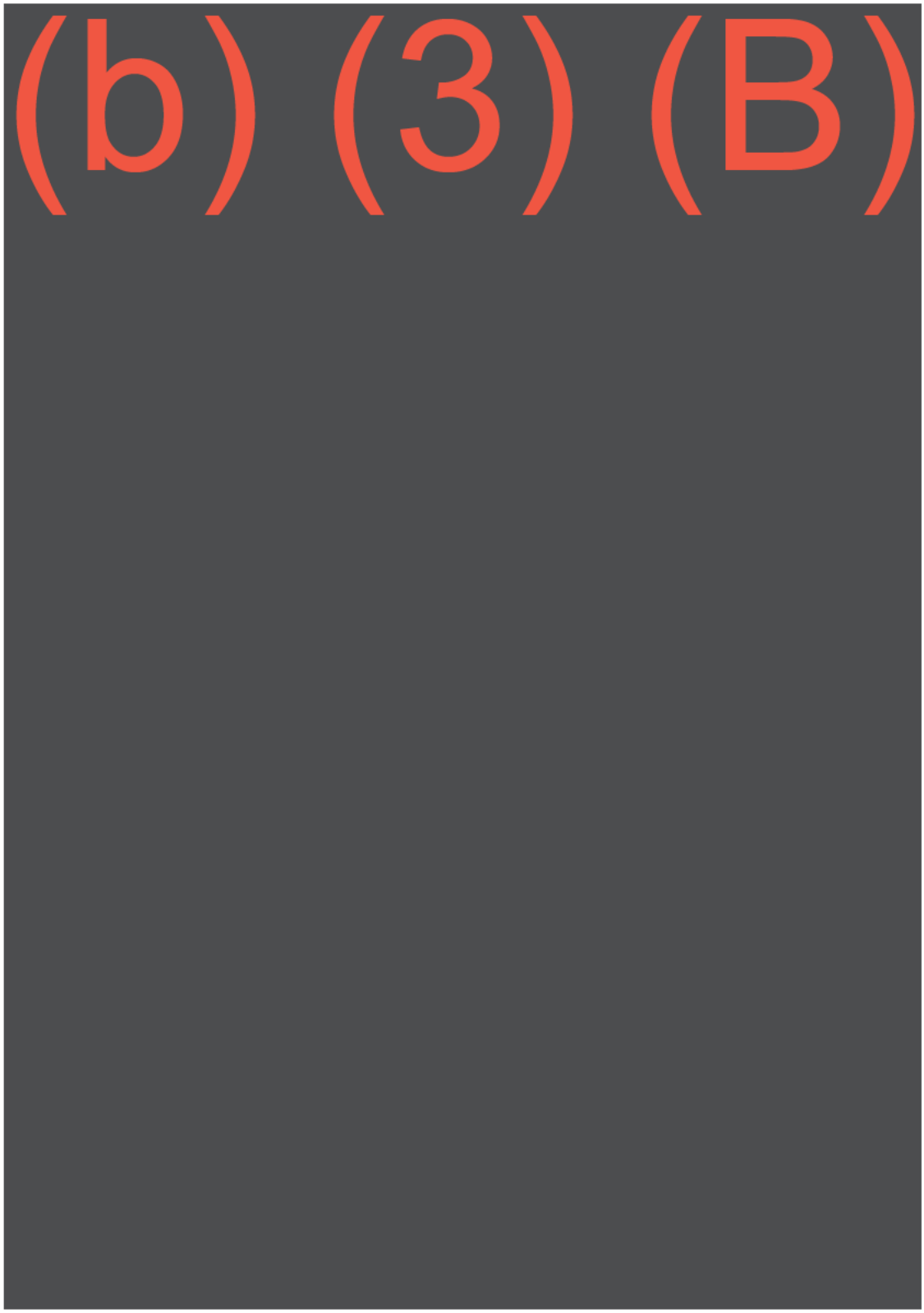
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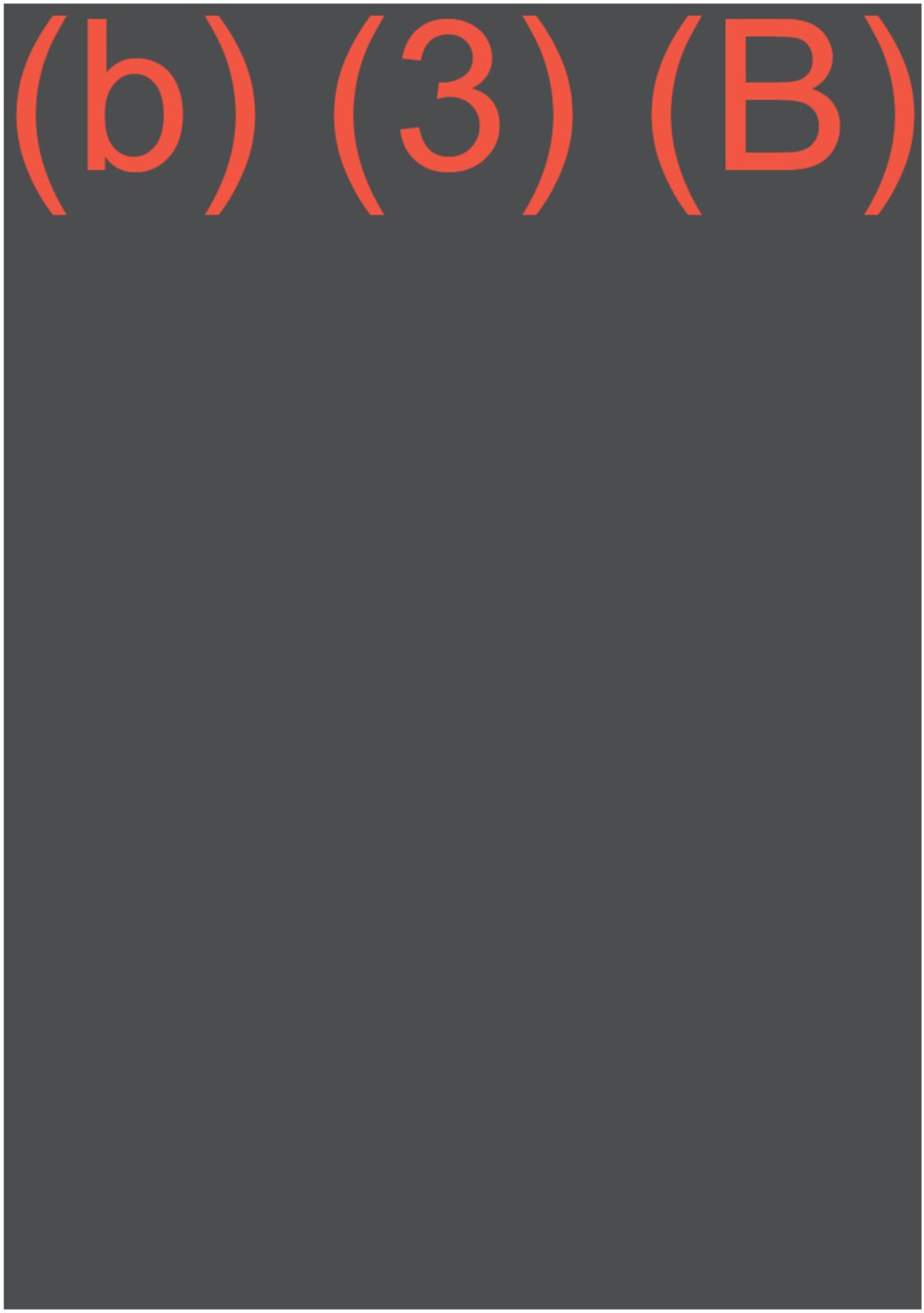
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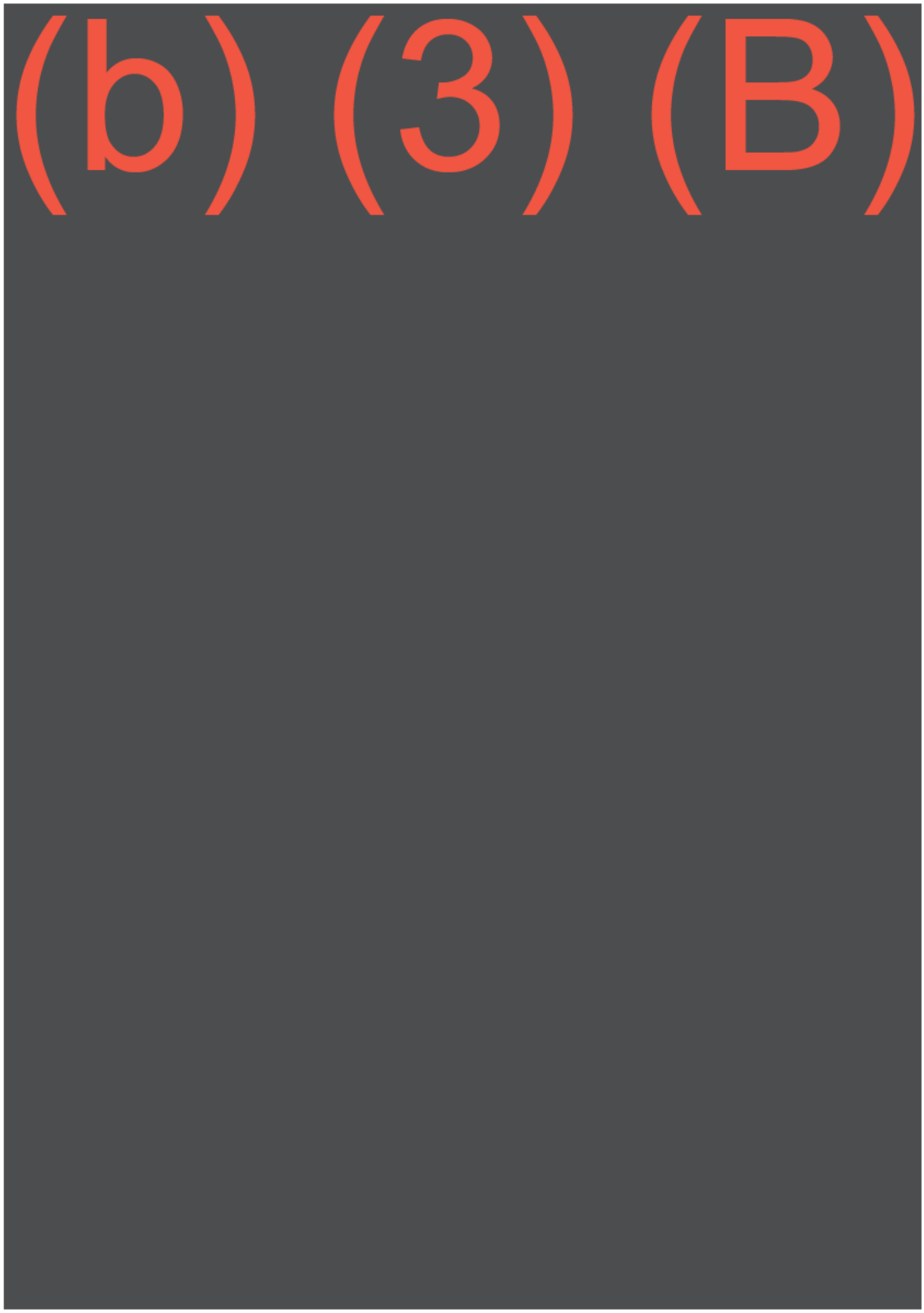
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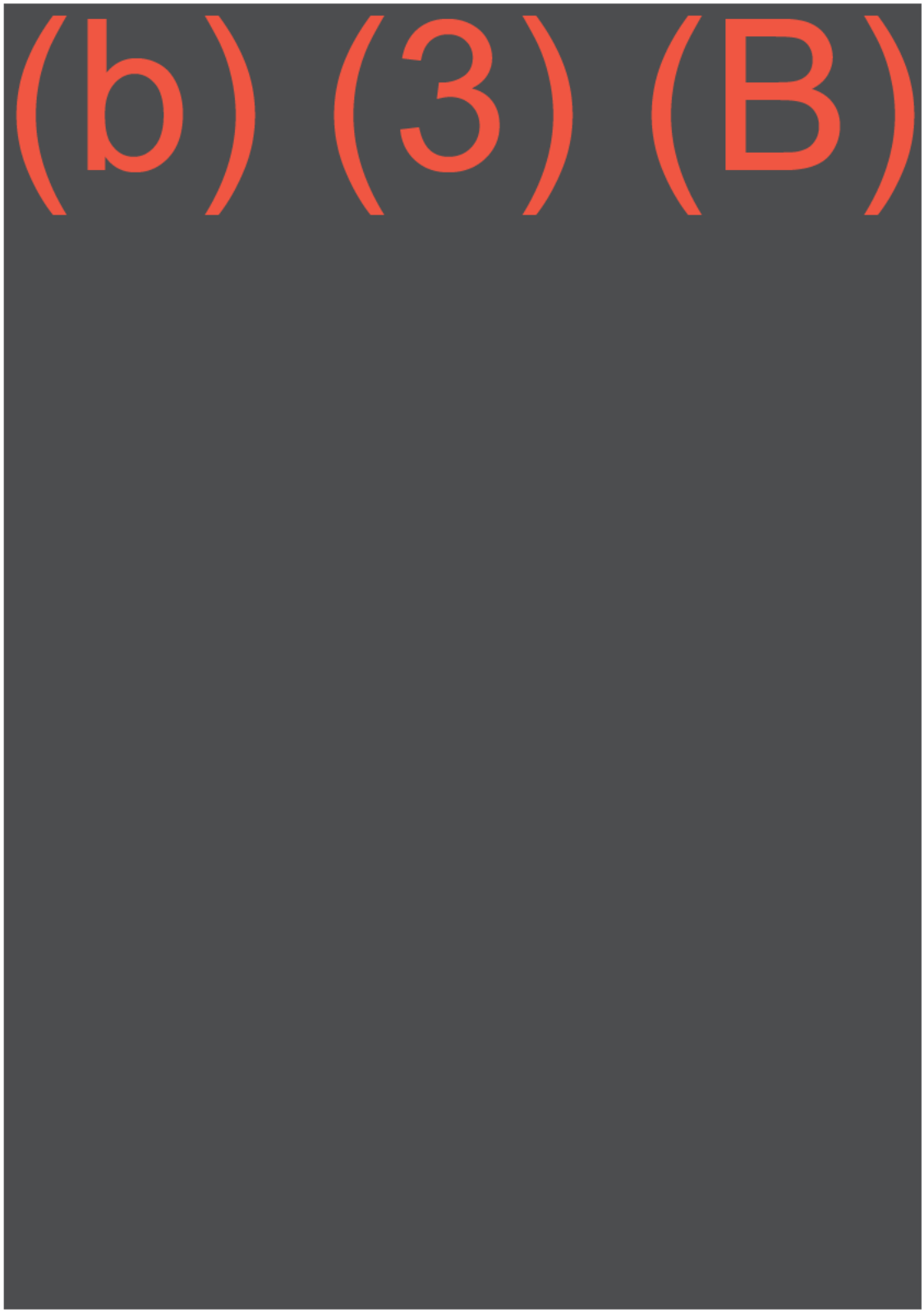
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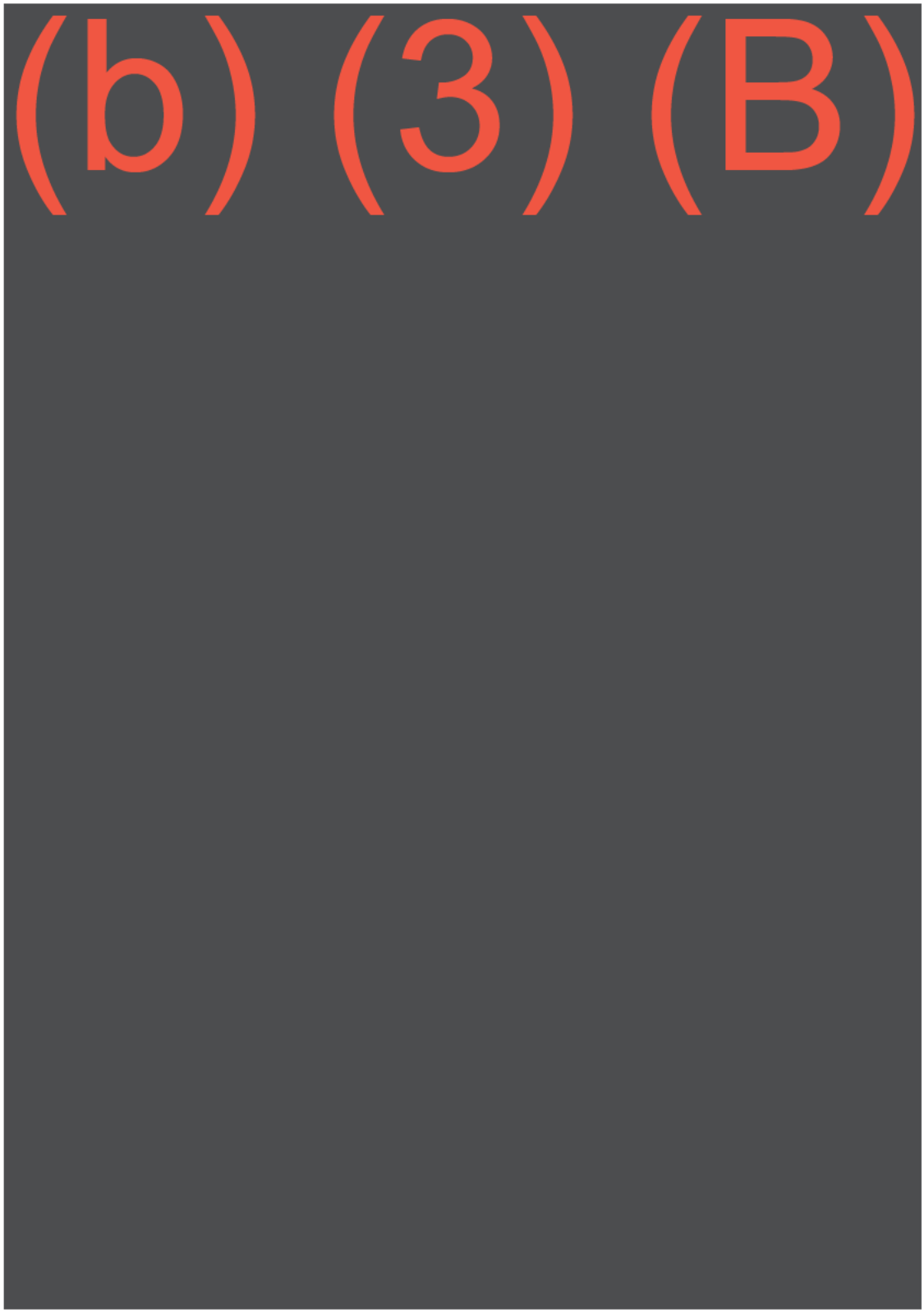
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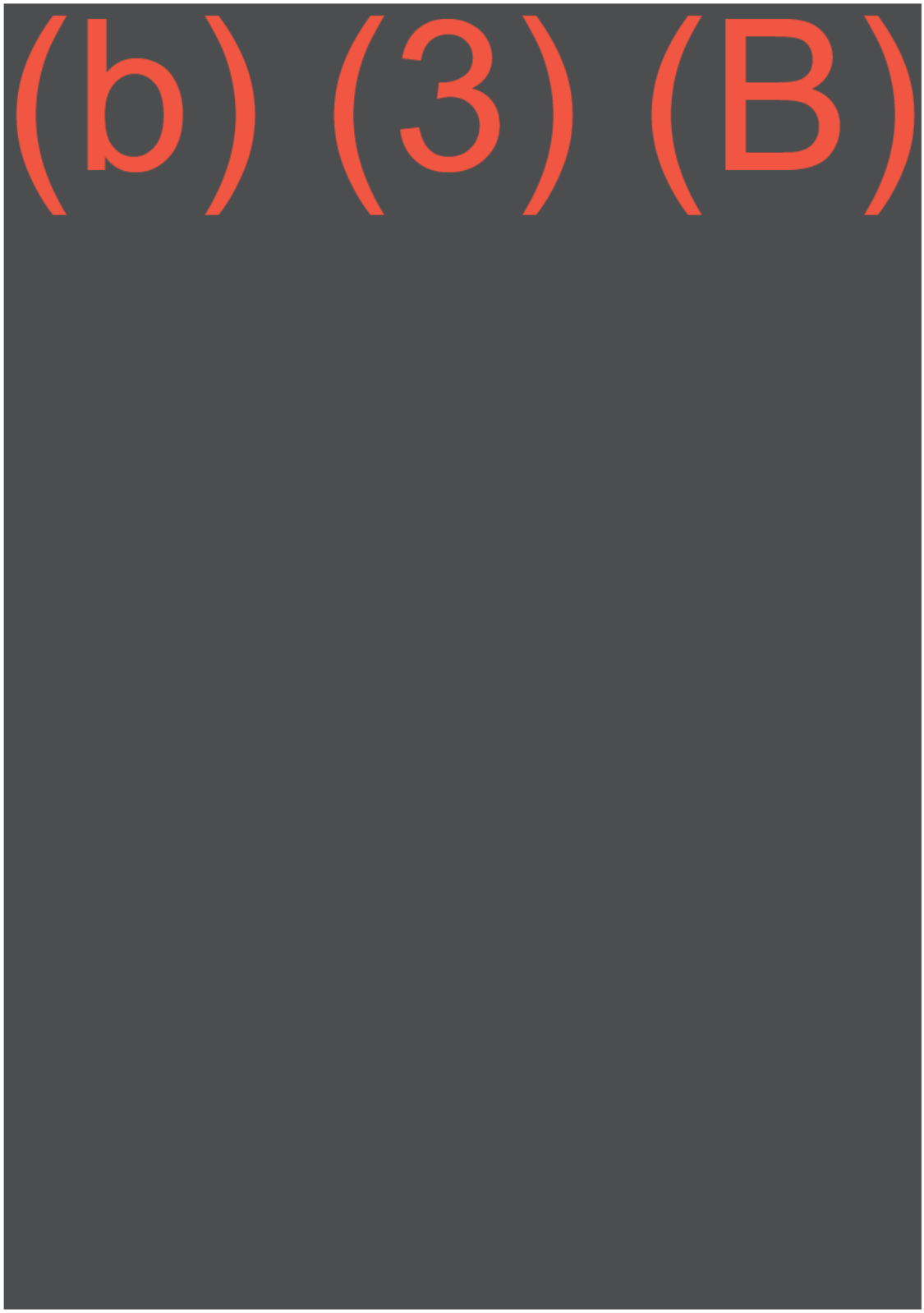
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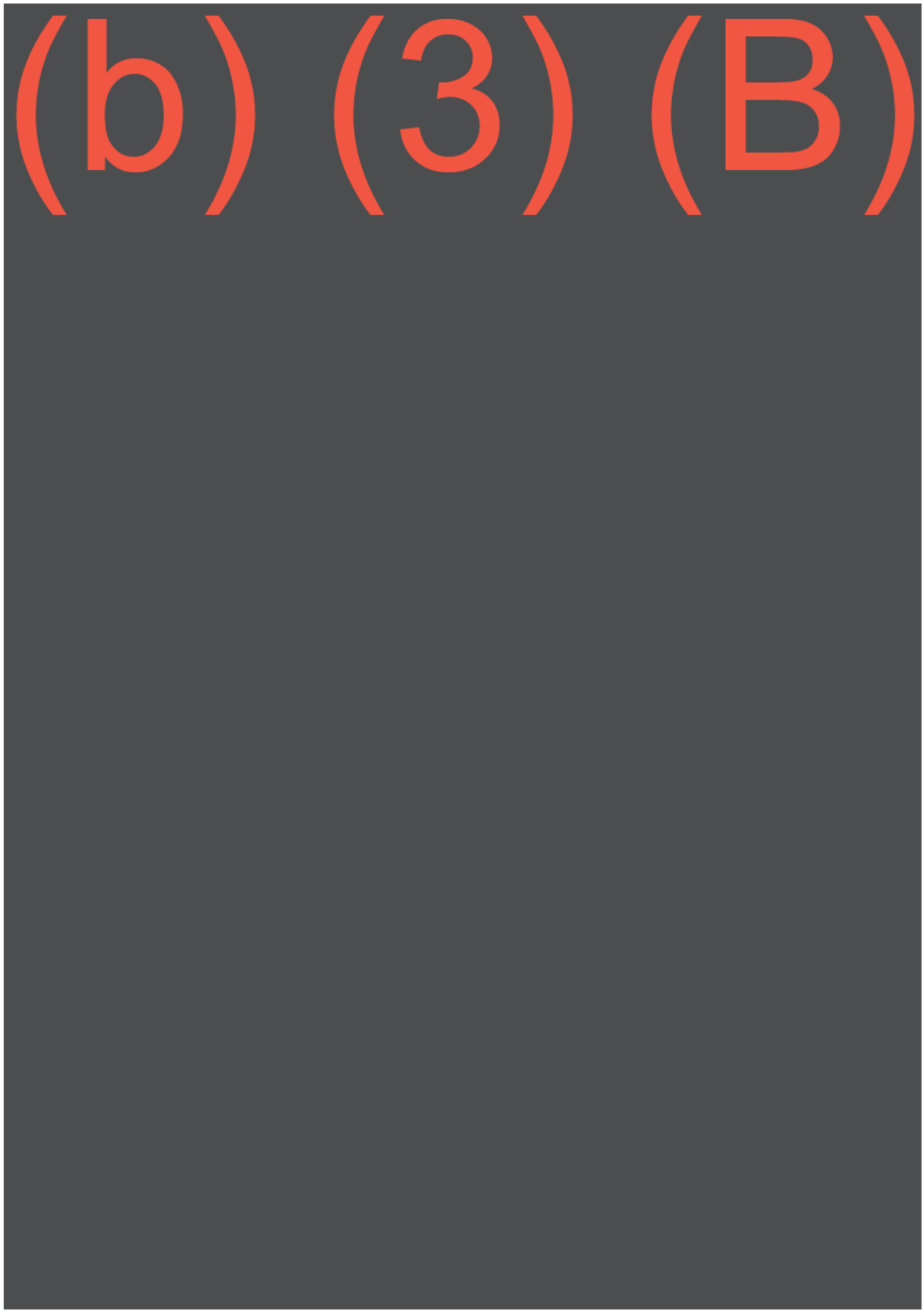
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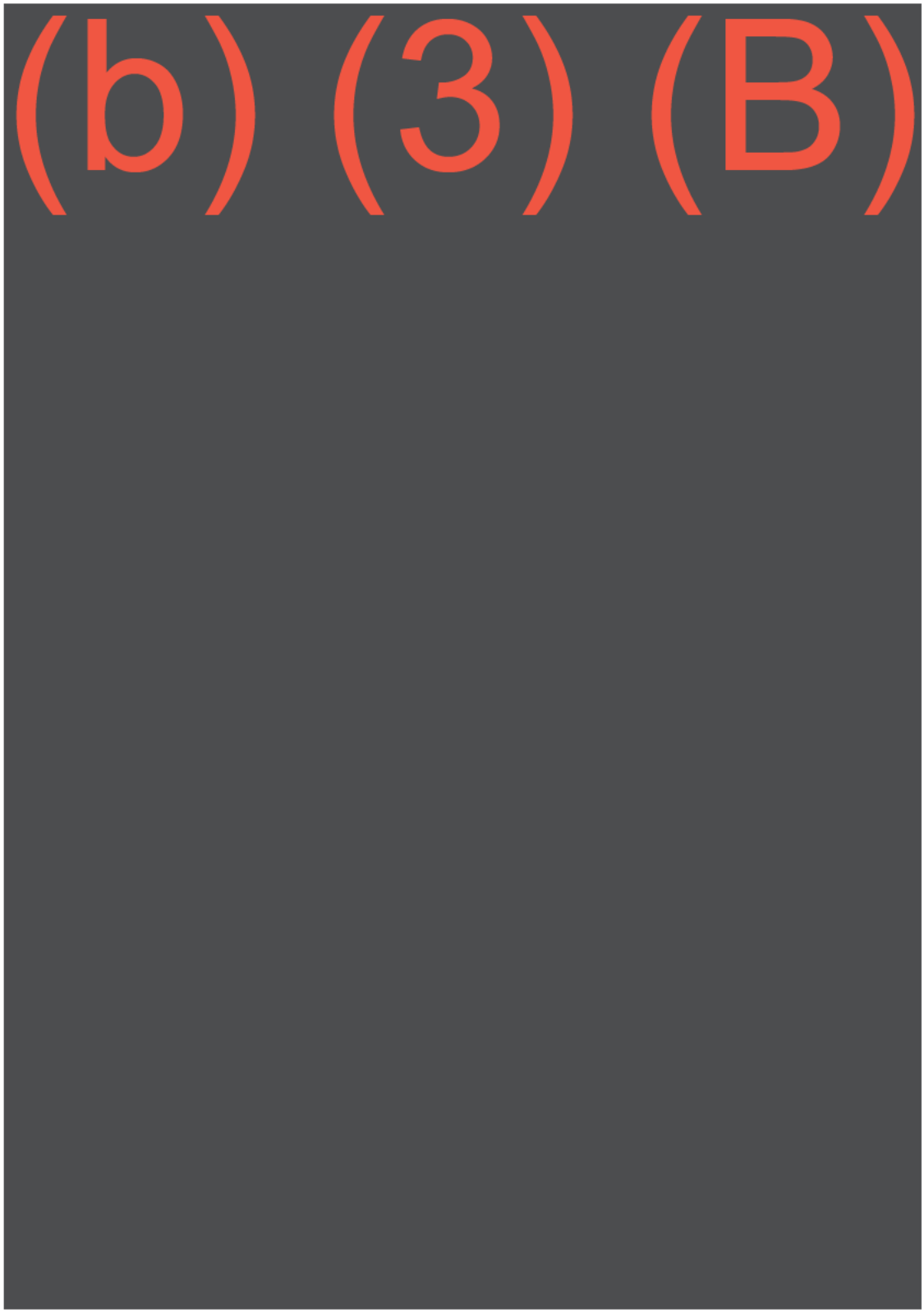
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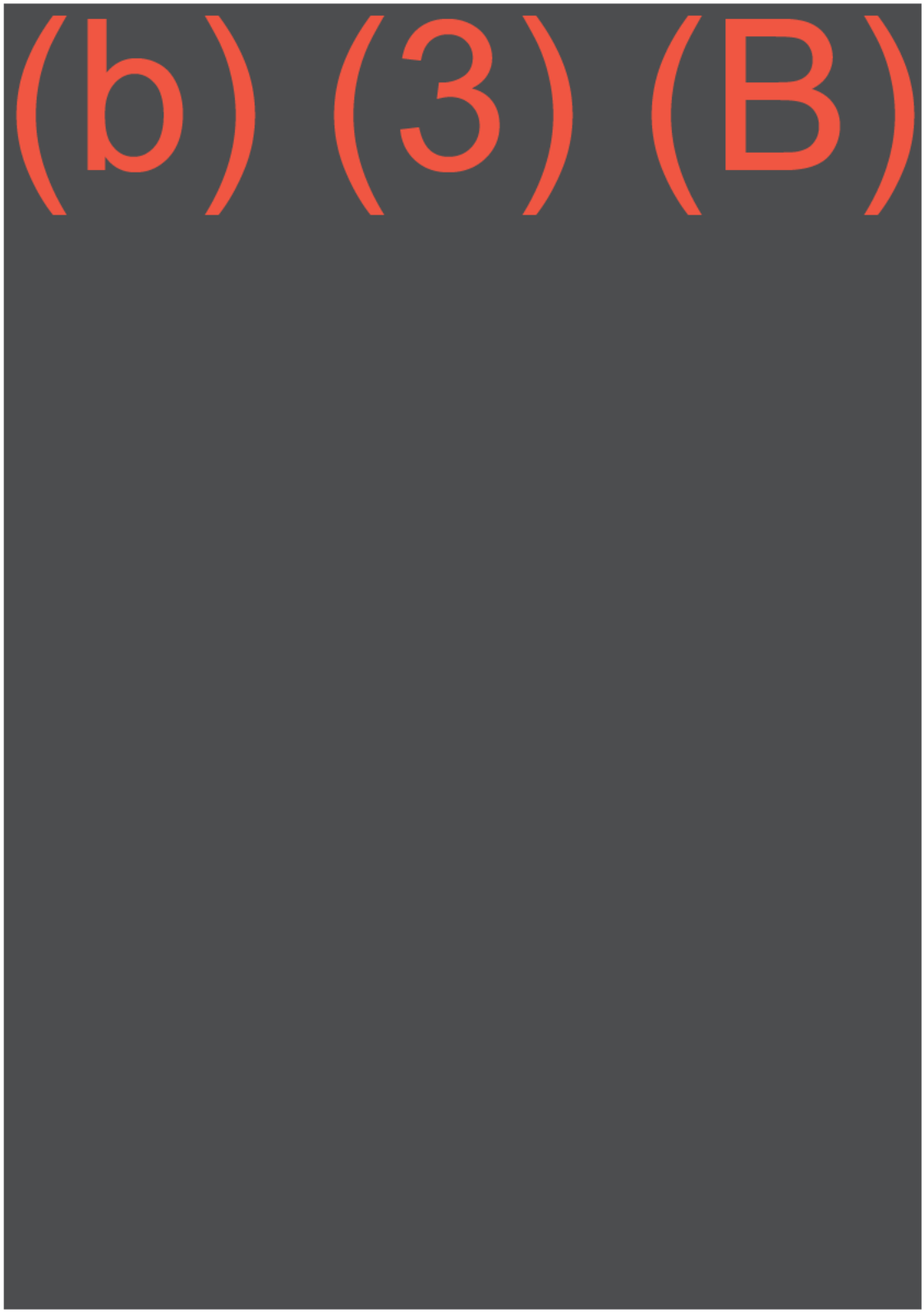
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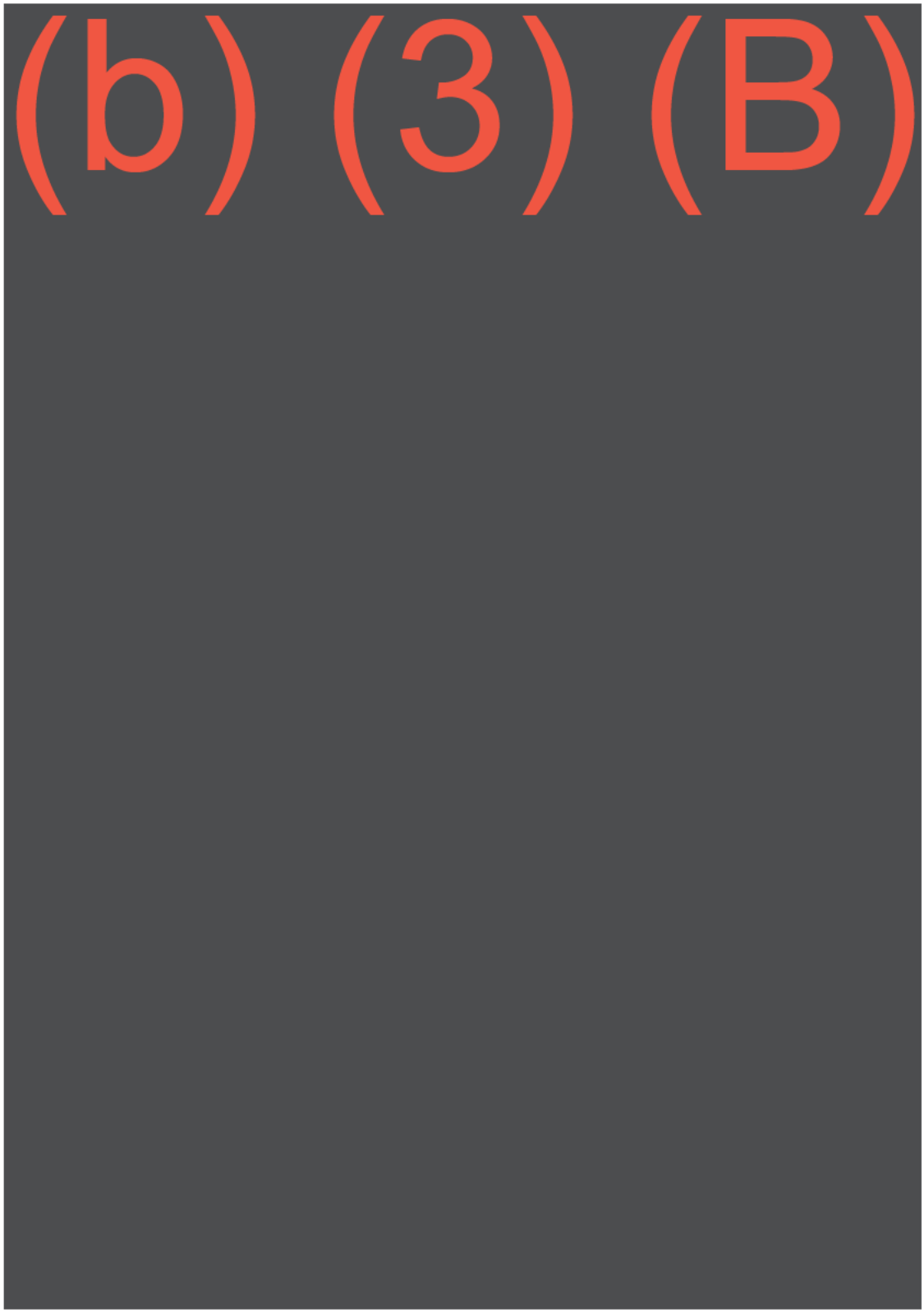
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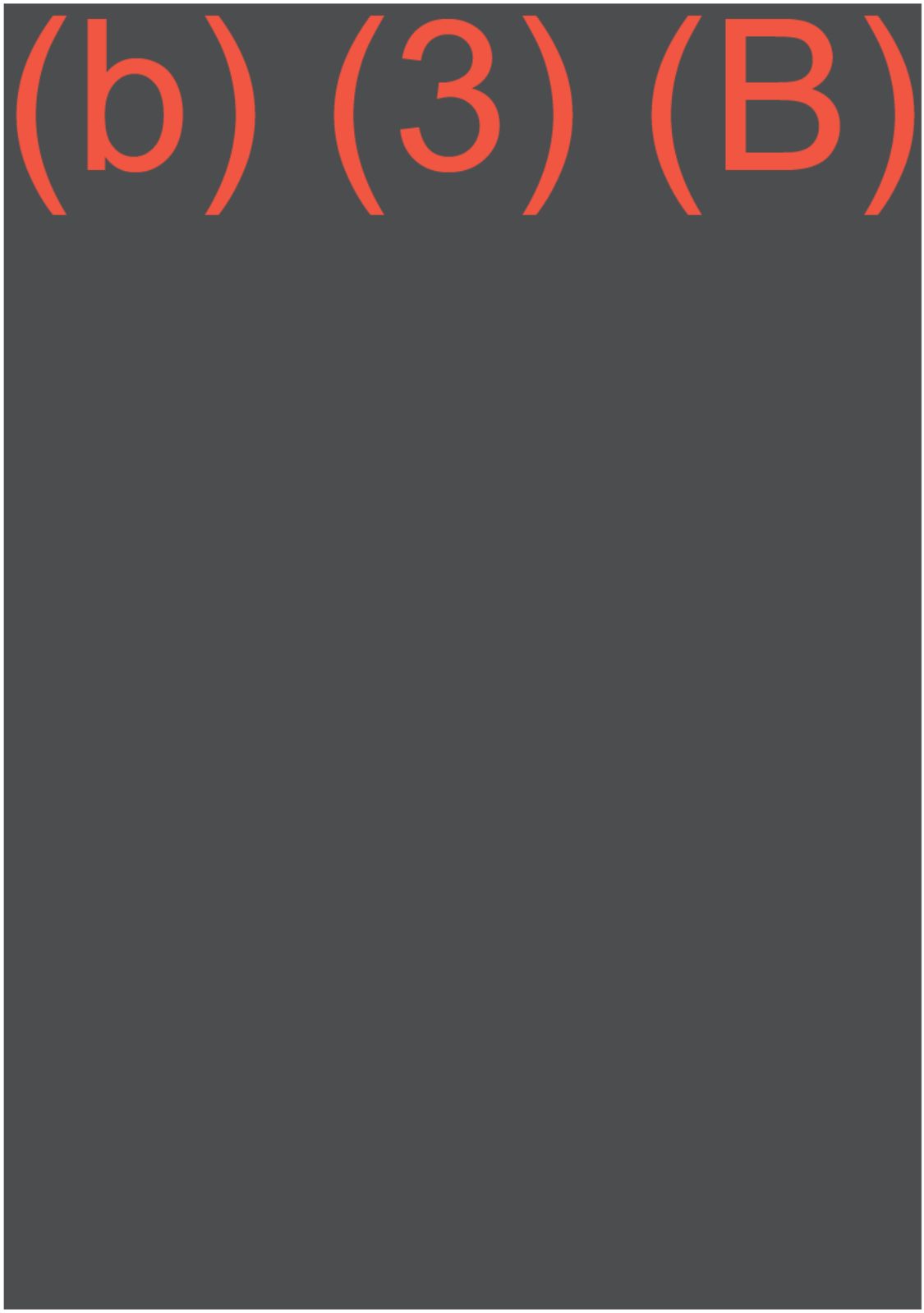
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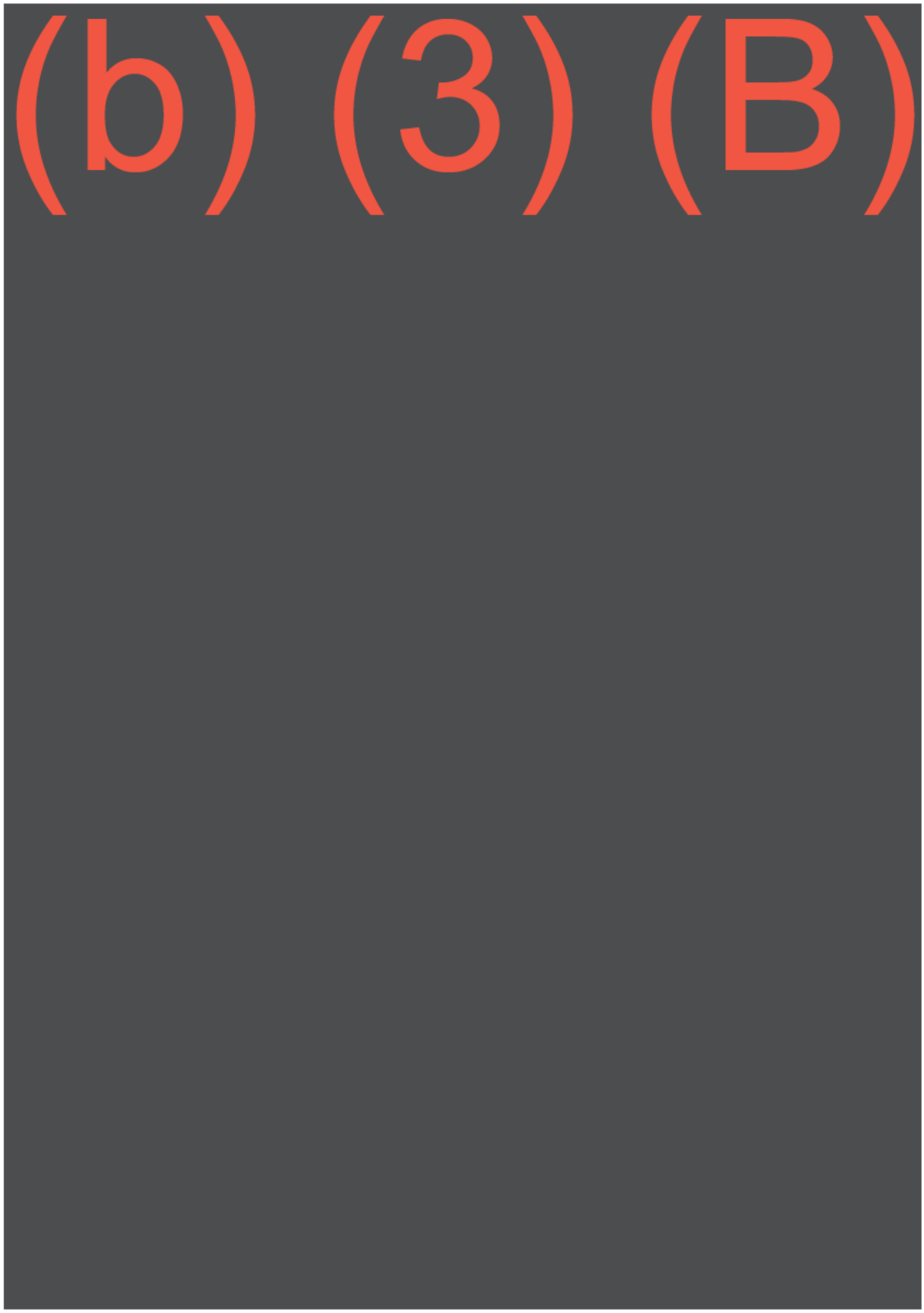
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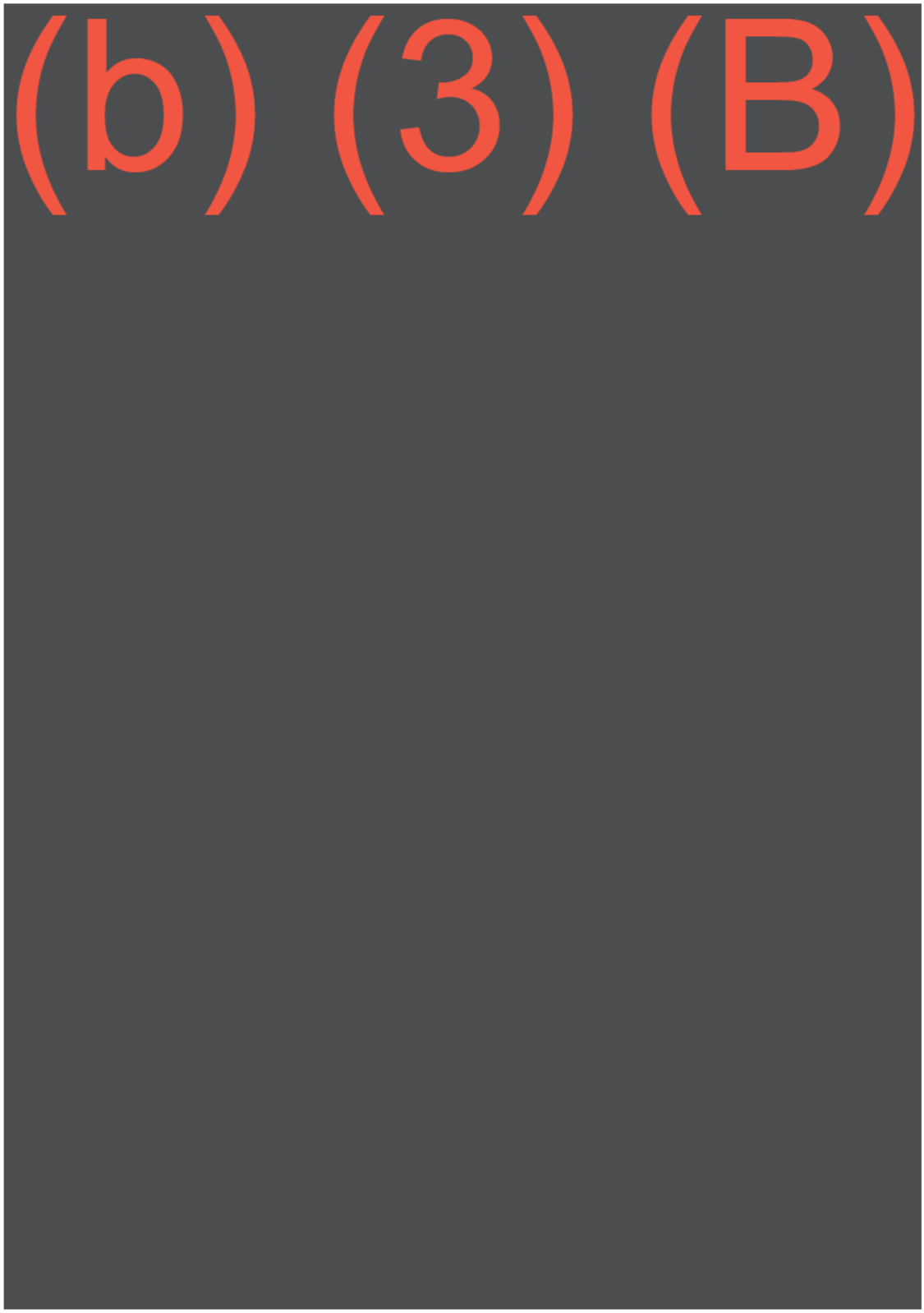
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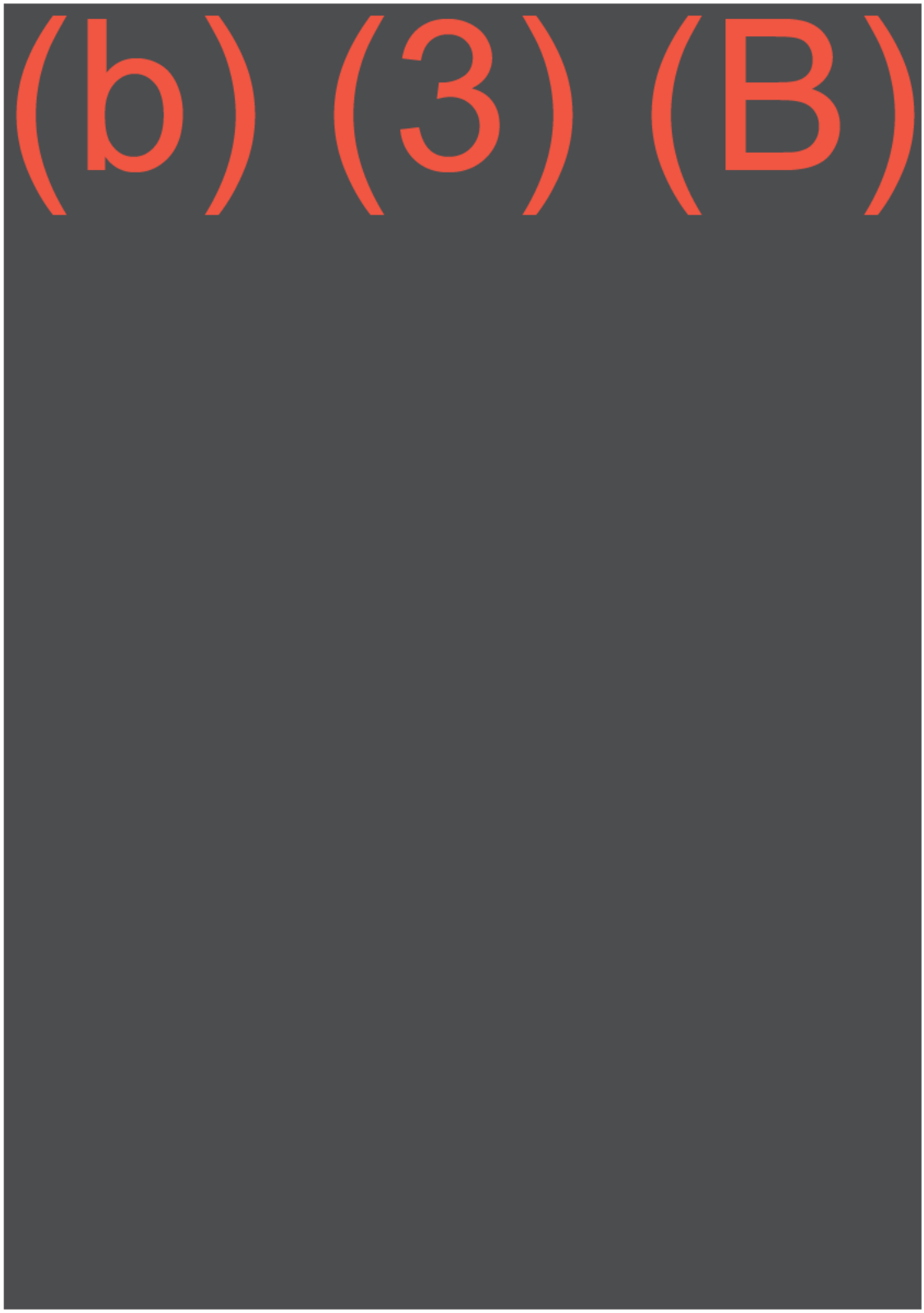
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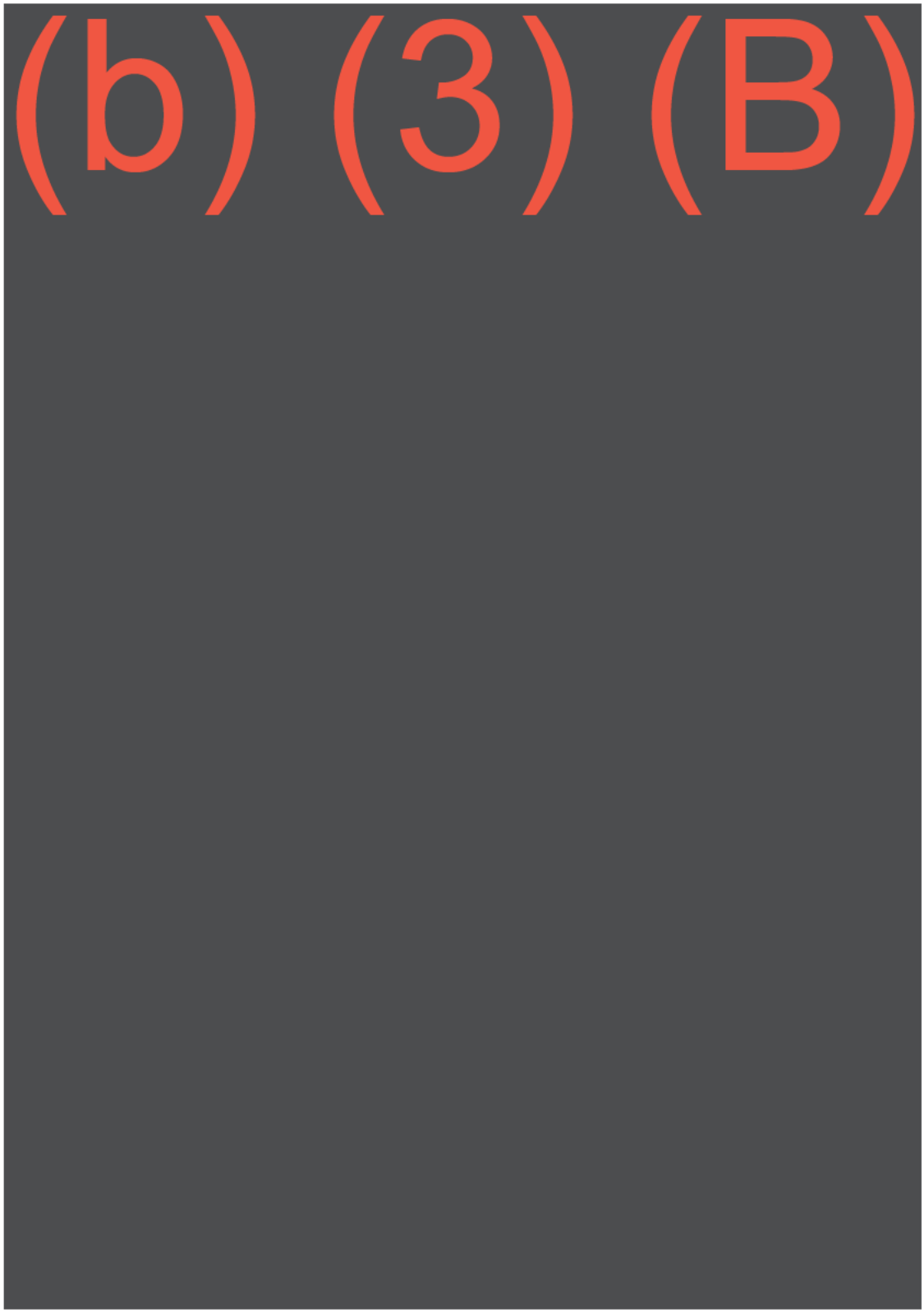
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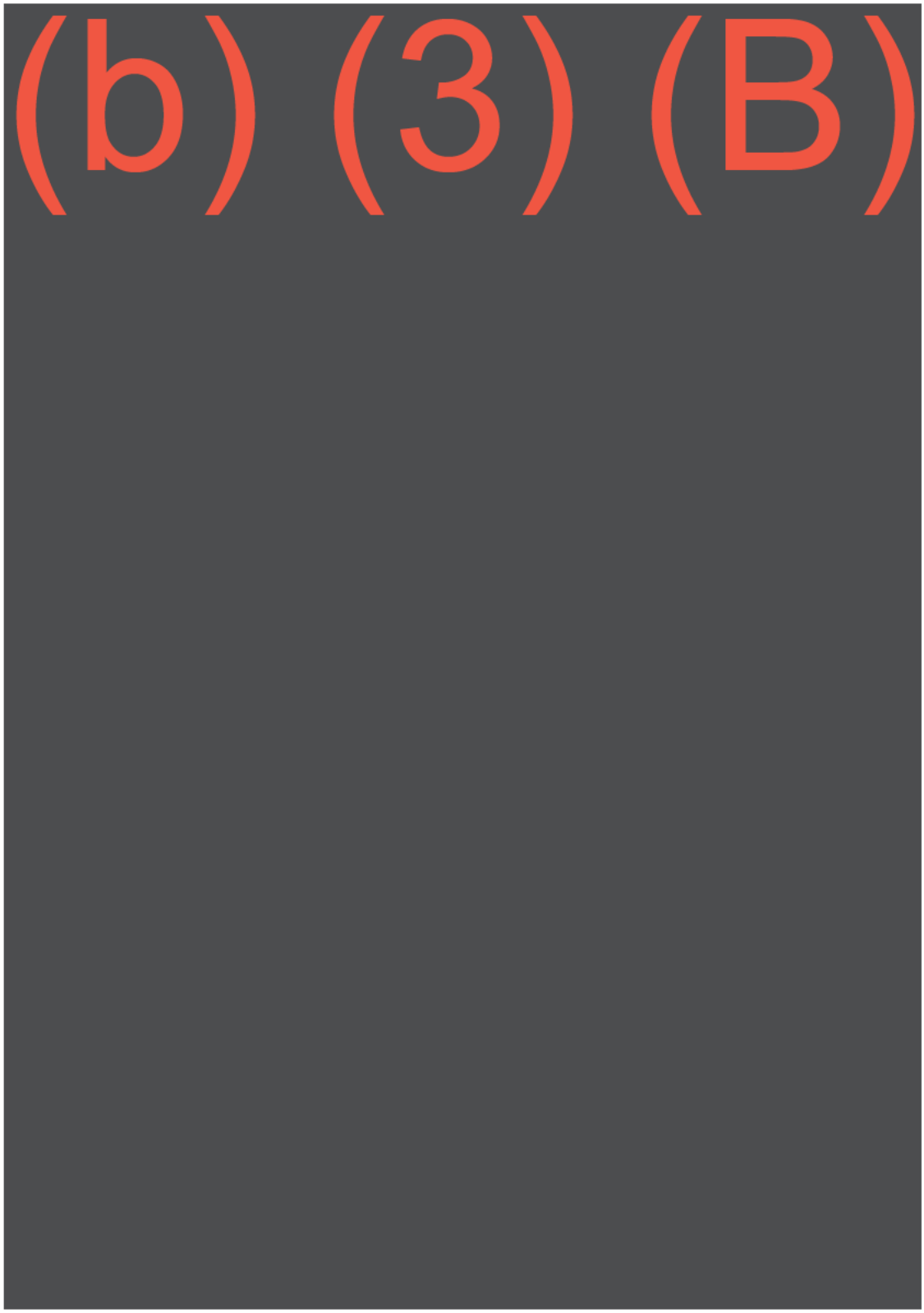
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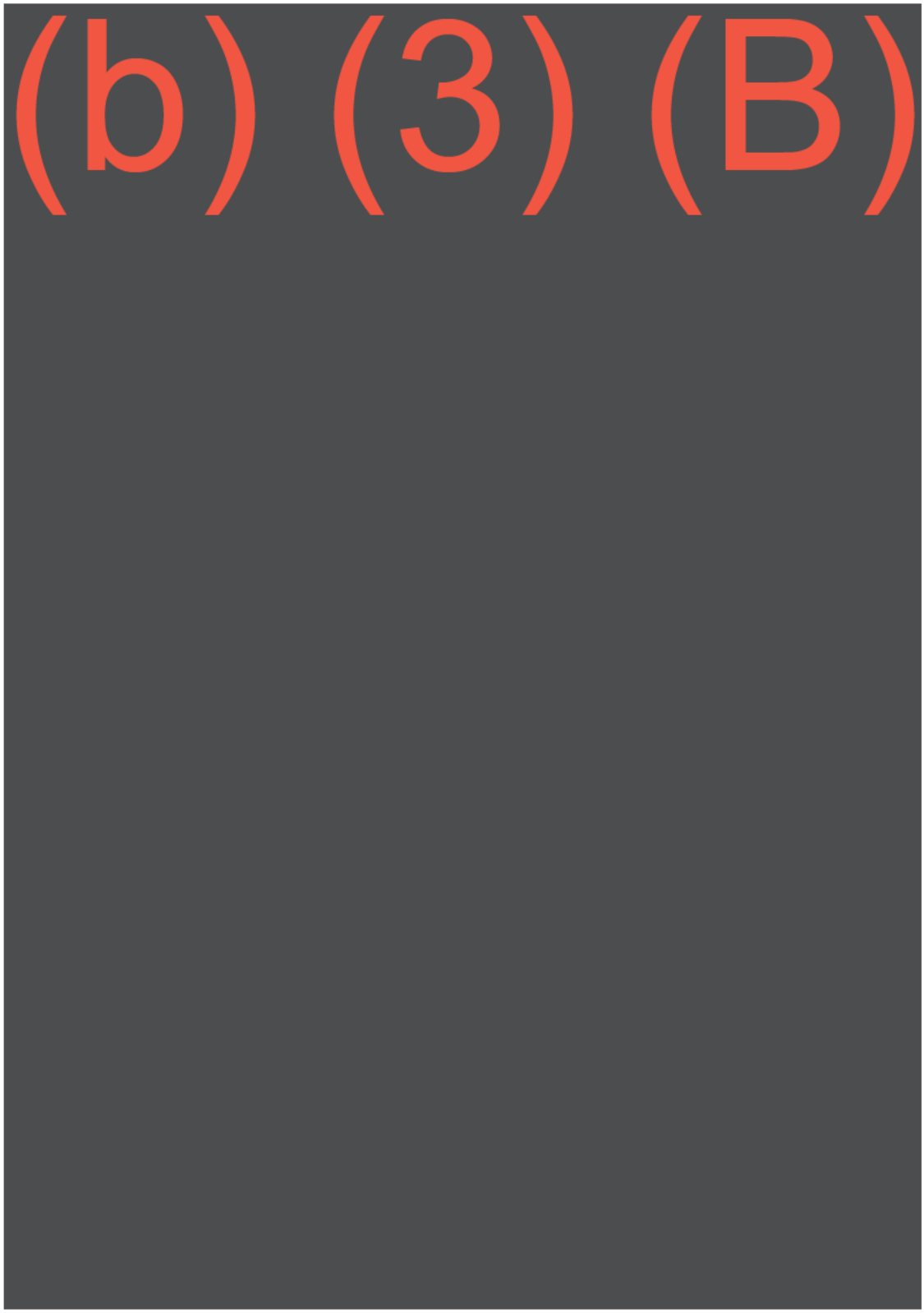
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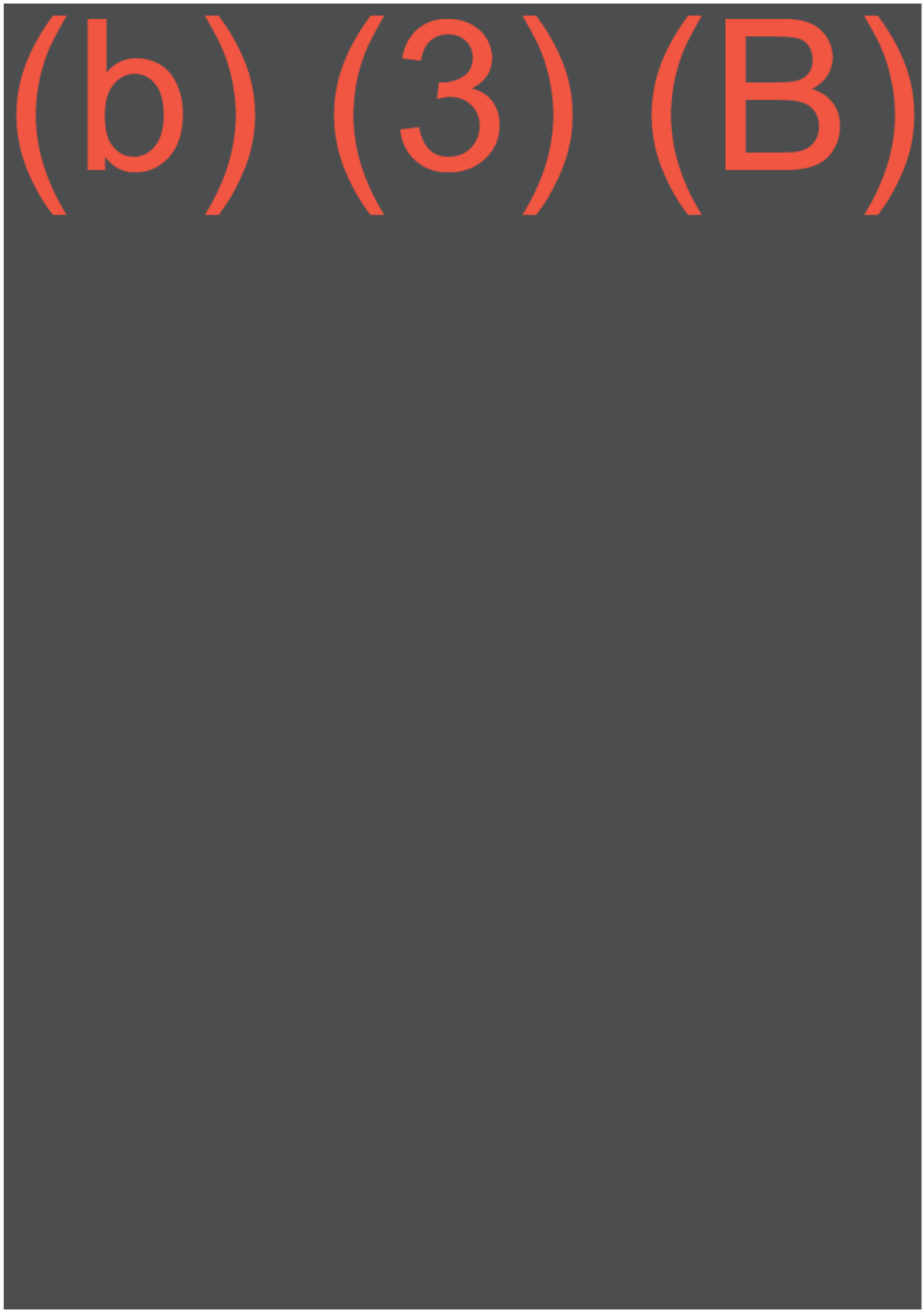
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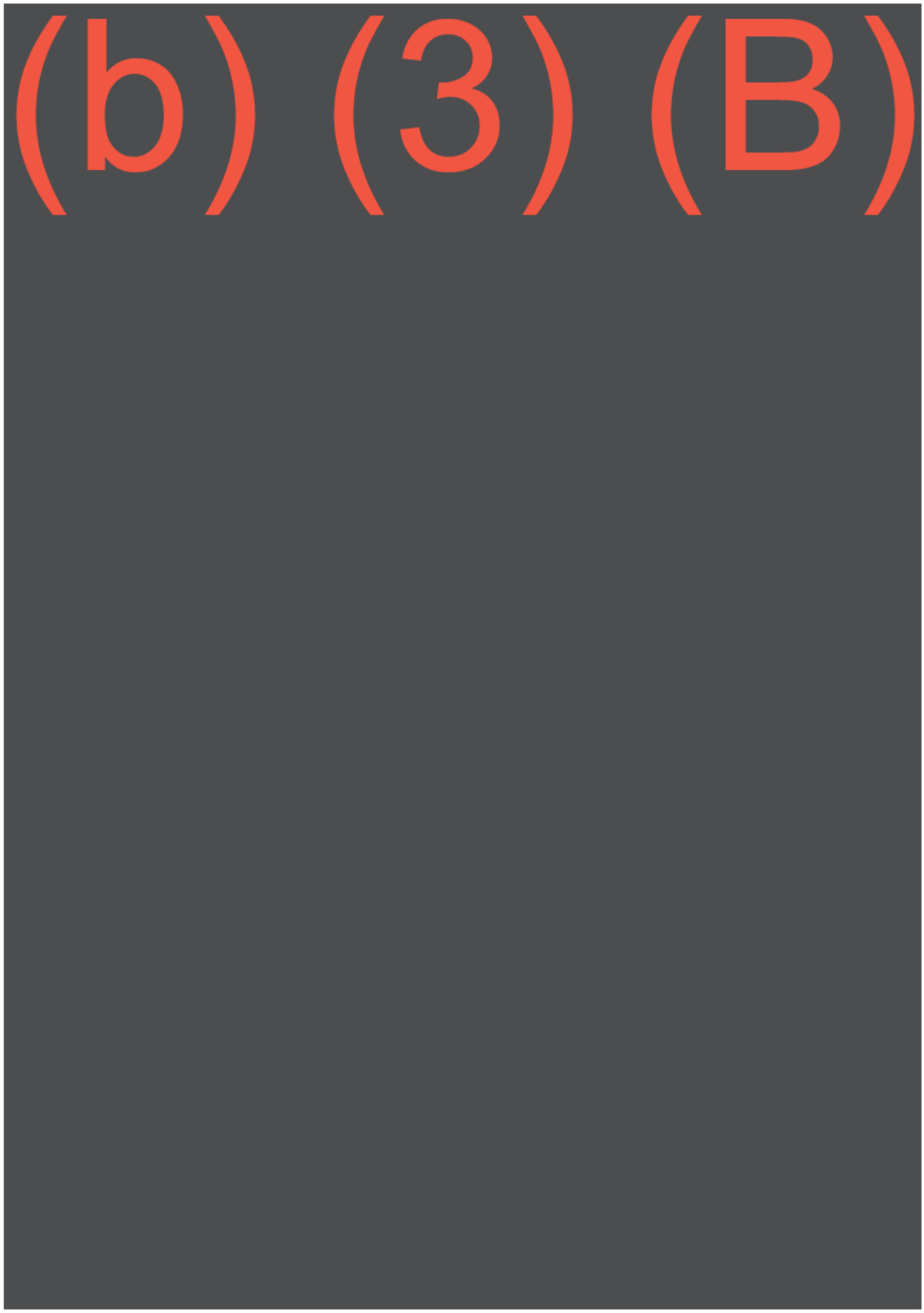
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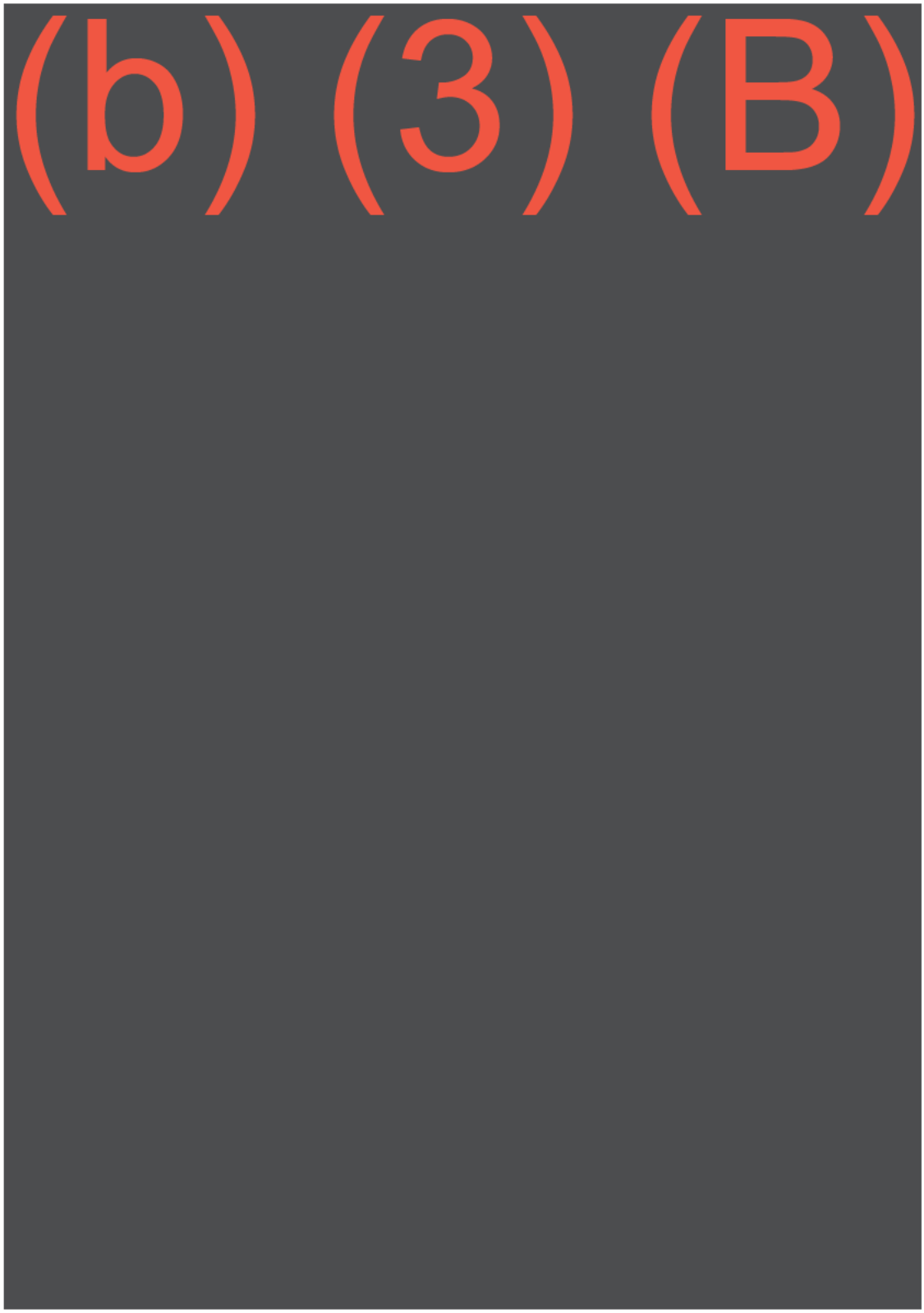
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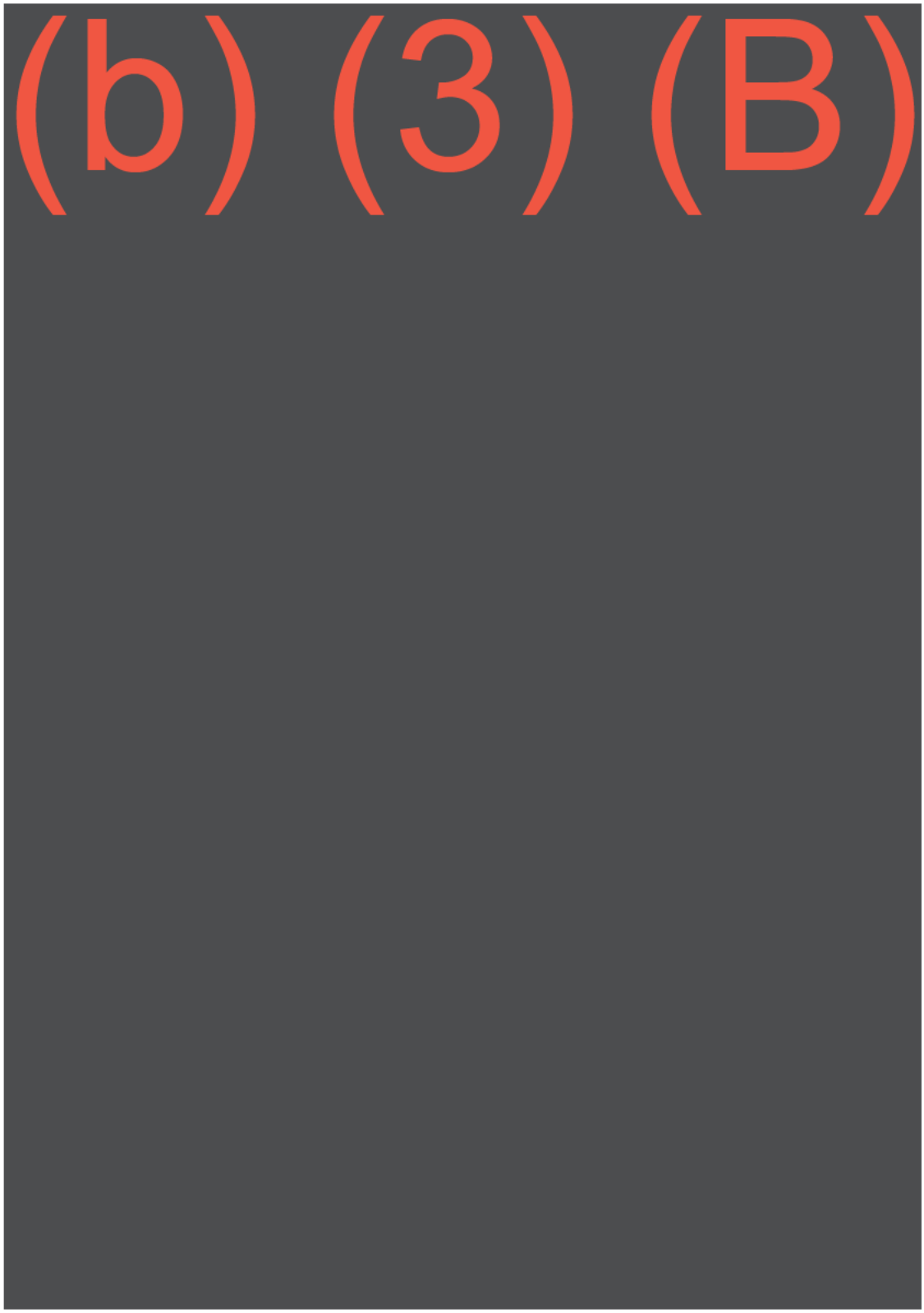
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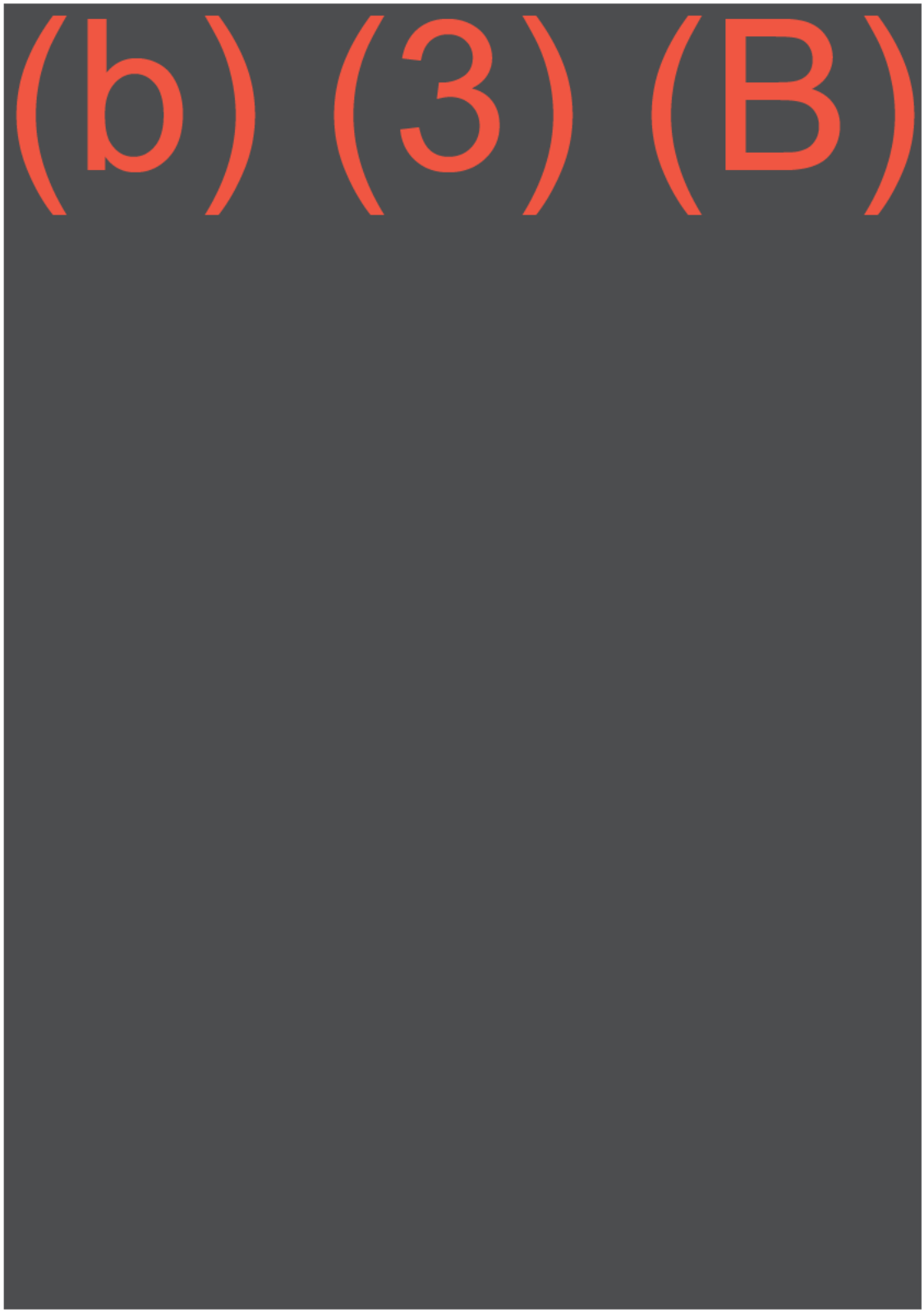
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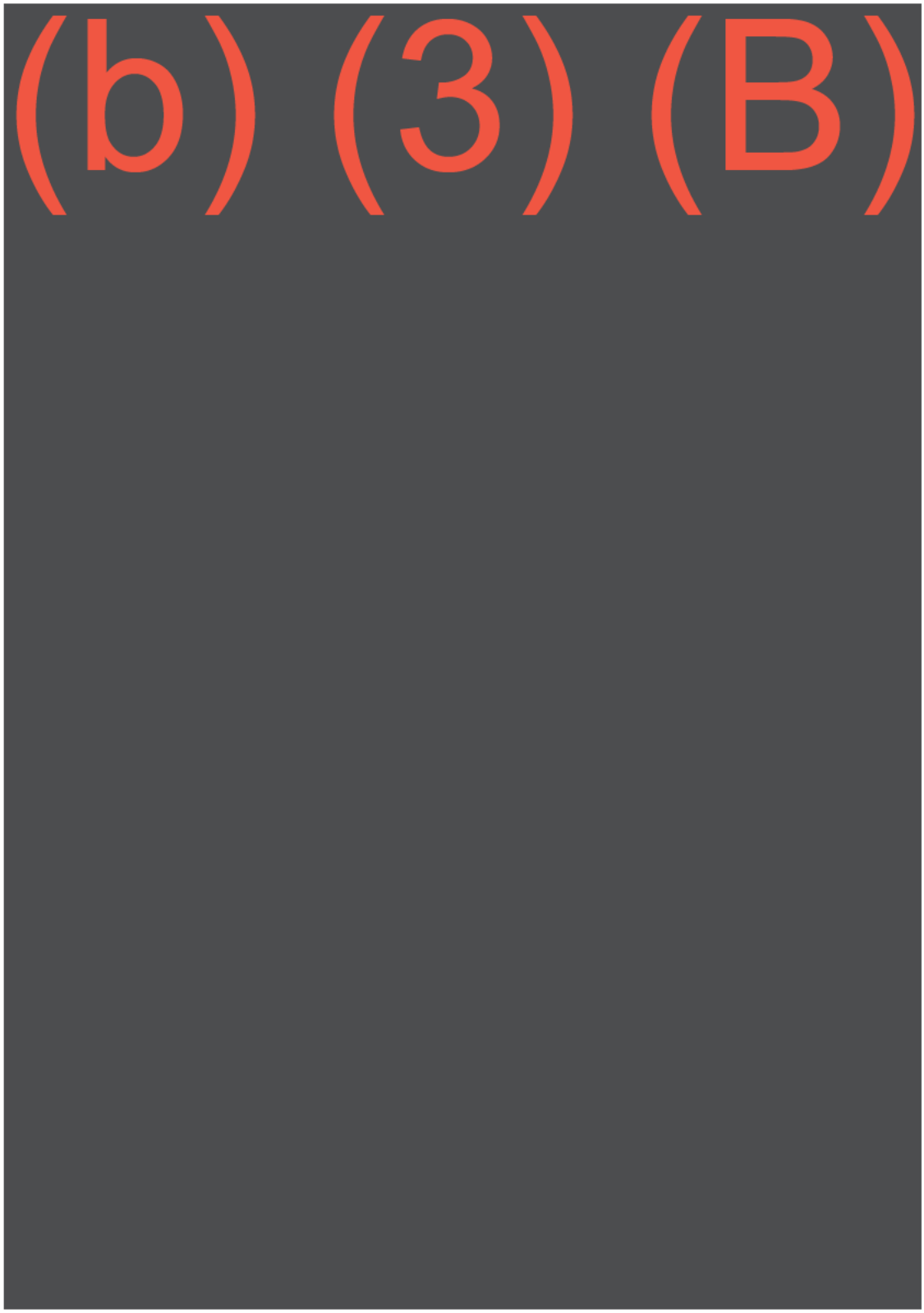
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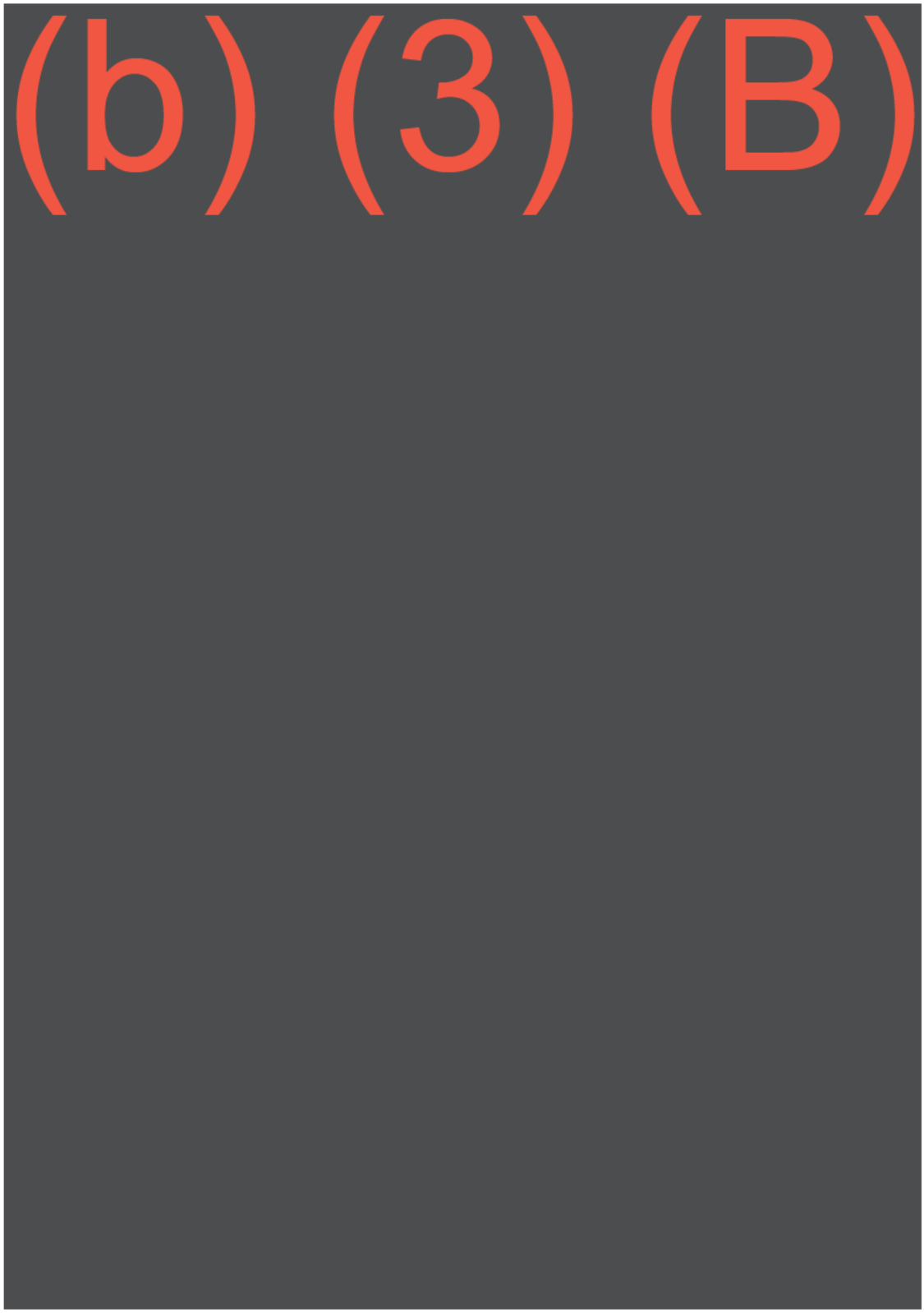
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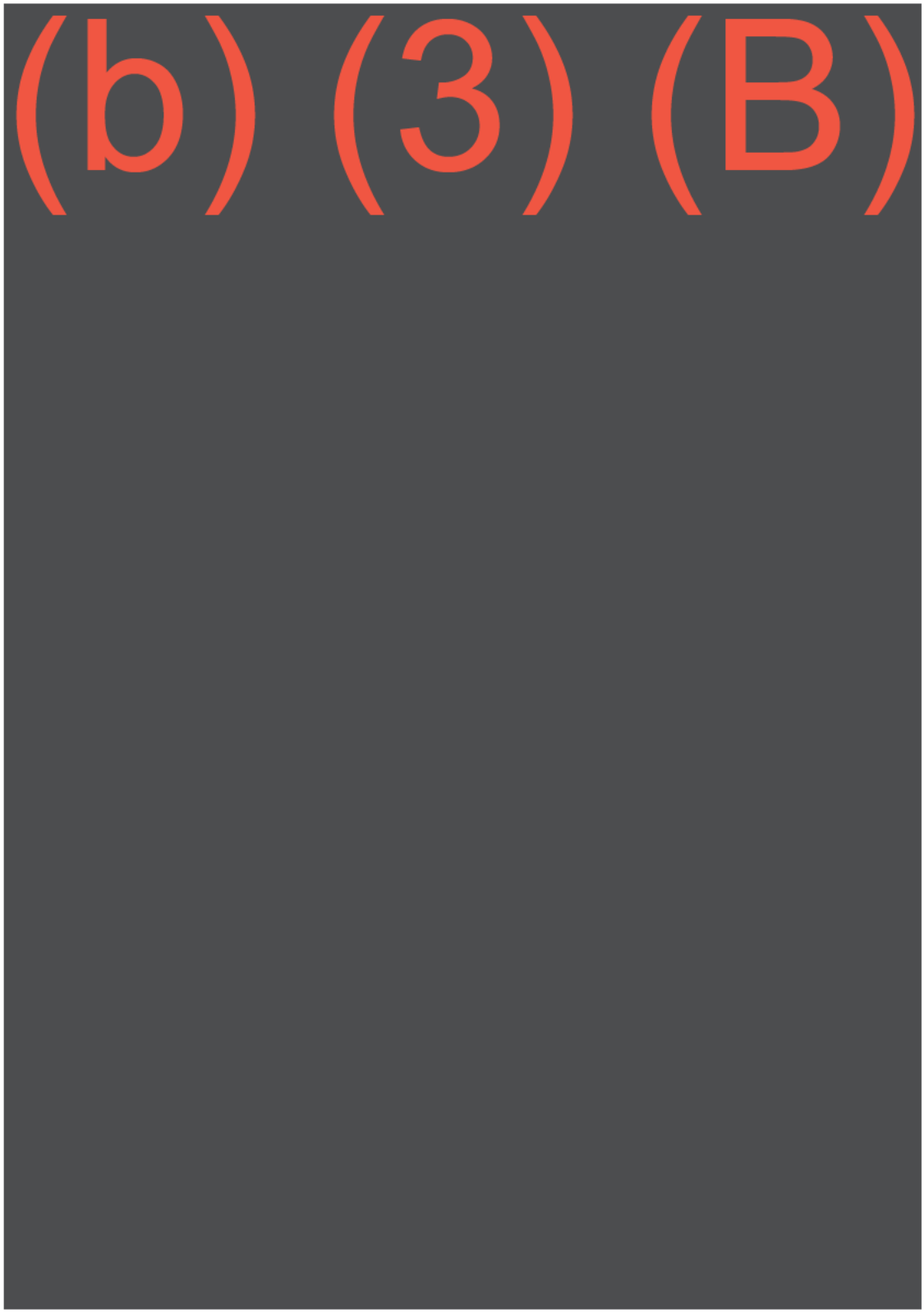
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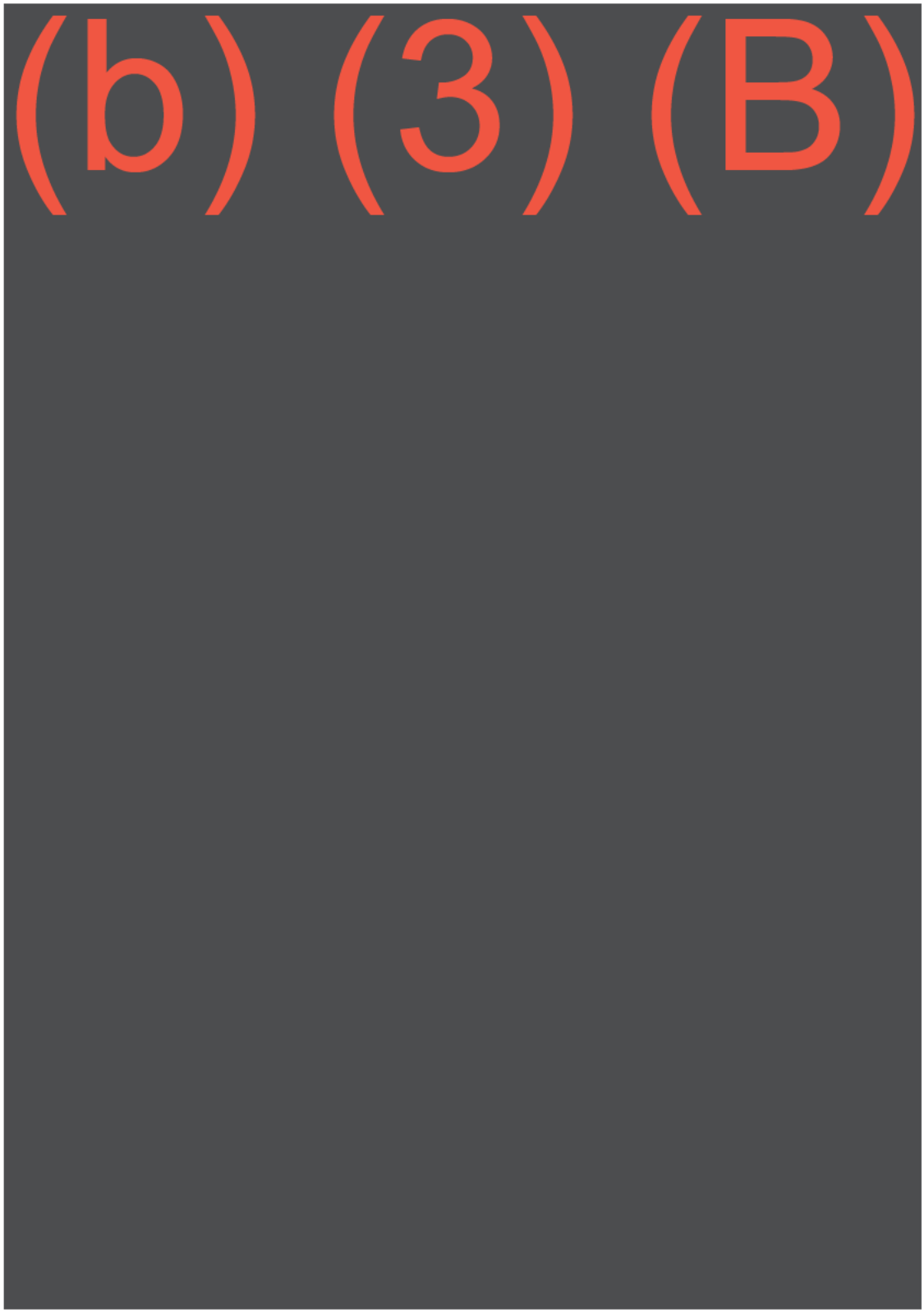
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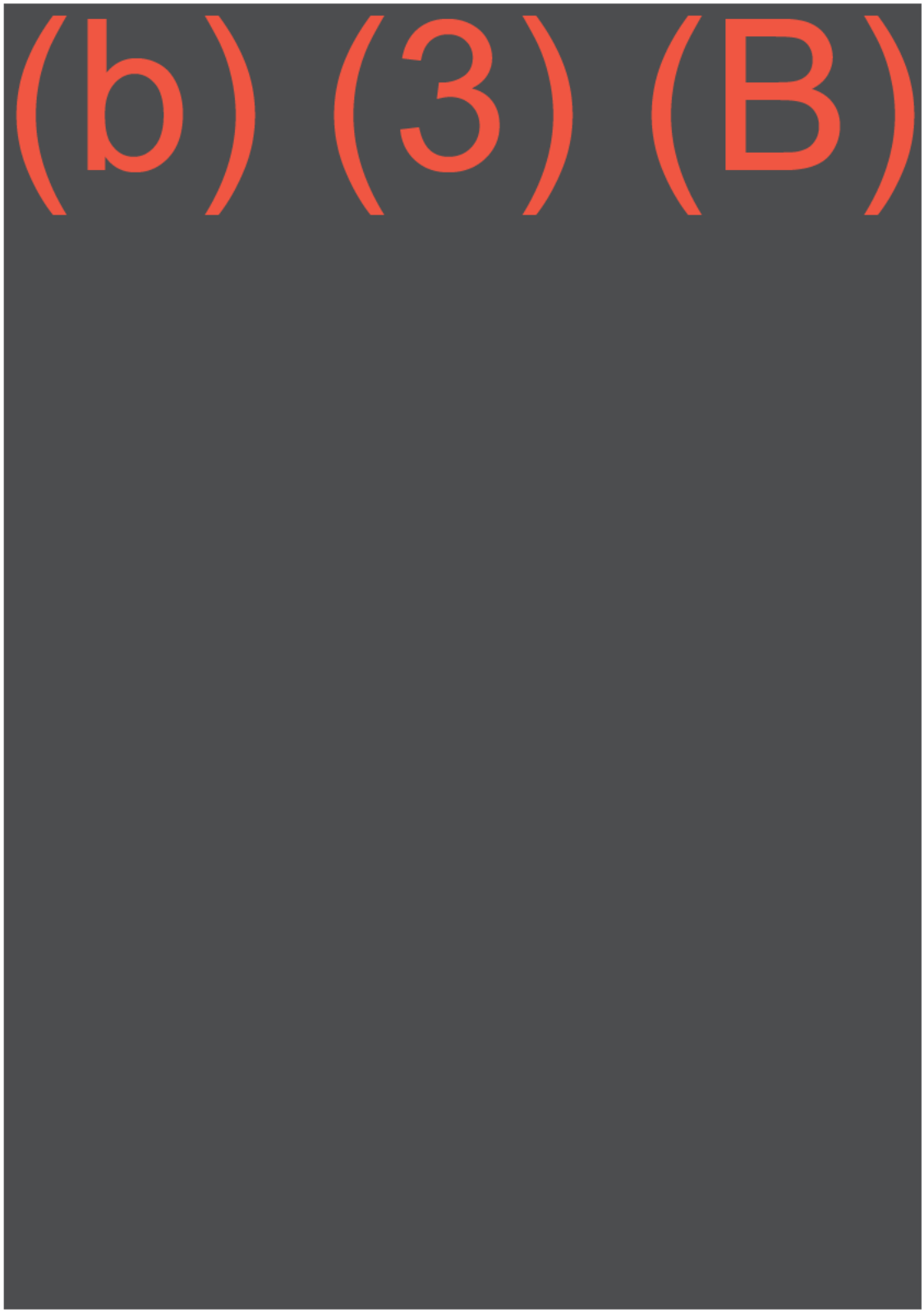
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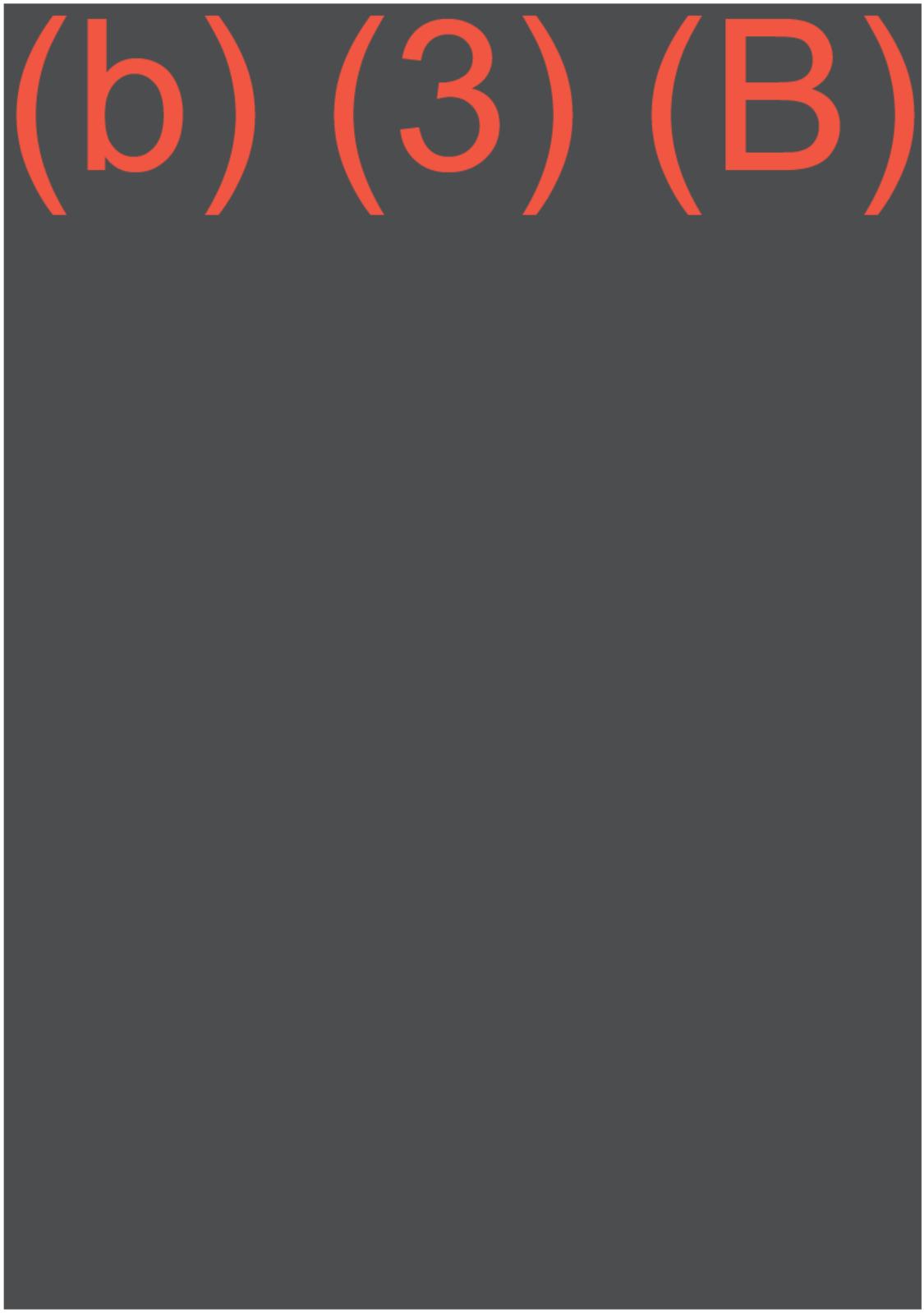
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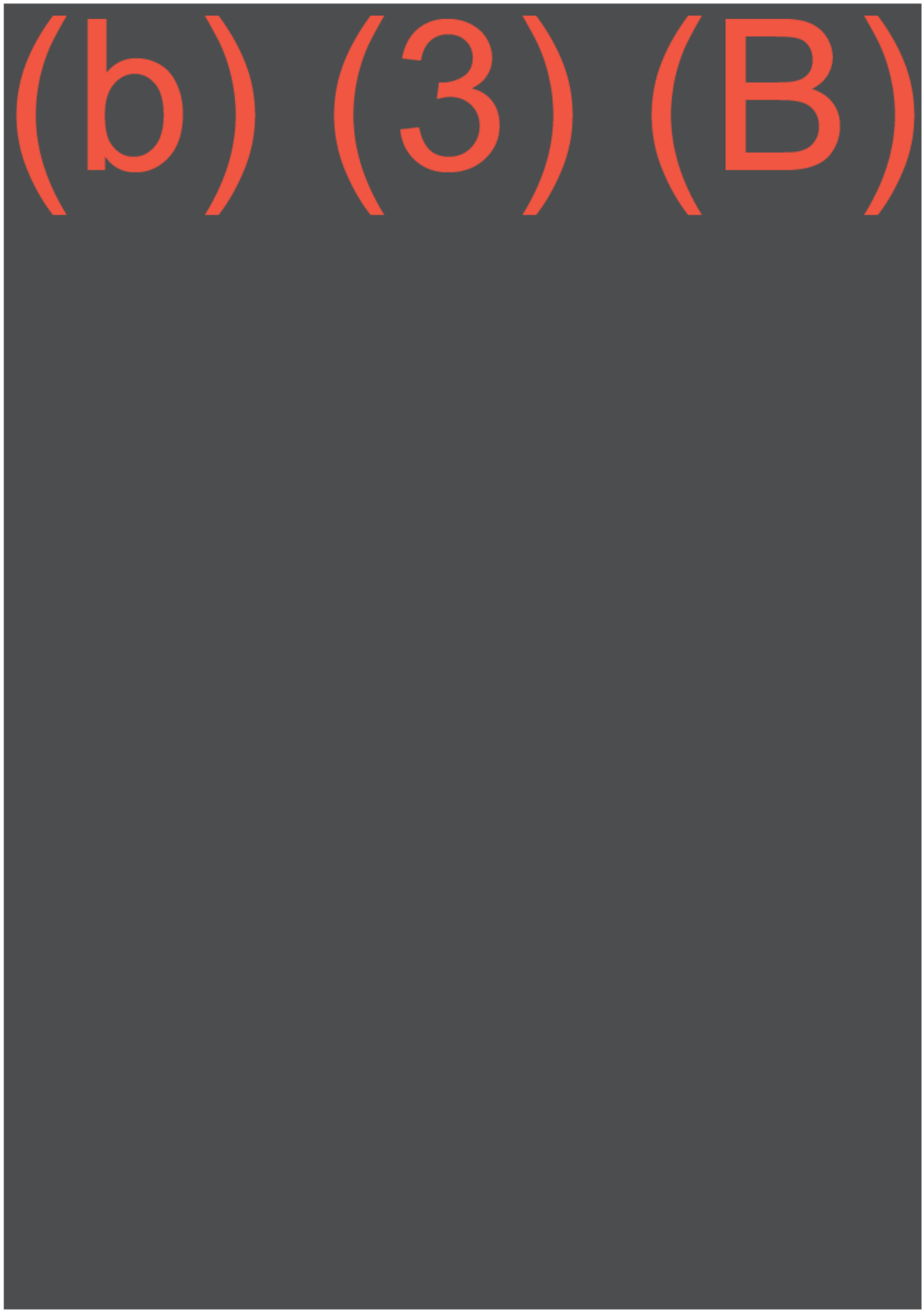
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Attachment 8:
(b) (3) (B) Bidirectional Pitot Tube Sensor Cut Sheet and Instructions

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Attachment 9:
(b) (3) (B) Seismic Velocity (Vibration) Transmitter Datasheet

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